Journal of Scientific & Industrial Research

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A—GENERAL

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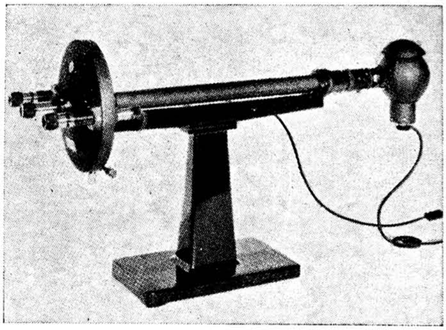

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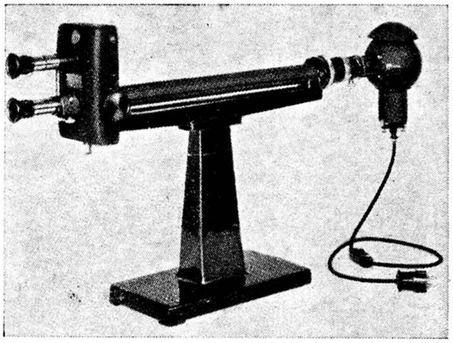

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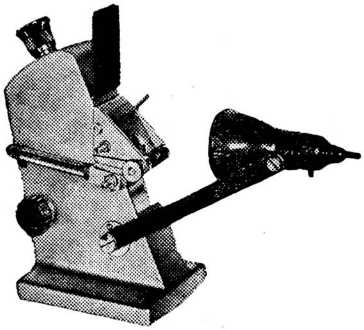

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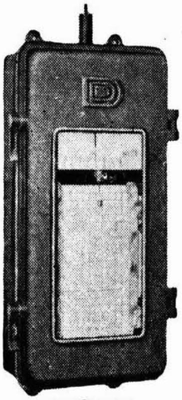

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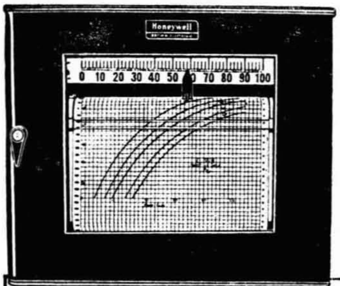

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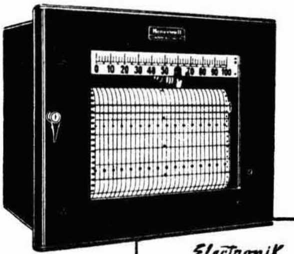

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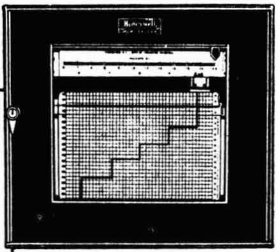

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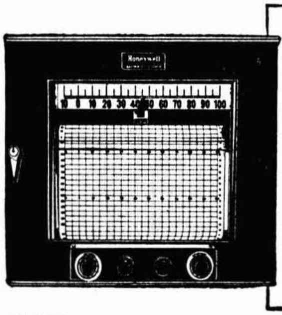

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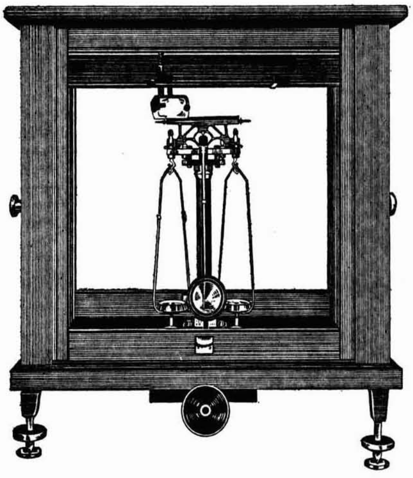

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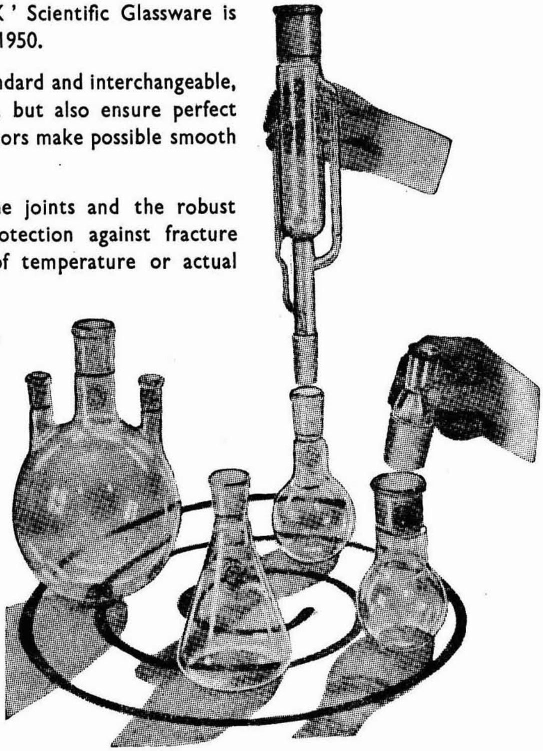

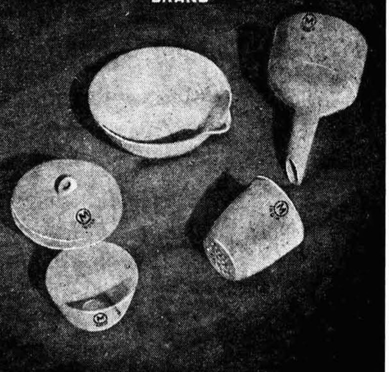

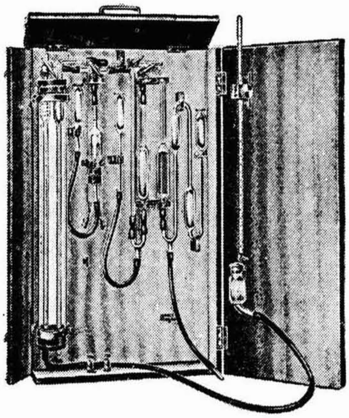

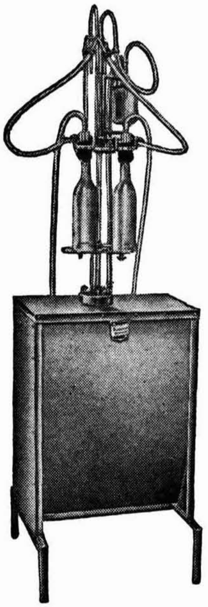

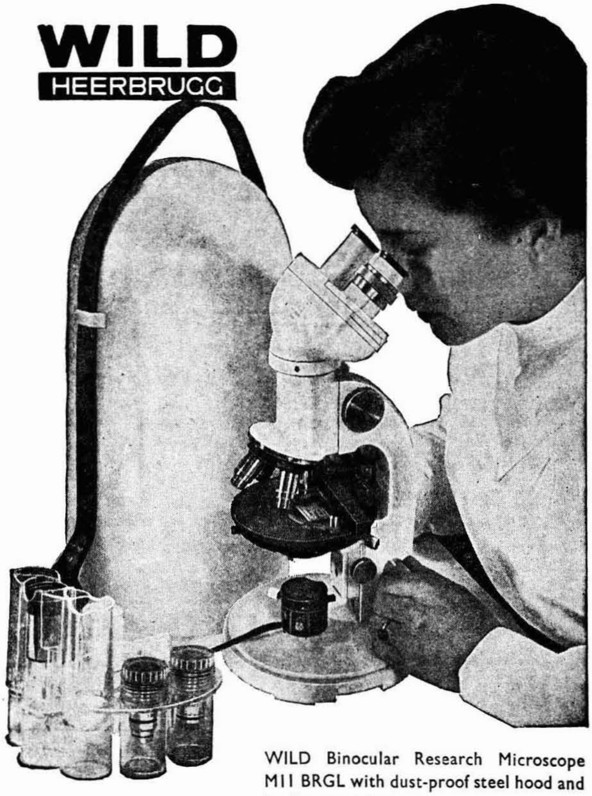

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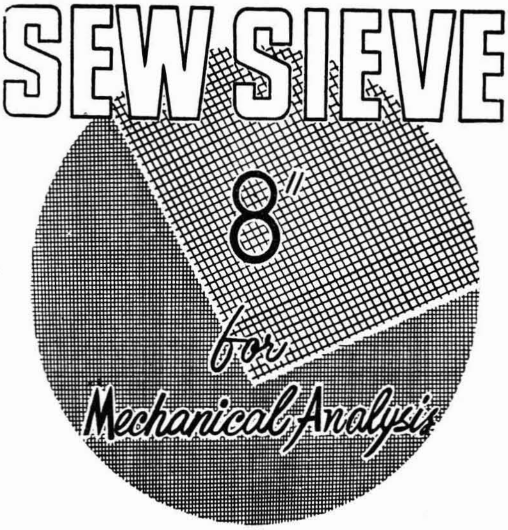
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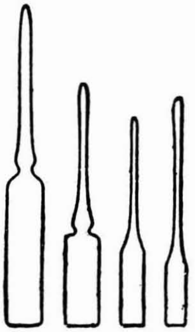

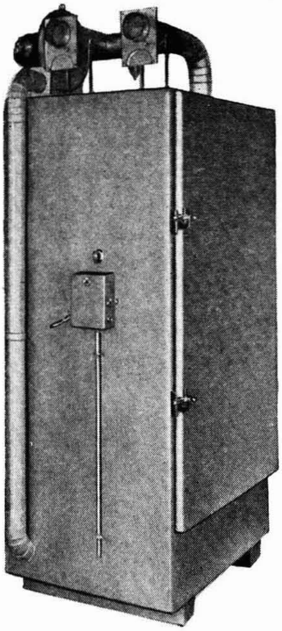

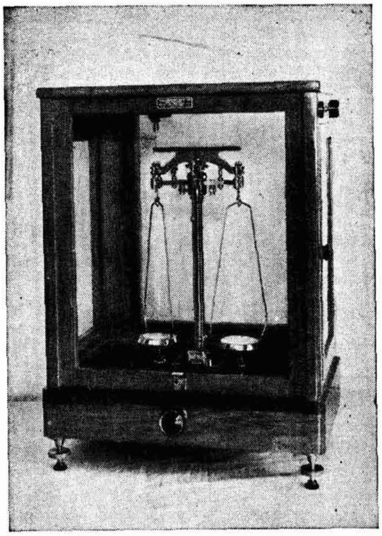

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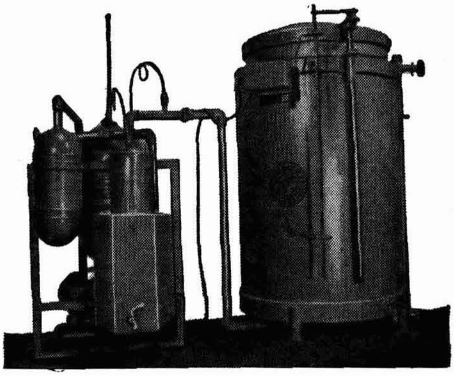

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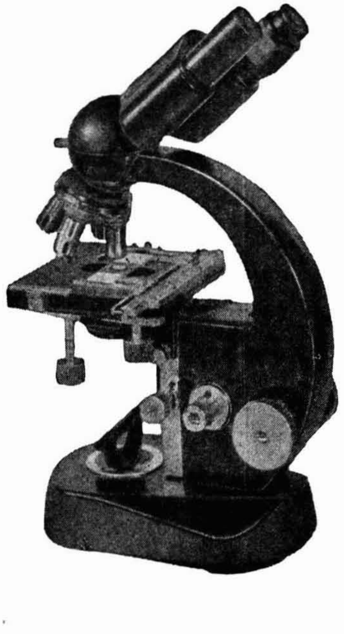

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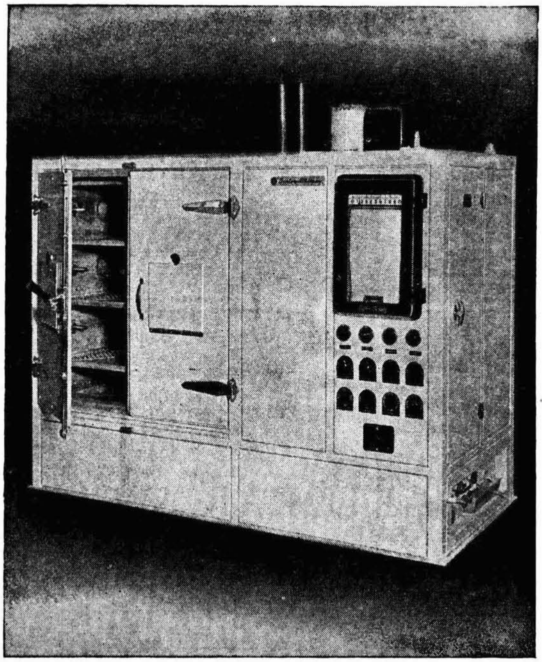

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INDEX TO ADVERTISERS

Current Topics

SPEED IN THE DISSEMINATION OF RESEARCH RESULTS

LIBERAL FINANCIAL GRANTS TO SCIENTIFIC PUBLIcations and information centres, recently announced by the National Science Foundation, provides an indication of the rising importance attached to scientific communication in U.S.A. The Foundation's support to scientific publications alone during the first quarter of 1959 was $ 527,803 which is nearly five times that made during the same period in 1958.

The grants are intended to assist scientific publications during critical periods, encourage testing of experimental methods of speeding laboratory results into print and new methods of dissemination of scientific information, and develop new ways of helping scientists to find what they need. Support has been extended to data compilation centres to survey the needs of scientists for critical numerical data and develop uniform editorial standards for the presentation of data. Aid is given to journals confronted with financial difficulties incident on printing expanding volumes of research data at ever rising costs. Grants are also made to journals in geophysics, astronomy, mathematics and other fields to reorganize or expand, publish back log of manuscripts or issue cumulative indexes. Other grants are intended to develop new methods of dissemination of scientific information. For example, the American Physical Society has been enabled to publish a new monthly periodical, *Physical Review Letters*, utilizing special typewriter composition, so that research workers are informed quickly of new developments. This periodical publishes short, unedited communications of research information ten days to two weeks after their receipt and includes abstracts of full papers about three months in advance of their publication in *Physical Review*.

The measures announced by the National Science Foundation put the accent on speed — speed in the dissemination of research results. Concerted efforts are being made in other countries too to ensure rapid and efficient distribution of scientific information to users in the research laboratory, in industry, and elsewhere. The awareness of the need for such efforts is not lacking in India, but positive steps have yet to be taken to induct speed into scientific communications. The tendency of some of the research workers to communicate their papers for publication in foreign periodicals, many of which are already faced with a back log of manuscripts, cannot be regarded as conducive to speed in the publication of research results. Whatever may have prompted this practice in the past, developments in documentation and the publication of bibliographical periodicals ensure that research results, wherever published, are promptly brought to the notice of users, provided they are of sufficient merit. This was pointed out by Prof. G. I. Finch at a conference of Directors of National Laboratories held in Delhi in 1956. The need is to develop media of high standard for the publication of research communications and this is a responsibility primarily of scientists and learned societies. The National Science Foundation's announcement emphasizes the importance of short communications in the form of ' Letters ' and the support extended to the publication of *Physical Review Letters* will bring research information to the notice of research workers three months in advance of their publication in the *Physical Review*. Many other international periodicals are following the example of *Physical Review*. As a supplement to *Tetrahedron*, the Pergamon Press, London, have commenced the publication of *Tetrahedron Letters*, in which short communications of interest to organic chemists will be published within a week or month of acceptance. These developments should be taken note of, particularly by some of the bibliographical periodicals in India, which exclude short communications from their purview. The time appears to be ripe for the publication of a periodical exclusively for short communications in the interest of speeding the dissemination of research results.

SUMMER SCHOOL IN THEORETICAL PHYSICS

THE SUMMER SCHOOL IN THEORETICAL PHYSICS, organized by the Ministry of Scientific Research & Cultural Affairs at Mussoorie, during May-June 1959, provided, for the first time, an opportunity to university professors and research workers to commune and discuss developments in a field which is basic to the progress of science. Some fifty delegates from different parts of the country participated in the deliberations, conducted under the general guidance of Prof. S. N. Bose, F.R.S. And as they resided in the same campus throughout the period of the school (from 22 May to 18 June), the delegates had opportunities to discuss and critically appraise the results of nascent research and plan collaborative research on problems considered promising.

It is safe to prognosticate that the Summer School in Theoretical Physics will become an annual event. There is unanimity among the participants on the benefits of the present meet and a recommendation has been made that the National Institute of Sciences should set up a committee to co-ordinate the work of, and promote liaison between, research groups in India working in different problems of theoretical physics. The participants felt that institutes for advanced research should be established for the promotion and intensive development of theoretical physics in the country.

The success of the Summer School at Mussoorie will no doubt stimulate the organization of similar schools in other selected fields which are receiving particular attention in this country. The organization of such schools demands advance planning and they fulfil a need somewhat different from that of symposia and seminars. Intimate and unhurried discussion and mutual criticism in an informal and academic atmosphere are conducive to the promotion of creativity among scientists and every measure that leads to such beneficent results should be warmly welcomed.

SCIENTISTS' POOL

HOW IS THE EVER-INCREASING NEED FOR RESEARCH and development to be matched against the shortage of trained specialists in various fields is a question which is current in many countries, and India is no exception. While research and development are necessarily limited by the availability of manpower, a practical approach to the optimizing of research effort is to utilize to the best advantage all the resources of trained manpower and, at the same time, enlarge the facilities for training of scientists and technologists within the country. The Council of Scientific & Industrial Research and the Directorate of Manpower in the Ministry of Home Affairs are seized of these problems in India.

One of the problems which has recently received close attention relates to the utilization of personnel with distinguished academic records and who have received specialized training in foreign countries. Do they always find, on return to India, employment calling for the expert knowledge they have acquired ? There are also persons who are employed in the countries in which they have received postgraduate training in special fields. Is it possible to get them back to India and utilize their talents for furthering various projects under the national plan ? To assist such persons in finding suitable posts and obviate hardship and frustration due to the lack of suitable employment over long periods, it has been recently decided to create a ' pool ' (under the control of the Council of Scientific & Industrial Research) for temporary placement of qualified personnel, until they are absorbed in suitable posts. Persons trained in Indian institutions with high qualifications and outstanding academic records are also eligible for appointment to the pool.

Recently, the Council selected candidates for the pool whose normal strength will be 100. Persons selected for temporary placement will receive a fixed monthly salary varying between Rs 350 and 600 according to their qualifications and experience; in exceptional cases, a salary in excess of Rs 600 may be offered with the prior approval of the Government. The term of the pool officers is not limited to any specified period, but the question of their placement and utilization will be reviewed at least once a year. Arrangements are made to attach or second the selected persons to Government departments, state undertakings, national laboratories, universities, and scientific and technological institutions, including establishments under the private sector.

Communication of Research Information

RAM D. TANEJA

Rensselaer Polytechnic Institute, Troy, New York

AN event of interest to scientists in general and to science writers in particular was the Sixth Annual Convention of the Society of Technical Writers and Editors (STWE), which was held in Washington during November 1958. The convention brought together over 600 scientists, engineers, information scientists, technical writers and editors from government, education departments and industry, and discussions at a technical level were organized on several topics, such as the role of language in communication, training of technical writers, writing for technical periodicals, technical reporting, scientific documentation, and layout planning.

This convention of scientists, writers and editors is one of the several held in the United States from time to time and provides an indication of the growing importance attached to the communication of technical information. It is being increasingly realized that the scientist and the engineer must develop, to a high degree, the ability to communicate with their colleagues, with the management, and with the non-technical public. The importance of identifying the barriers that exist between different scientific disciplines, between technologies, and between scientists and technologists working in the same general field, cannot be overstated when it is realized that research is not an end in itself. Knowledge gained has to be distributed to those who can use it. In this process there comes a stage when facts must be marshalled, linked together, and given an expression, and here again what is not properly presented is simply not present — and its purely potential existence is of little avail.

Technical writing

With the phenomenal developments currently taking place in science and technology, technical writing must necessarily play an increasingly important role in the work of scientists and technologists. Also, if the current pace of development is to be sustained, dissemination of scientific knowledge must keep pace with it. Recognizing the seriousness of the problem, industrial, government and scientific groups in the United States have focussed attention on the different phases of technical communication. The result is the birth of a new and rapidly growing profession — technical writing — as a specialized branch of communication. Organized professional bodies like the STWE, the Technical Publishing Society (TPS), and the Institute of Radio Engineers Professional Group of Engineering Writing and Speech (PG-EWS) have come into being for the profession of technical writing.

Basically, a technical writer's job is to present information about a scientific or technical subject in a form in which it can be understood and used by someone who is not as highly specialized in the particular field as the author of the subject. The technical writer is also concerned with the communication of information to technical persons trained in other areas of knowledge. This information may treat any technical subject: the operation of a machine, the behaviour of a circuit, or the development of a theory. The product may be a technical report, an instruction book, a maintenance manual, a research paper, a proposal or a copy for a film strip. The third major area is the presentation of scientific and technical information to the lay public; this includes public relations work, news releases, articles in trade and semi-technical journals and newspapers, technical advertising, and sales promotion.

Preparatory schools and universities in the United States are awakening to the need for formal training of technical writers, particularly in the engineering field. Almost all state colleges have instituted courses in technical writing. The Rensselaer Polytechnic Institute (RPI) offers a postgraduate degree in technical writing while the Carnegie Institute of Technology has organized a four-year undergraduate programme in technical writing and editing. These facilities, however, are not adequate to meet the growing needs of technical writing departments of government, industry and research organizations. In recent years, therefore, several industrial establishments have started on-the-job training programmes for their engineers.

The Convention

The trends and ideas in some of the major areas of technical communication contained in the papers presented to the Washington convention are summarized below.

Communication and research — Dr Walter J. Murphy, Editorial Director of the American Chemical

Society Publications, observed that the United States now spends about seven billion dollars a year on research; by 1967 this is expected to be of the order of 21 billion dollars. To be useful, the results of research must be put to *work*. Yet, the process of exchanging scientific and technical ideas has grown so complex that some scientists have already found it more expedient to repeat costly experiments than to search and digest existing literature. Already there is shortage of expert writers and editors able to interpret complex ideas quickly and clearly. Unless this emergency is recognized and overcome soon, the billions spent on research will, to a great extent, be a waste of both money and the scarce creative brainpower.

Motivational factors — In a penetrating address on Motivational Factors in Communication, Dr Ronald A. Mueller (RPI) underlined the importance of the intellectual make-up of the reader over the purely technical skill of the writer. In the process of communication, often the communicator gives expression to his thoughts, hopes and fears inadvertently without recognizing the motivational factors involved on the part of the reader. The willingness to accept information on the part of the reader represents a major consideration in the type, form and quality of communication. Writing skill is no less important than an understanding of the emotional make-up of the audience. Nevertheless, both are variables that must be brought into relationship and one without the other is bound to decrease the effectiveness of the communication process.

Education of technical writers — College curricula aimed at turning out specially trained writers and editors, formed the subject of a panel discussion held under the chairmanship of Prof. Jay R. Gould (RPI).

Dr Erwin R. Steinberg (Carnegie Institute of Technology) felt that technical writers need to know enough science to understand the major outlines and implications of a scientific or technical report. That is to say they must be trained in the basic sciences: mathematics, physics, chemistry and biology. As professional writers, they should know the language and its resources: how to use it, and how it has been used in the past. Thus training in composition, journalism, technical writing and function of language, and literature becomes the basic requirement. And they should have some training in the mechanical means by which written language is recorded and presented: typing, layout and design, and the graphic arts process. As members of the industrial community who must work with a variety of people and institutions, they must also know some psychology, economics and history.

Dr Sterling P. Olmsted and Prof. Chris Sanford (RPI) presented a paper on " Developing a graduate curriculum in technical writing ". Graduate training must be built on an undergraduate programme, and while it should be specialized professional training, it should not be technician training. The technical writer needs, first of all, the kind of knowledge of science and technology which will enable him to ' work-up ' a specific field, to understand it and to interpret it. This implies a basic scientific background. The second thing the technical writer needs is ability as a writer. The third requirement is what may be called a professional attitude. If the technical writer is to be something more than a skilled technician, if his training is to be actually at the graduate level, he must have more than a trace of theory, more than a trace of history. He should know something of communication theory and semantics and he should learn to apply his scientific knowledge to the study of communication problems. The fourth requisite a technical writer needs is a knowledge of his craft; it has to include the skills of the editor, the rewrite man, etc. Thus the objective of the programme outlined is to train the student in fundamentals, so that in the long run he will be better able to cope not with just one job but with many and varying types of jobs.

Communication problem in India

The scope for technical communication services in India is unlimited. The impetus which the Council of Scientific & Industrial Research has given to scientific research by setting up national laboratories and research committees, ensures a growing supply of information. The expansion of the nation's industrial base and facilities for co-operative research have further increased the inflow of scientific knowledge. This knowledge, to be useful, must be organized, and made accessible to those who need it, and in a form in which they can apply it. The existing facilities in the country are quite inadequate for this stupendous task. Also professionally trained personnel for handling communication problems are too few. It will be appreciated, therefore, that there is need for initiating and encouraging at all levels — school, university and on-the-job — programmes for the training of communication specialists to meet the country's needs in science and education, agriculture and industry.

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Carbene — Divalent Carbon

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OF the different reactive intermediates postulated in the mechanistic interpretation of organic reactions like the carbanion, the carbonium ion and the carbon-free radical, 'Carbene' or the divalent carbon radical is a newcomer in some ways and yet is a concept much discussed since the close of the last century. The earliest observation of a divalent carbon intermediate dates back to 1862 and is mentioned in connection with the basic hydrolysis of haloforms[1]. Oddly enough the hypothesis of dihalomethylenes in such a reaction is the only one among the few that have survived the scrutiny of more recent and rigorous experimental verification of such intermediates[2]. The popularity of the intermediacy of divalent carbon in organic reactions caught on with such great vigour that in the succeeding years many other reactions like the formation of stilbene derivatives[3-10] from benzyl halides, or diphenylacetylenes[11] from β, β-diphenyl vinyl halides were suggested to go through methylene type of intermediates. Consequent upon the unduly liberal usage of this intermediate, quite a few subsequent publications[12-16] have established the erroneous nature of such a hypothesis. Although the occurrence of divalent carbon intermediates in many such heterolytic reactions was discredited, the formation of methylene diradical by such homolytic reactions as the photolysis of ketene, the photolysis and pyrolysis of diazomethane has been established beyond doubt. Similarly, methylene derivatives have also been obtained by the photolysis of diazoacetic ester, diazoisobutane, diphenylenediazomethane and such other diazoalkanes[17-33].

The simplest member of the family of divalent carbon intermediates has been designated as methylene or carbene. (The latter is a name collaboratively conceived by Professors R. B. Woodward, S. Winstein and W. E. Doering. Carbenes are related to carbinols in the same way as methylene is to methanol.) The remarkable properties of the simplest carbene, viz. $:CH_2$, have been extensively investigated by its generation from diazomethane by homolytic cleavage. Unlike methyl radicals, carbene does not remove mirrors of Zn, Cd, Pb, Th and Bi, although it does remove mirrors of As, Sb, Se and Te. The product obtained by removal of tellurium mirrors has been isolated and characterized as polytelluroformaldehyde $(CH_2Te)_x$.

Carbene is such an extremely reactive intermediate that in the absence of other substrates, it dimerizes readily to ethylene. However, in the presence of other reactants, carbene reacts in an entirely indiscriminate fashion such that the addition products formed are exceptionally close to the statistical ratios. With carbon tetrachloride four moles of carbene react to give $C(CH_2Cl)_4$ and with trichlorobromomethane yield $C(CH_2Cl)_3CH_2Br$. With ether carbene forms ethyl *n*-propyl ether and isopropyl ether. In its reaction with the carbon-hydrogen bond of saturated hydrocarbons like *n*-pentane and 2,3-dimethylbutane either at −75° or at 15°, carbene shows no selectivity of reactivity[28]. *n*-Hexane, 2-methylpentane and 3-methylpentane are formed from *n*-pentane in the ratio 48 : 35 : 17, the statistical ratio being 6 : 4 : 2. Similarly, with 2,3-dimethylbutane, carbene gives 2,3-dimethylpentane and 2,2,3-trimethylbutane in the ratio 83 : 17.

With cyclohexene four types of addition products are possible, viz. attack at the vinyl position, the allylic position, the aliphatic positions and across the double bond itself. In fact carbene gives all the four types of products in the ratios of 10 : 25 : 25 : 40 and 11 : 26 : 26 : 37 at −75° and 15° respectively. In all these instances it will be seen that the addition of the carbene occurs only at the carbon-hydrogen bond and not at the carbon-carbon bond. This is confirmed by the observation that cyclopentane yields only methylcyclopentane and not cyclohexane on reaction with carbene. (The general procedure in all these additions is to irradiate, with an ultraviolet source, dilute solutions of diazomethane in the appropriate hydrocarbon.)

Such reactions as these show the extreme reactivity of the diradical and the lack of selectivity in any one of them. Configurationally, carbene has, therefore, been represented with two of carbon's four orbitals bonded to hydrogen and the other two unpaired and located in two separate orbitals of equal energy. The lack of stabilization in the radical thus accounts for its extreme non-selective reactivity.

Other carbenes like dihalocarbenes and carbethoxycarbene display certain degree of selectivity. For example, in the reaction of carbomethoxycarbene with pentane, methyl heptanoate, 3-methylhexanoate and 3-ethylpentanoate are formed in the ratio of 38, 42 and 20 per cent respectively thus exhibiting a slight preference for secondary over primary hydrogens. The secondary hydrogen reacts 1·62 times faster than the primary. Likewise 2,3-dimethylbutane gives 76·5 per cent of 4,5-dimethylhexanoate and 23·5 per cent of 3,3,4-trimethylpentanoate indicating that the tertiary centre reacts even faster than the rest.

A much clearer evidence for the stereospecificity in the reaction of carbenes is found in the addition of dibromocarbene : CBr_2 to *cis* and *trans* butenes. In an exclusively *cis* addition to the olefine, *cis* and *trans* 1,1-dibromo-2,3-dimethylcyclopropanes were obtained from *cis* and *trans* butenes respectively[34].

In competitive addition reactions with different olefines like tetramethylethylene, trimethylethylene cyclohexene and 1-hexene, dibromocarbene shows a remarkable jump in the rate of addition (1·00-50·00) between the first and the last mentioned olefines[35]. However, carbethoxycarbene exhibits only a very low degree of selectivity (1·00-1·80) with reference to the same olefines. This disparity has been attributed to the greater resonance stabilization of the dibromocarbene in which the vacant p-orbital of the carbon overlaps sufficiently strongly with the filled p-orbital of bromine. Further substantiation of the electrophilic nature of the halocarbenes is available in their reactions with indenes to form naphthalenes[36]. When the indene double bond carries an electron releasing substituent, yields of naphthalene are comparable to that of the unsubstituted indene. In the presence of electron withdrawing groups like Cl, Br, COOEt or phenyl, the yields are low. The argument is thus advanced that the lone electrons in the carbenes are actually paired so that the carbon is sp_2 hybridized with a vacant p-orbital which is responsible for the electrophilic character of the carbene.

The formation of carbenes under heterolytic conditions has been variously designated as ' unilateral eliminations ', ' 1,1 eliminations ' and ' α-eliminations '. In such reactions, as Michael[37] had discussed, the intermediacy of carbenes has been disproved. Ingold, however, has discussed the possibility of α-elimination during Hoffman degradations[38]. In such cases although the alpha-hydrogen is more labile by its proximity to the positive nitrogen atom, usually only the beta-hydrogen is lost since this preserves the octet while the loss of an alpha-hydrogen would leave an unstable sextet. But this inhibitory influence can be overcome in cases like the fluorene derivatives where the alpha-hydrogen is considerably activated.

The most lucid and forthright demonstration of the intermediacy of carbenes in ionic eliminations is due to the work of Hine and his collaborators[2]. In a brilliant reinvestigation of Geuther's work on the kinetics of hydrolysis of haloforms with bases, the reaction has been shown to involve the following steps:

$$CHX_3 + OH^- \overset{\text{fast}}{\rightleftharpoons} CX_3^- + H_2O \quad \ldots\ldots \quad (1)$$

$$CX_3^- \xrightarrow[\text{slow}]{} :CX_2 + X^- \quad \ldots\ldots\ldots \quad (2)$$

$$:CX_2 \xrightarrow{OH^-,\ H_2O} CO + HCOO^- \quad \ldots\ldots \quad (3)$$

$$:CX_2 + X^- \rightarrow CX_3^- \quad \ldots\ldots\ldots\ldots \quad (4)$$

A study of the base-catalysed deuterium exchange of chloroform in aqueous solution revealed that the first step in the above mechanism is a very fast reversible process of removal of proton followed by a slow rate-determining loss of the halide ion from the trihalomethyl anion to yield the methylene dihalide. The latter, because of its extreme reactivity caused by the electron deficiency, reacts rapidly with other anions present.

An alternative mechanism of a direct nucleophilic displacement on the haloform by the hydroxide ions is ruled out because such a mechanism should exhibit no kinetic effect due to the presence of added salts. However, the presence of salts like NaCl, NaBr or NaI decreases the rate constant in the above reaction due to the reversal of the hydrolysis by recombination of the dihalomethylene with the halide ions by step (4) in the above equations. In particular, NaCl in the hydrolysis of chloroform exerts a mass law effect in the recombination of $:CCl_2$ with Cl^- to give CCl_3^- ions. The addition of bromide and iodide ions generates respectively dichlorobromomethane and dichloroiodomethane of which the latter has been actually isolated. However, a rate increase in the hydrolysis is observed as the reaction proceeds, in the presence of the bromide and iodide ions. This is because the latter-mentioned haloforms are more readily hydrolysed than chloroform itself. Thus the isolation of dichloroiodomethane in the hydrolysis of chloroform with added iodide ions, the diminution in the rate of hydrolysis by added chloride ions and the climbing rates of hydrolysis due to added bromide and iodide ions are strong evidence in favour of alpha-elimination. Additional evidence is also available from the use of *p*-thiocresolate anions to capture the carbenes. The latter reaction is strongly catalysed by the presence of free hydroxide ions which furnish the necessary trihalomethyl anions by proton abstraction.

In an extended comparative study of the rates of hydrolysis of different haloforms, Hine and coworkers[39] have established the following order of reactivity: $CHBrClF \gg CHBrCl_2 > CHBr_2Cl >$

$CHCl_2I > CHBr_3 > CHCl_3$. Fluoroform reacted too slow to be measured. The very high reactivity of fluorochlorobromomethane compared with the other haloforms also points out against the S_{N2} mechanism because in the latter cases replacement of an alpha-hydrogen by fluorine only decreases the reactivity.

In the reactions discussed above, the dihalocarbene formation is pictured as a stepwise process in which there is a rapid step of proton abstraction (which is reversible) followed by a rate controlling loss of halide ion. However, a concerted alpha-elimination has also been demonstrated by Hine. In all such haloforms that contain either no fluorine atom at all or only one fluorine atom proton removal by base is undoubtedly the fast reversible step while decomposition of the carbanion occurs 8-40 per cent of the times it is formed. Introduction of an additional fluorine atom might be expected to show a decreased reactivity due to the decreasing rates of carbanion formation (α-halogen substituted carbanion stability decreases in the order $I \sim Br > Cl > F$). On the contrary the hydrolysis rates of $CHBrF_2$ and $CHClF_2$ are at least 40 times as large as would be expected for carbanion formation. This would appear to indicate the absence of carbanion formation. In other words, if the fluorine atom stabilizes the dihalomethylenes or at least the transition state leading to them, the second step should be faster than the first in the alpha-elimination mechanism (*vide supra*) since fluorine atoms retard carbanion formation.

$$CHX_3 + OH^- \xrightarrow{\text{slow}} CX_3^- + H_2O$$

$$CX_3^- \xrightarrow{\text{fast}} :CX_2 + X^-$$

or each of the above two processes could be mutually facilitating the other, resulting in a concerted elimination.

$$HO^- + HCF_2Cl \rightarrow \overset{-\delta}{HO} \ldots H \ldots \overset{-\delta}{CF_2} \ldots \overset{-\delta}{Cl}$$

$$\rightarrow HOH + :CF_2 + Cl^-$$

The loss of the halogen is thus dependent on the negative charge formation on the carbon which in turn is enhanced by the loss of the proton. The more acidic the hydrogen the more labile will be the halide ion.

Aside from these intriguing questions of mechanistic interest in the formation and behaviour of carbenes, several interesting synthetic applications have also been made employing carbene intermediates. Among these may be mentioned the conversion of indenes to β-halonaphthalenes[40], pyrroles to β-substituted pyridines[41], indoles to haloquinolines[42], and cyclopentenes to halocyclohexanols[43]. Syntheses of tropolone derivatives[44], cyclopropenone derivatives[45,46] and vinyl cyclopropane derivatives[47] have also been effected through carbene intermediates. A two-step synthesis of allenes[48] has also been reported recently. Attempts towards the synthesis of colchicine derivatives are also reported employing carbene intermediates[49]. From the innumerable publications that appear on 'carbene intermediates', the chemical interest in this area of organic chemistry might well be said to be at the stage of 'rapid chain propagation'.

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Configuration of Natural Mixed Glycerides According to the Restricted Random Distribution Rule

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The number and proportions of configurational isomers of individual triglycerides required according to restricted random distribution (RRD) rule have been discussed and the method for calculating the configuration of mixed glycerides in natural fats according to RRD rule is described.

According to RRD rule, the ratio between the amounts of symmetrical and unsymmetrical components in any glyceride type does not remain fixed but varies from 1:1 to 1:2 according to component acid composition. The variation of the relative proportions of the symmetrical and unsymmetrical isomers of the saturated-unsaturated glycerides in different natural fats is given along with a review of the progress of the experimental study of configuration.

A NUMBER of theories have been advanced to explain the glyceride structure of different groups of natural fats, namely the even distribution[1,2], partial random distribution[3] and random distribution[4] theories for various groups of vegetable fats and random distribution[5] and central-site fat synthesis[6,7] theories for animal fats. So far no attempt has been made to discuss the proportions of configurational (con.) isomers required by any of these theories. In view of the attempts made to develop new methods for the determination of the configuration of natural mixed glycerides[8-10], the proportions of con. isomers required by the restricted random distribution (RRD) rule[11,12] are discussed in this paper.

Number and proportions of isomers of individual glycerides according to RRD rule

According to the RRD rule, the structure of the glycerides constituting individual glyceride types is the same as that required by random distribution. Hence the number and proportions of the con. isomers of any individual triglyceride required by RRD rule are the same as those required by random distribution. When a compound which can occur in n-isomeric forms is synthesized in the laboratory (laboratory synthesis always takes place according to random distribution), all the theoretically possible isomers will be present in the synthetic mixture, each being present to the extent of $1/n$ of the total. The number and proportions of con. isomers of individual glycerides possible will hence depend on the number of isomers theoretically possible.

The glyceride radical (G) esterifies three acid radicals (say X, Y and Z) to give a triglyceride. No isomers are possible when all the three acid radicals present are the same (GXXX). When two radicals of X and one of Y are present, two con. isomers GXYX and GXXY are possible. When all the three acid radicals present are different three con. isomers GXYZ, GXZY and GYXZ can be formed. Thus, according to random distribution, any triglyceride containing two different acid radicals will be made up of equal proportions of its two con. isomers and a triglyceride containing three different acid radicals will have each of its three isomers present to the extent of one-third of the total.

Configurational types and variations in their proportions with component acid composition

The general glyceride structure of the natural fats is governed by the glyceride type distribution rule[13]. According to this the proportions of disaturated monounsaturated (disats.), monosaturated-diunsaturated (monosats.) and triunsaturated (triunsats.) glycerides in a natural fat can be calculated from the trisaturated (trisats.) glyceride content and the saturated (sat.) acid content of the mixed fatty acids. Of these four structure types, the trisats. and triunsats. cannot be usefully divided into further subgroups for studying the configuration. The disats. occur in two subgroups or configurational types, the alpha- and beta-unsaturated [GUSS and GSUS if S and U stand for sat. and unsaturated (unsat.) acid radicals], usually termed unsymmetrical (unsym.) and symmetrical (sym.) disats. respectively. The ratio of the amount of unsym. to the amount of sym. type present may be designated the con. type ratio for the disats. The same arguments apply to the monosats. also and the ratio of unsym. (GSUU) to sym. (GUSU) type present may be termed the con. type ratio for monosats.

When only one sat. acid is present in every disats. molecule, only two con. isomers are possible and the con. type ratio will be 1: 1. When two sat. acids are present in every disats. molecule, three con. isomers are possible, two of which will contain the unsat. acid in the alpha position and one in the beta position. The con. type ratio will hence be 2: 1. Similarly, with the monosats. the con. type ratio will be 1: 1 when only one unsat. acid is present but will increase to 2: 1 when two unsat. acids are present in every monosats. molecule. The relative proportions of the unsym. and sym. types, both in disats. and in monosats., can, therefore, vary independently with variation in component sat. and unsat. acid compositions.

Calculation of the proportions of con. isomers and con. type ratios in natural fats

The calculation of the proportions of individual glycerides according to RRD rule has been described earlier[11,12]. The number and proportions of the con. isomers of each individual glyceride are obtained from the number of different acid radicals it contains and its total amount present. The summation of the proportions of individual con. isomers of specific types will give the con. type ratios of the disats. and monosats. The con. type ratios can hence be calculated only if the detailed component acid composition of the fat is known as it depends entirely on the nature and proportions of the individual glycerides present and cannot be calculated from the proportions of saturated and unsaturated acids alone.

Example — A fat containing 50 per cent each of sat. and unsat. acid molecules and not containing any trisats. would, according to RRD rule, have a glyceride type structure of 58 per cent disats., 34 per cent monosats. and 8 per cent triunsats.[12,13]. If the fat contains only one sat. acid (stearic) and one unsat. acid (oleic), then the disats. will consist of distearoolein and the monosats. of stearodiolein. Both these exist in two configurations only and hence the con. type ratios of both monosats. and disats. will be 1: 1. If the sat. acids contain 25 per cent each of palmitic and stearic acids while the unsat. acids remain oleic, the con. type ratio of the monosats. will remain unchanged while that of the disats. will change. One quarter of the total disats. will now be dipalmitoolein, another quarter distearoolein and the other half will be stearopalmitoolein. Both the distearo- and dipalmitooleins occur as 50: 50 mixture of the sym. and unsym. forms whereas the palmitostearoolein will be made up of two-thirds of unsym. and one-third of sym. types. The con. type ratio of the total disats. will hence be as 25 + 33·3: 25 + 16·7, i.e. as 58·3:41·7. As the relative proportion of one sat. acid increases the con. type ratio will decrease towards 50:50. If in the above example, the sat. acids remain stearic while the unsat. acids form a 50: 50 mixture of oleic and linoleic, the con. type ratio of the disats. will remain unchanged while that of the monosats. will change to 58·3: 31·7 in the same way as occurs with disats. when component sat. acid composition is changed. The con. type ratios of the disats. and monosats. are thus entirely independent of each other and also of the relative proportions of sat. and unsat. acids in the fat. The disats. con. type ratio is dependent entirely on the component sat. acid composition and the monosats. ratio on the unsat. acid composition.

Maximum and minimum values of con. type ratios in natural fats

If in the above example the sat. acids consist of equal amounts of myristic, palmitic and stearic, the proportions of dimyristo, diplamito and distearooleins will be each one-ninth of the total disats. while the balance two-thirds will contain three different acid radicals. The con. type ratio will hence be 16·6 + 44·4: 16·6 + 22·2, i.e. 61: 39, and is higher than when only two sat. acids occur. Thus when the number of major (an acid which forms not less than 10 per cent of the total is considered a major component) sat. acids increases, the con. type ratio of the disats. will increase towards a maximum value of 2: 1. Similarly, when the number of major unsat. acids increases, the con. type ratio of monosats. will increase towards 2: 1. The con. type ratios of disats. and monosats. can, therefore, vary from 1: 1 to 2: 1 in different fats according to component acid composition.

General proportions of symmetrical and unsymmetrical glyceride types in various natural fats

Marine fats

The marine fats[14] generally contain only one major sat. acid, palmitic, and four or more major unsat. acids. The disats. will have con. type ratio 1: 1 while in the monosats. the ratio will be nearly 2: 1.

Land animal fats

When raised on low fat or fat-free diets the depot fats of rodents and birds contain predominantly palmitic in the sat. series and oleic in the unsat. series[14]. The con. type ratio will be 1: 1 for both monosats. and disats. for these fats. In case of larger land animals maintained on low fat diets the depot fats contain only one major unsat. acid (oleic) while the sat. acids contain major proportions of palmitic and stearic[14]. The monosats. will hence have con. type ratio 1: 1 while in the disats. the ratio will be 60: 40. The ruminant milk fats contain a large number of sat. acids of which not less than four, namely butyric, myristic, palmitic and stearic, occur in major proportions whereas only one major unsat. acid is present. The con. type ratio for disats. will, therefore, be nearly 2: 1 and that for monosats. will be 1: 1.

Considerable changes in the component acids of the depot fats take place when foreign fats are included in the diet of land animals[14], and along with these, changes in con. type ratios will also occur. For example, when a rodent or bird is raised on a diet containing large amounts of marine fats, the unsat. acids in the food fats will tend to pass into the depot fats making the unsat. acid composition similar to that of marine fats. This variation is seen in the component acids of sea-bird depot fats[15]. The con. type ratio would change from 1: 1 to 2: 1 for the monosats. in such fats. Similarly, when large amounts of fats of the coconut oil type are ingested large amounts of lauric and myristic acids will tend to pass into the depot fats and the sat. acids will tend to contain three or more major components and the con. type ratio will increase to 2: 1 from the normal 1: 1. The previous diet of the animal is hence of importance when studying the configuration of animal depot fats, particularly when they show appreciable difference in composition from the depot fats on low fat diets and in such cases detailed component acid analyses are essential.

Plant fats

The plant fats can be divided into a number of well-defined groups for considering their con. type ratios.

Fats of the coconut oil group — These contain a number of major sat. acids but only one major unsat. acid. The con. type ratio of the disats. will hence be nearabout 2: 1 while that of the monosats. is 1: 1.

Fats containing one major sat. and unsat. acids each — Fats from the Lauraceae and Myristicacae generally contain lauric or myristic acids as the predominant sat. acid component and oleic as the unsat. acid component[14]. Similarly, fats like kokum butter, phulwara butter and *Vaterian indica* fat contain only one major sat. or unsat. acid. In these fats the con. type ratios will be 1: 1 for both disats. and monosats.

Fats containing two major sat. and one major unsat. acids or vice versa — Cacao butter, borneo tallow, fats from *Irvingia* and *Salvadora* species, etc., contain two major sat. acids and one major unsat. acid. They will show con. type ratio 60: 40 for disats. and 1: 1 for monosats. Fats like cottonseed oil and palm oil[14] contain one major sat. acid (palmitic) and two major unsat. acids (oleic and linoleic) and hence would have con. type ratio 1: 1 for disats. and 60: 40 for monosats.

Fats containing two major sat. and two major unsat. acids — The usual palmitic-stearic-oleic-linoleic type vegetable fats contain palmitic and stearic as major sat. and oleic and linoleic as major unsat. acids. They would hence have con. type ratio 60: 40 for both disats. and monosats.

Fats containing three or more major unsat. acids — Seed fats from the Cruciferae and Umbelliferae and also seed fats containing appreciable amounts of linolenic acid, e.g. linseed oil contains three or more major unsat. acids and in these the monosats. will have con. type ratio of 2: 1 while the small amounts of disats. present will have a ratio of 1: 1 to 60: 40 depending on the sat. acid composition.

Experimental determination of triglyceride configuration

A review of the progress in experimental determination of configuration would also be of interest in this paper. Methods based on fractional crystallization and identification of pure fractions by melting points (points of complete fusion) have not proved useful in this field. So far only disats. have been studied by this method. Denoting disats. containing only one sat. acid as simple disats. and those containing two sat. acids as mixed disats., the sym. and unsym. isomers of the simple disaturated oleins show nearly the same melting points and solubilities for all acids lower than stearic and even in the case of distearoolein, the sym. and unsym. isomers differ by only 3°C. in melting point[16]. The con. isomers of mixed disats. also would not show differences of more than 1-2°C. in m.p. since this is the difference shown by palmitostearooleins[17] and in the case of sat. acids lower than stearic the differences would be smaller by analogy with the sym. disats. Hence the technique is suitable at best only for fats containing stearic as the predominant sat. acid. However, a further limitation has to be considered when the identity of the fractions is to be established by their melting points alone. As a rule the melting points of organic compounds show depression in presence of impurities, whether higher or lower melting. But the addition of small amounts of high melting trisats. to any of the other glyceride structure types raises the melting point in accordance with the melting point variation rule[18], the nature of the non-trisats. substrate being of little influence in this case. As an illustration, any of the ordinary oils, e.g. groundnut oil or sesame oil, will show melting points of 114·6, 120·4, 126·2 and 132°F. when they contain 0·39, 0·78, 1·56 and 3·12 per cent respectively of tristearin of m.p. 161°F. The trisats. from stearic-predominant fats, like kokum butter, would have melting points of the order of 160°F.[18] which is sufficiently high to introduce increase in the melting point of the disats. even when the former is present in very small quantities, say less than 0·5 per cent, and all natural fats containing above *c.* 45 per cent sat. acids invariably contain small amounts of trisats. Further, though in general, higher melting impurities can be removed from organic substances by repeated recrystallization, the trisats. from a natural fat cannot be completely removed from the disats. in the same fat, for under the usual conditions where the disats. crystallize out (e.g. distearoolein in kokum butter), the corresponding trisats. (tristearin in this case) are so sparingly soluble that they separate out almost completely with the most sparingly soluble fractions of the disats.[19]. Though trisats., when present in large amounts, can be removed substantially from disats. by crystallization under conditions where little crystallization of the latter takes place[19], this separation is only partial and at present no technique is known to eliminate with certainty the last traces of trisats. from the disats. fractions. The melting points of the more sparingly soluble disats. fractions will hence have a tendency to be too high due to the presence of small amounts of trisats. and this might be the reason for the higher reported and variable melting points of much of the distearooleins from natural fats (42·5-44°C.)[20] as against the m.p. of 41·6°C. for the pure synthetic product[16]. The technique hence cannot give reliable information on configuration except when procedures are developed for complete elimination of trisats.

Another attempt has been recorded for determining the configuration of the disats. from beef tallow, mutton tallow and lard by comparing the X-ray long spacings of the entire composite disats. fractions from these (the fractions studied had sat. acid contents of 64·6, 61·6 and 63·3 per cent respectively) with those of the pure synthetic sym. and unsym. stearopalmitooleins[21]. These fats contained 59, 56 and 34 per cent sat. acids (calculated from glyceride type structures given) as against 35, 31 and 31 per cent respectively of palmitic and lower acids. The sat. acids of lard are hence almost entirely palmitic while those of beef and mutton tallows contain near about equal amounts of palmitic and stearic. It is not clear how comparison with long spacings of pure palmitostearooleins can throw light on the configuration of the disats. from lard which contains practically no stearic acid. In the case of the other two fats in which two major sat. acids occur, considerable dipalmito and distearooleins would be present[12] and hence the X-ray long spacing of the entire composite fractions will be of use only when methods have been developed to determine the configuration of all the constituents in a mixture containing distearo, dipalmito and palmitostearooleins from the X-ray long spacings of the mixture alone. The study by the same technique reported for cacao butter[22] is subject to the same uncertainties. There is the added doubt that the fat specimen examined appears to be far from genuine[22], since genuine cacao butter shows a stearic : palmitic ratio of 60 : 40 which would increase to *c.* 70 : 30 in the least soluble 50 per cent of the fat[23] whereas in the present case, the least soluble 50 per cent fraction showed a stearic : palmitic ratio of only 50 : 50.

More recently it has been found that pancreas lipase shows specificity towards the alpha-hydroxyl of the glycerol[8,9,24] and an attempt has been made to develop new methods for determining configuration based on this[10]. The experiments on the lipolysis of sym. dipalmitoolein and dioleopalmitin show that the beta-hydroxyl is only about 1/9·5 times as active as the alpha-hydroxyl in these instances[8,9]. However, alpha specificity is only one of the specificities displayed, for the amounts of alpha-palmityl, and oleyl radicals hydrolysed from unsym. dipalmitoolein should have been equal if there is no other specificity, but actually has the ratio of 63 : 32 if we assume that 5 per cent of the palmitic acid hydrolysed is derived from the beta position. Since pure synthetic glycerides were used, we have to conclude that a beta-palmityl can increase the specificity of pancreas lipase to alpha-palmityl or vice versa if we assume that the extra palmitic acid is derived from the beta-palmityl. Either way specificities other than that due to alpha position of the hydroxyl is evident from the above experiment.

Had pancreas lipase specificities been limited to the above, the technique could yet be used as an empirical procedure to study configuration but the data presented by Savary *et al.*[10]. show that in the case of natural fats or fat fractions other unknown factors exist which can further alter the specificity of the lipase in different ways.

In the lipolysis of cacao butter the iodine values of the hydrolysed and original acids were 12 and 39 respectively showing 30 per cent sat. acid increase in the former. The cacao butter would contain 75 per cent disats. and 25 per cent monosats., and if we calculate on the basis that the monosats. are entirely unsymmetric and would show 12 per cent sat. acid increase in the hydrolysed acids, the disats. fraction would by itself show 36 per cent sat. acid increase against the maximum 28 per cent possible if they were entirely symmetric isomers. The existence of unusual specificity-altering factors in cacao butter is supported by the fact that the acids from the unattacked triglycerides have iodine value of 52 against the 39 for the acids from original fat; this cannot be accounted for except by increased specificity of pancreas lipase towards the disats., and this specificity, obviously, is of a kind entirely different from that towards the alpha-hydroxyl.

In the above two examples, factors increasing the specificity towards sat. acids have been discussed. In the case of the disats. fraction from lard we find factors which increase the specificity towards unsaturated acids. The predominantly disats. fraction from lard showed iodine values of 39 and 57 for original and hydrolysed acids. Since both the unsat. acids have an iodine value *c.* 95, the sat. acid contents are 63 and 46 respectively. The fraction cannot, therefore, contain more than 10 per cent monosats. and correction for this would be small. The fraction hence shows a decrease in sat. acid content of 17 per cent whereas even the 100 per cent pure unsym. disats. cannot show any decrease in percentage of sat. acids on lipolysis.

The specificities of pancreas lipase can, therefore, be altered by a large number of other known and unknown factors in addition to that due to the alpha position of the hydroxyl. This is in agreement with the results obtained by Geidel and Abderhalden[25] who reported that its specificity towards lower sat. acids is increased by the presence of several polypeptides and also with the results obtained by Giri and Dastur[26] who found that it showed increased specificity towards coconut oil and butter fat in the presence of sodium taurocholate, but not towards any of the other ordinary oils like groundnut and sesame oils. Before the reasons for these alterations in specificity can be clearly distinguished and their influence effectively eliminated, the study of the action of pancreas lipase on whole fats or fat fractions cannot give any information on triglyceride configuration.

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New Type Jena Microscope

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LATEST developments in design and construction of microscopes by VEB Carl Zeiss, Jena, are incorporated in their 'N g' and 'N f' types of microscopes. The construction of these instruments embodies the experience gathered during the past 25 years in practical and theoretical microscopy. The microscope 'N f', the larger one of the two, can be arranged either for incident (Fig. 1) or for transmitted light (Fig. 2) observations, while the smaller instrument 'N g' (Fig. 3) is suitable for transmitted light observations only.

The coarse and fine adjustments are arranged coaxially in both the models. The size of the coarse adjustment head has been made larger, thus ensuring greater reliability in setting. In both the models the coarse motion acts on the tube carrier, while the fine adjustment actuates the object stage. Moving on a ball and groove slideway the response of fine motion is extremely accurate.

One of the principal features is the interchangeability of parts. This enables a quick changeover from transmitted light system to incident light or polarized light or phase contrast systems according to requirements. Thus, for incident light work, the pancratic sub-stage with triple condenser is detached, while the quadruple or quintuple objective turret is replaced by an incident light condenser. For polarizing work in transmitted light the objective is in a

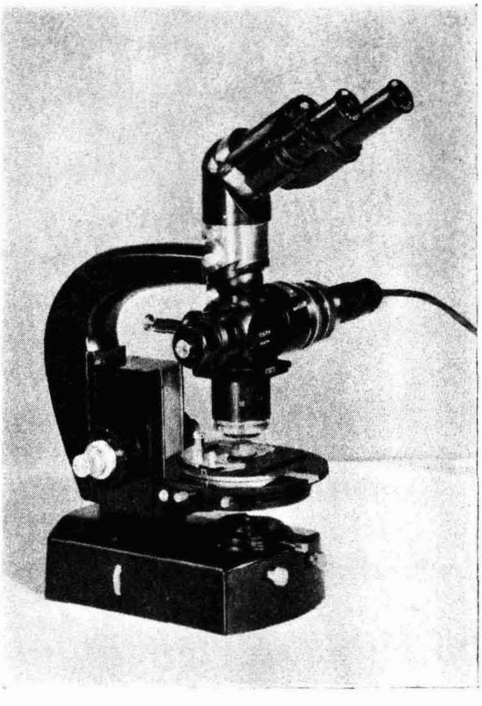

Fig. 1 — Microscope with incident light condenser and binocular inclined tube

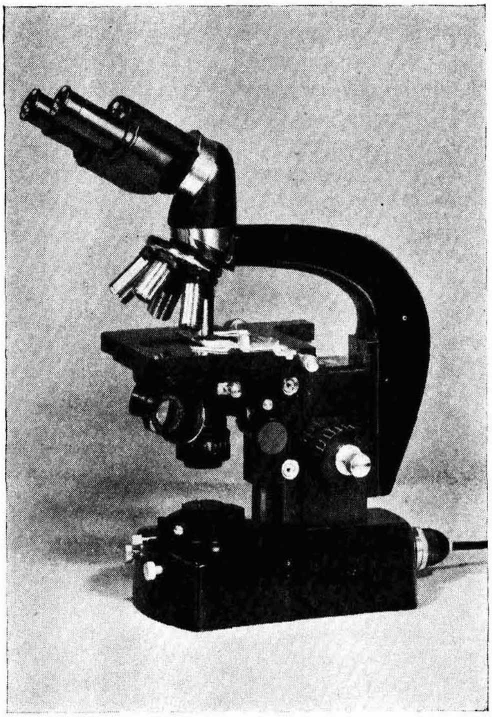

FIG. 2 — MICROSCOPE WITH PLANE-FIELD ACHROMATS AND BINOCULAR INCLINED TUBE

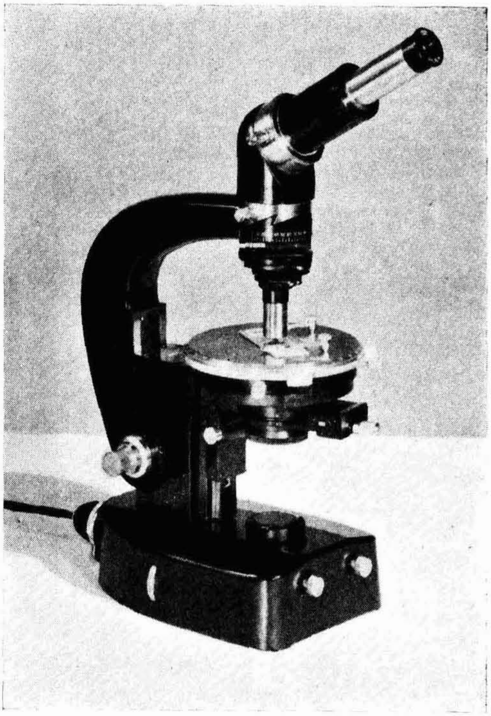

FIG. 3 — INTERMEDIATE TUBE 'POL' WITH DIVISION FOR ROTATION OF COMPENSATOR, OBJECTIVE SLIDE CHANGEOVER AND QUICK-CHANGING DEVICE BETWEEN DEFLECTING PRISM AND TUBE

changing slide with facilities for centring. The intermediate tube contains the filter analyser and compensator.

The phase-contrast unit consists of phase objectives, light filter and auxiliary microscope, the phase-contrast devices with special condenser and these can be fitted in with considerable ease since the parts are all interchangeable with the main microscope body.

Among the illumination methods possible in transmitted light are bright field, dark ground, phase-contrast, fluorescence microscopy, polarized light, measuring, counting and drawing. In incident light also, bright field, dark ground, and fluorescence microscopy are possible. Photomicrography is possible both in transmitted and incident light. For this purpose, a miniature camera or the standard size camera (9 × 12 cm.) can be used.

A Method of Testing Optical Flatness of Pre-polished Glass Surfaces

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A method for the quantitative estimation of the form of an optical surface, just before polishing, has been described. The optical lever with suitable modifications has been used for the purpose, so that departures from a standard form, say an optical flat, could be evaluated in terms of wavelengths of light. This data will be helpful in correcting surfaces even in the pre-polishing stages. The time spent in effecting the corrections at this stage will be very much less than the time taken in the figuring stages, after polishing. The results obtained by the method are verified by interference methods.

THE surfaces of metal tools, plane or curved, determine largely the accuracy of the glass surfaces which are worked on them. The use of interference methods of testing the correctness in regard to flatness or curvature of glass surfaces worked with such tools, particularly while the glass surfaces are in the ground stage, becomes difficult because of the non-reflecting nature of the glass surfaces. The method described here provides a means of assessing the correctness of the surfaces even in the ground stages. Such an assessment will be useful and time saving in optical operations, since serious departures from the required form can be corrected for, even when they are non-reflecting.

Apparatus

The apparatus (Fig. 1) consists of a sensitive optical lever, capable of giving definite and required magnifications of the variations in the level of the glass surface when it is made to traverse beneath the front leg of the instrument. A cast-iron frame, on which rests a flat ground-glass base, serves as a support for the test piece. The optical lever proper consists of a 1 × 1 in. plane mirror rigidly attached to a T-shaped

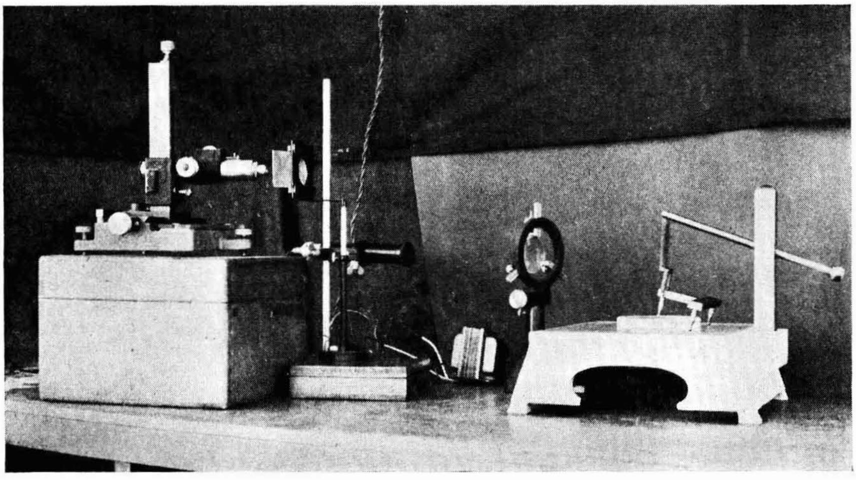

FIG. 1 — EXPERIMENTAL SET-UP TO TEST THE FLATNESS OF SURFACE

mild steel plate resting on 3 ball-ended stainless steel legs over the ground-glass base. The mirror mount is fastened by means of a linkage to a lever that passes through a hole on a vertical pillar which is fixed to the cast iron frame. The lever is pivoted at the hole about a rod provided at right angles and its free end is so shaped as to form a counterweight to facilitate the easy action of the lever. An illuminated cross-wire, contained in a brass tube, is focussed after reflection by the mirror on to a ground-glass screen by means of a suitable lens and the image is viewed through a travelling microscope.

As the surface under test is made to traverse beneath the front leg, any variation of the surface level will produce a corresponding tilt of the mirror and the image of the illuminated wire thus obtained after reflection at the mirror suffers a vertical displacement. The well-known principle of the optical lever provides the desired magnification and in the present case a value of 50 is chosen. When the displacement could be taken correct to 0·001 cm., the smallest variation that could be measured will be

$$\frac{0{\cdot}001}{50} = 0{\cdot}00002 \text{ cm.}$$

which is of the order of the wavelength of light used for observation.

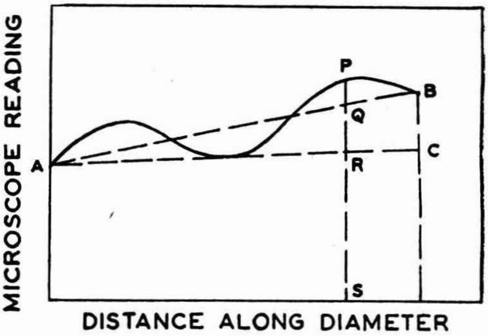

FIG. 2 — DIAGRAM ILLUSTRATING THE CALCULATION OF SURFACE FLATNESS AT ANY POINT ALONG THE DIAMETER

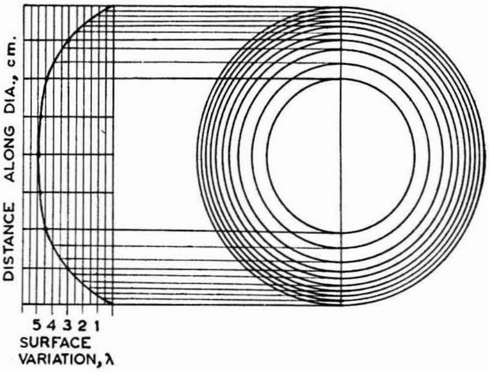

FIG. 3 — RING SYSTEM OBTAINED BY GRAPHICAL CONSTRUCTION FROM EXPERIMENTAL OBSERVATIONS

Experimental procedure and method of calculation

The surface under test is placed below the front leg of the optical lever and is moved in steps of 1 cm. from one end to the other along its diameter. The method of determination of the departure from flatness at any point P along the diameter AB is illustrated with the help of Fig. 2. The bottom of the disc is in contact with the flat ground surface on which it rests. Let the top surface under test make an angle with the bottom. The increase in thickness along AB can be taken to be proportional to the distance from the point A, so that the departure PQ from flatness at P distant L from A can, in general, be given by

$$Y_L - Y_A - \left[\frac{Y_B - Y_A}{d} . L\right]$$

where Y_L, Y_A, Y_B are the readings of the optical

TABLE 1 — CALCULATION OF VARIATIONS IN THE LEVEL OF THE GLASS SURFACE

L cm.	Y_L cm.	Y_A cm.	$M_1 = Y_L - Y_A$ cm.	Y_B cm.	$\frac{Y_B - Y_A}{d}$	$M_2 = \frac{Y_B - Y_A}{d} . L$ cm.	MAGNIFIED SURFACE VARIATION, M ($M = M_1 - M_2$) cm.	ACTUAL SURFACE VARIATION, t ($t = M/50$) 10^{-4} cm.	t/λ ($\lambda = 5893$ A.)
0	5·859	5·859	0	6·328	0·0586	0	0	0	0
1	5·928		0·069			0·0586	0·0104	2·08	3·5
2	5·990		0·131			0·1172	0·0138	2·76	4·7
3	6·049		0·190			0·1758	0·0142	2·84	4·8
4	6·108		0·249			0·2344	0·0146	2·92	5·0
5	6·166		0·307			0·2930	0·0140	2·80	4·8
6	6·224		0·365			0·3516	0·0134	2·68	4·5
7	6·279		0·420			0·4102	0·0098	1·96	3·3
8	6·328		0·469			0·4690	0	0	0

lever when the central leg rests at L, A, B respectively and d the diameter of the disc. To determine the true value of the increase in thickness, the values so obtained should be divided by the magnification (50 in the present case). The variations in the level of the glass are calculated from a set of experimental readings using the above expression as indicated in Table 1.

A graph is then drawn with the true surface level variations on the Y axis and distance along the diameter on the X axis and a system of rings is obtained as shown in Fig. 3.

Testing

A pitch polisher is then moulded on the surface and the surface worked over it for a few minutes so that it becomes just reflecting without producing any appreciable change in the figure of the surface. The surface is then tested by interference methods for its figure, using a proofplate. A convexity of ten rings of yellow light was observed, conforming to the results obtained by the optical lever method. The interference ring pattern obtained is shown in Fig. 4 for comparison. The proofplate is of a larger size, and the ring system is confined to the area of the surface under test.

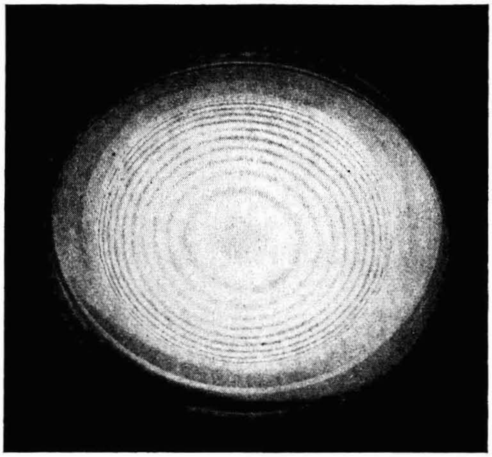

FIG. 4 — INTERFERENCE RING PATTERN OBTAINED WITH PROOFPLATE

The method has been applied for other surfaces and identical results have been obtained. The procedure can be made useful in optical working on both curved and plane surfaces in the last stages of grinding and in testing their form before actual polishing operations are commenced.

Use of Crystalline Limestone in the Production of Calcium Carbide

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The use of crystalline limestone (calcite) from Tinnevelly and Salem districts, Madras State, in the production of calcium carbide has been investigated. A charge consisting of unburnt crystalline limestone (0·5 in. size grade) charcoal and petroleum coke, when heated in a three-phase submerged arc furnace, has been found to yield calcium carbide satisfying the ISI specifications for Grade A quality calcium carbide, thereby showing that crystalline limestone can be employed in the manufacture of calcium carbide.

THE quality of calcium carbide produced in India still falls short of the prescribed standards, both in regard to gas yield and phosphine impurity in the gas. The Indian Standards Institution (ISI) formulated standards for two grades of calcium carbide, Grade A corresponding to the average quality of the imported material and Grade B corresponding to the lowest quality of the indigenous material. Inferior quality of raw materials, namely limestone and coke, appears to be one of the obstacles in producing Grade A quality product by the Indian calcium carbide industry. The importance of this problem will be appreciated when it is realized that from the current production of about 5000 tons/year, the rated capacity of the industry is to be raised to about 40,000 tons/year by 1960-61. Achievement of this target involves, besides increasing the production capacity at existing centres, setting up of new centres of production, some of them in South India.

Experimental trials, reported earlier[1] from this Institute, dealt with the utilization of lignite char from Neiveli for calcium carbide manufacture, in view of the dearth of good quality coke. The present paper deals with the other raw material, namely limestone, large deposits of which, in the form of crystalline calcite, are available in the Tinnevelly and Salem districts and are already being exploited by the cement and alkali-chlorine industries. It is, however, the general opinion that these deposits are not suitable raw material for the calcium carbide industry. The material must satisfy certain specifications as regards chemical purity since magnesia, silica, iron oxide, sulphur, phosphorus and alkalies constitute objectionable impurities and which have an adverse effect both on the quality of the calcium carbide produced and also on the smooth and trouble-free operation of the arc furnace. Most of the varieties of the crystalline limestone referred to above fulfil the chemical requirements, but while chemical purity is undoubtedly an essential prerequisite, it is also of the utmost importance that the quicklime must fulfil certain requirements as regards its mechanical properties. If it is very friable, it gives rise to much dust or fines during use, leading to blow-outs and other difficulties in furnace operation. It is in this respect that crystalline limestone is usually considered unsuitable for the purpose, since the burnt lime which it yields crumbles easily.

In view of the excellent chemical quality of the crystalline limestone, which is available in large quantities, it appeared worthwhile to carry out investigations for overcoming the difficulty mentioned above. One of the methods considered was to briquette powdery lime, using a suitable binder prior to mixing with coke, charcoal or other carbonaceous raw material for feeding into the furnace. Some preliminary trials carried out have shown that carbide could be produced successfully by this procedure but the gas yields from the product have not been found to be quite satisfactory. Further trials on these lines are under way. An alternative method which has been attempted, namely feeding the unburnt limestone of suitable size-grade as such, mixed with charcoal and petroleum coke in a number of trial runs, has resulted in a product satisfying the ISI specifications for Grade A calcium carbide. Some of the results obtained in the course of typical trial runs are given here. The general practice everywhere is to feed burnt lime rather than unburnt limestone into the carbide furnace for obvious reasons. In dealing with crystalline varieties of limestone, however, this departure from the conventional procedure appears to be advantageous. The relative merits as regards the overall economics will have to be worked out on the basis of several other considerations, which are not within the scope of this paper. The results of trial runs described in this paper are encouraging.

Experimental procedure

Materials — White crystalline limestone from Ramayanpatti deposits (Tinnevelly district) was used in all the experiments. Locally available charcoal and petroleum coke supplied by Messrs Burmah-Shell were used. The electrodes of the arc furnace used were cylindrical rods (2 in. diam.) of Acheson graphite although in commercial practice, instead of graphite, either carbon or Soderberg paste electrodes would be desirable.

The furnace — The three-phase submerged arc furnace built for the purpose and the accessory connections are shown in Fig. 1. The furnace is approximately 1½ × 1½ × 1½ ft in dimensions and is connected to the secondary side of a 45-kVA. transformer manufactured by National Electrical Industries Ltd, Bombay. The transformer is fed on the primary side from 440 V., three-phase a.c. supply lines. The three graphite electrodes of the furnace are arranged in a triangular fashion, one at each of the apexes. A fourth auxiliary electrode connected to one of the three phases is also provided and is intended for use only at the time of tapping of the furnace, towards the end of each experiment. By making contact with the solid carbide in the furnace through an opening provided in the furnace wall for the purpose, the auxiliary electrode closes the electric circuit, thereby enabling the carbide to melt and flow out. The three furnace electrodes are provided with hollow copper jackets at the top through which cold water is circulated. The wire hoist, pulleys and the hand-wheel gear arrangement (Fig. 1) enable lifting or lowering of the furnace electrodes by simple manual operation.

Trial runs — The furnace described above is capable of taking about 10 lb. of the total charge for each experiment if intermittent tapping of the molten carbide is not resorted to. In the course of the trial runs using this furnace, the charges were limited to

10 lb. in each case, for a continuous run of 15-20 min. of furnace operation. Some trial runs, however, were also carried out for much longer durations, up to 60 min. continuously, wherein the charge was fed from time to time and the product formed was also tapped intermittently. In such experiments the total charge used was of the order of 20-30 lb.

For a comparative evaluation of the effects of using straight unburnt limestone and conventional burnt lime, a few trial runs were also carried out using quicklime prepared from the crystalline limestone by a prior lime burning operation. Great care had to be taken in the experiments using the burnt lime in the charge so as to minimize dust formation. Pieces of burnt lime of the required size-grade were hand-picked from the lime kiln and the mixing with charcoal and petroleum coke as well as the actual feeding of the mixed charge into the furnace were done with great care so as to avoid as much disintegration or crumbling of lime as possible during handling operations. It may be difficult to exercise such care in large-scale furnace operation, but the data obtained from the small-scale trial runs, however, are useful in judging the relative efficacy of using straight unburnt limestone itself in the charge.

Results

The results of some of the typical trial runs are given in Table 1. The figures for the gas yield given in Table 1 are values experimentally determined and converted to 80·6°F. temperature and 30 in. Hg pressure for easy comparison with ISI specifications. From the results it is seen that unburnt crystalline limestone of suitable size-grade for direct use in the charge is as satisfactory as burnt lime. The only point to be considered is that instead of 1·5-2 in. size-grade generally prescribed for burnt lime in industrial practice, a slightly smaller size-grade, viz. 1 in. size-grade, material may have to be used in the case of unburnt crystalline limestone. For this and also for having a realistic idea as regards the electrode consumption and energy consumption, it will be necessary to carry out a few large-scale trials in industrial furnaces.

In the calcium carbide industry the nature of the raw materials is such that the formation of dusts and fines is inevitable to a certain extent during the handling operations. Only when it is excessive, furnace blow-outs and other troubles occur in continuous operation. Lime produced from *kankar* or Katni limestone, which is generally used in the industry, has the requisite mechanical strength to resist abrasion to dust in the normal handling operations. Since it is now advocated to use unburnt crystalline limestone instead, it will be useful to compare this material with burnt *kankar* or Katni lime. For this purpose a few barrel-tumbling tests were carried out in which the raw material under test, of different size-grades, was subjected to continuous tumbling in a M.S. barrel for specified durations, the dust or fines resulting therefrom being subjected to sieve analysis. The barrel used was cylindrical in shape, 11 in. diameter and 5 in high, and was operated by an electric motor drive to give 50-60 r.p.m. For each experiment 1 lb. of the material was used. It may be pointed out here that these barrel-tumbling tests are not to be treated as representing any standards of an absolute nature, but are of relative

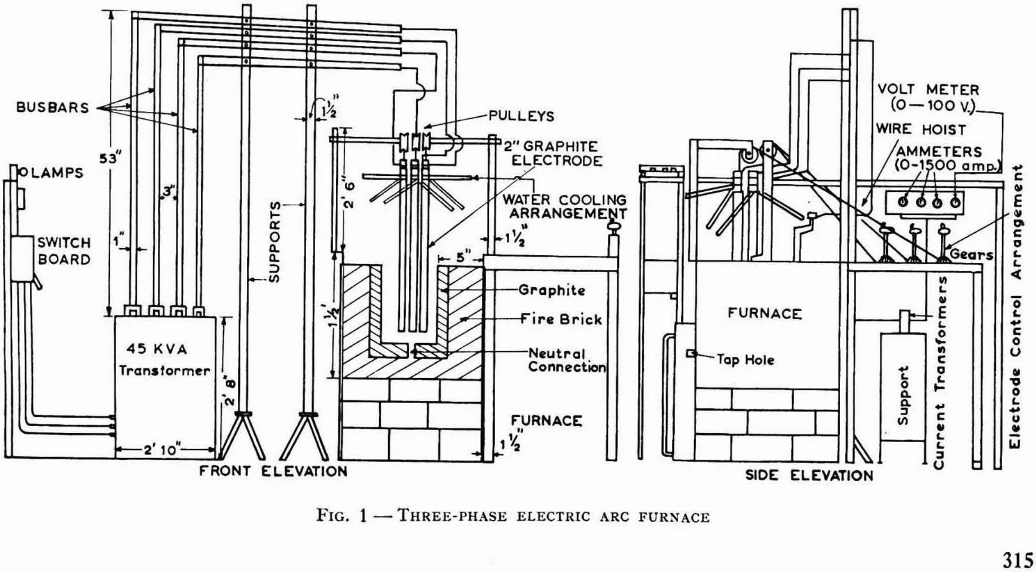

FIG. 1 — THREE-PHASE ELECTRIC ARC FURNACE

TABLE 1 — TYPICAL TRIAL RUNS WITH CRYSTALLINE LIMESTONE

(*Arc furnace operated at* 40-50 *V. and* 400-500 *amp.*)

CHARGE No.	COMPOSITION OF CHARGE	DURATION FOR WHICH THE FURNACE WAS OPERATED *min.*	QUANTITY OF CARBIDE PRODUCED *lb.*	GAS YIELD *cu. ft/lb.*	QUALITY OF THE PRODUCT	
					Phosphine in gas % (*by vol.*)	Hydrogen sulphide in gas % (*by vol.*)
1	Unburnt limestone (size 0·5 in.), 4·4 lb. Charcoal (size 0·5 in.), 2·2 lb. Petroleum coke (size 0·25 in.), 0·44 lb.	15	2·16	5·22	0·048	0·009
2	Unburnt limestone (size 0·5 in.), 17·6 lb. Charcoal (size 0·5 in.), 8·8 lb. Petroleum coke (size 0·25 in.), 1·8 lb.	60	10·10	5·08	0·042	0·008
3	Burnt lime (size 0·5 in.), 2·5 lb. Charcoal (size 0·5 in.), 2·2 lb. Petroleum coke (size 0·25 in.), 0·4 lb.	10	2·13	5·16	0·050	0·010
4	Burnt lime (size 0·5 in.), 10·1 lb. Charcoal (size 0·5 in.), 8·8 lb. Petroleum coke (size 0·25 in.), 1·8 lb.	45	9·14	5·00	0·040	0·012
	ISI specification for calcium carbide					
	Grade A			4·98 min.	0·06 max.	0·15 max.
	Grade B			4·50 min.	0·08 max.	0·15 max.

TABLE 2 — BARREL-TUMBLING TESTS*

DURATION OF BARREL-TUMBLING TEST *min.*	BURNT LIME FROM *kankar* LIMESTONE: FINES (<10 MESH) RESULTING FROM			UNBURNT CRYSTALLINE LIMESTONE FROM TINNEVELLY DISTRICT: FINES (<10 MESH) RESULTING FROM		
	0·5 in. size-grade (av.) %	1 in. size-grade (av.) %	1·5 in. size-grade (av.) %	0·5 in. size-grade (av.) %	1 in. size-grade (av.) %	1·5 in. size-grade (av.) %
15	48·9	50·4	59·9	8·0	8·7	10·4
30	50·7	53·3	61·9	11·3	16·3	17·2
60	54·2	59·7	76·0	20·1	21·6	33·5

*For each of the tests carried out, 1 lb. of the material was taken. Sieve analysis was carried out for the resulting fines, but only the figures for 10-mesh sieve are given, as they are more relevant in this study.

significance in comparing the two materials as regards friability under the particular experimental conditions adopted for the tests.

The results given in Table 2 indicate that disintegration to dust or fines occurs to the extent of 60-76 per cent in the case of burnt *kankar* lime whereas it is only 10-34 per cent in the case of unburnt crystalline limestone. If 1-1·5 in. size-grade is ultimately going to be used, the unburnt crystalline limestone will appear to resist disintegration twice or thrice as effectively as burnt lime from *kankar*. It is to be observed that fine dust formation when using unburnt crystalline limestone can arise mostly at the stage when it is converted into quicklime, as the material progressively approaches the zone of the arc. At that stage it quickly reacts to form the carbide or associated eutectic mixtures, and there does not appear to be much possibility of accumulation of the fines in the vicinity of the arc. Not much of lime dust formation will occur in the higher reaches of the furnace either, where the crystalline limestone is yet unconverted into quicklime. Hence there does not seem to be much practical difficulty in the use of straight unburnt crystalline limestone when compared with the use of burnt *kankar* or Katni lime.

Discussion

From the experimental results presented it appears to be a feasible and practical proposition to use straight unburnt crystalline limestone, of selected size-grade, available in South India in the manufacture of calcium carbide. From the results given in Table 1 it is seen that the percentage of phosphine and hydrogen sulphide impurities in the gas are within the stipulated ISI limits for Grade A calcium carbide. The gas yields also fulfil the requirements for Grade A. Certain deposits of crystalline limestone available at Sankaridrug in Salem district also appear to be as good as the grades of limestone from the Tinnevelly district. The composition of some grades of

TABLE 3 — CHEMICAL COMPOSITION OF CRYSTALLINE LIMESTONE FROM CALCITE DEPOSITS*

CONSTITUENT	RAMAYANPATTI (TINNEVELLY DISTRICT)	SANKARIDRUG WHITE (SALEM DISTRICT)	SANKARIDRUG GREY (SALEM DISTRICT)	SANKARIDRUG PINK (SALEM DISTRICT)	ASTM SPECIFICATIONS (C: 258-52) FOR UNBURNT LIMESTONE
Total calcium oxide (CaO), %	54·47	55·60	54·19	52·48	51·52
Silica (SiO_2 and acid-insolubles), %	1·10	0·37	1·40	4·35	1·12
Iron oxide (Fe_2O_3), %	0·30	0·16	0·53	0·39	—
Manganese oxide (Mn_2O_3), %	0·03	0·02	0·08	0·04	—
Alumina (Al_2O_3), %	0·03	0·01	0·66	0·01	—
Iron oxide-alumina (R_2O_3), %	0·36	0·19	1·27	0·44	0·56
Magnesia (MgO), %	0·52	0·13	0·26	0·48	0·98
Phosphorus pentoxide (P_2O_5), %	0·07	0·03	0·12	0·02	0·03
Total sulphur (S), %	0·01	0·05	0·23	0·05	0·11

*Data given in the table are taken from *High Calcium Limestones of India* by H. C. Bijawat and S. L. Sastry (Council of Scientific & Industrial Research, New Delhi), 1956.

crystalline limestone from Ramayanpatti (Tinnevelly district) and Sankaridrug (Salem district) is given in Table 3. The stipulated requirements of chemical purity as per ASTM standards are also indicated in Table 3 for comparison.

The Sankaridrug grey and pink varieties of crystalline limestone contain too much sulphur and silica although the total calcium oxide in each is well above the requirements. Of the two, the grey variety appears promising and deserves further examination, by large-scale furnace trials. The Ramayanpatti and Sankaridrug white limestones satisfy the requirements in all respects, namely total calcium oxide and silica, magnesia, iron oxide and alumina, phosphorus and sulphur impurities. The phosphorus impurity in the Ramayanpatti limestone slightly exceeds the ASTM specifications, but it has been found that the calcium carbide produced from this material passes the ISI Grade A specifications.

Acknowledgement

The authors take this opportunity to express their thanks to Dr K. S. G. Doss, Director, Central Electrochemical Research Institute, Karaikudi, for his keen interest in this work and for his kind encouragement.

Reference

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Symposium on Thyro-gonad-adrenal-pituitary Relationships

A SYMPOSIUM ON THYRO-GONAD-ADRENAL-PITUITARY relationships, organized by the National Institute of Sciences of India, will be held in Delhi during 2-4 October 1959. The subjects included for discussion are: (1) Thyro-gonad-pituitary relationships; (2) Adrenocortical-gonad-pituitary mechanisms; (3) Thyro-adrenocortical-pituitary relationships; (4) Gonad-pituitary relationships; and (5) Pituitary-adrenocortical relationships. Abstracts of papers to be presented at the symposium, not exceeding 250 words, should be sent in duplicate to the Convener, Dr B. Mukerji, Director, Central Drug Research Institute, Lucknow, before 31 August 1959; the full papers, in duplicate, should reach him by 15 September 1959.

Shellac-Dimethylolurea Moulding Composition

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A method for the preparation of a moulding powder composition using shellac and dimethylolurea has been described. The shellac-dimethylolurea moulding composition, whose moulding characteristics are as good as that of lac-urea-formaldehyde powder, is much cheaper to produce because it can be prepared by the dry method which does not require the use of any solvents or machinery other than a pair of hot rollers.

SHELLAC is a thermoplastic resin which, on prolonged heating, slowly polymerizes to an infusible, insoluble product. Based on this property of slow heat polymerization of shellac, various attempts[1-7] have been made to convert it into a thermosetting resin that can cure quickly. So far only partial success has been achieved in this direction. Ranganathan and Aldis[8] observed that many chemicals including urea harden shellac quickly under heat treatment. Ranganathan[6] actually utilized this observation to prepare shellac-urea moulding powders by the wet process, but the compositions were not mouldable by the bakelite technique. Later on, Venugopalan and Sen[7] formulated an improved composition by reacting shellac, first with formaldehyde and then with urea in alcoholic solution. Moulding compositions thus prepared could be moulded hot and ejected hot. Since the process as a whole was rather complicated, time-consuming and costly, attempts were made to evolve an improved process involving the use of the dry[9] instead of the wet method. But attempts to incorporate urea into the reaction product of shellac and formaldehyde (termed 'shellac-formal') by the dry method, i.e. by passing the mix between steam-heated mixing rollers, resulted in premature curing. It was, however, thought that the dry method could be used and the process also improved, if, instead of proceeding separately with formaldehyde and urea, a direct reaction of shellac with dimethylolurea (DU), itself a product of reaction between formaldehyde and urea, were utilized. The present paper reports results of investigations along these lines.

Materials and methods

Shellac — Ordinary shellac having the following properties was used: life (polymerization time) at 150°C., 47 min.; flow, 75 sec.; wax content, 4·20 per cent; and carbonyl value, 17·3.

Dimethylolurea — As commercial DU was not available at the time of starting the investigation it was prepared in the laboratory according to the procedure employed by Einhorn[10,11]. Barium hydroxide (0·4 g.) was dissolved in formaldehyde solution (37·4 per cent; 26·7 g.) to which was added urea (10 g.). The mixture was maintained at 25-30°C. until all the formaldehyde had reacted. On completion of the reaction, carbon dioxide was passed into the solution for 10-15 min. after which the liquid was evaporated to dryness in a desiccator. The dried residue was extracted with warm 80 per cent ethyl alcohol and the solution filtered; on cooling, 10 g. of DU (m.p. 126°C.) crystallized out. DU thus prepared was used in preliminary experiments by the wet process for the determination of the optimum amount of DU necessary for successful moulding compositions, conditions of moulding, etc. Subsequently the commercial product was available which was used in further experiments. It may be noted, however, that both the commercial product and the laboratory-made sample deteriorate slowly on storage during the first six months, and rapidly thereafter, becoming more and more insoluble in alcohol.

Methods of preparation of the moulding powder

Wet process — The wet method of preparing the standard lac-urea-formaldehyde (L-U-F) moulding powder[12] was adopted in the case of shellac-DU compositions (S-DU). Shellac (100 g.) was mixed with varying amounts (0-35 g.) of DU and refluxed with methylated spirit (200 ml.) at 130-40°C. for 3 hr on an oil bath. *Haldu* (*Adina cordifolia*) wood flour (100 g.) and aluminium stearate (2 g.) were then

TABLE 1 — MOULDING TRIALS WITH DIFFERENT PROPORTIONS OF DU (WET METHOD)

DU USED *g./100 g. shellac*	MOULDING QUALITY	HOT ALCOHOL-INSOLUBLES OF THE MOULDED PRODUCT %	COLD ALCOHOL-INSOLUBLES OF THE MOULDED PRODUCT %	IMPACT STRENGTH *cm. kg./sq. cm.*	REMARKS
5	Bad	—	—	—	Too soft; blisters found on moulded articles even after prolonged baking at 90-95°C. for 6 hr
10	do	42·60	73·15	3·07	Soft during ejection
15	Good	53·17	76·80	4·17	Satisfactory moulding at 140°C., 1 ton/sq. in. pressure and 3 min. moulding time
20	do	59·58	81·42	4·19	Satisfactory moulding at 140°C., 1·5 tons/sq. in. pressure and 3 min. moulding time
30	do	70·30	84·10	4·19	do
35	do	71·86	85·40	4·38	Satisfactory moulding at 140°C., 2 tons/sq. in. pressure and 3 min. moulding time

added. The resulting composition, after drying at room temperature, was powdered to 80 mesh and baked at 90-95°C. for 2 hr before putting it into moulds. The results of moulding trials are given in Table 1.

It will be seen from the results presented in Table 1 that as the amount of DU per 100 g. of shellac is increased beyond 15 g., the moulding pressure goes on increasing without, however, any improvement in the impact strength. The optimum amount of DU per 100 g. of shellac may, therefore, be taken as 15 g. It is to be noted that compositions obtained with this proportion of DU could be satisfactorily moulded even without the help of any modifier. A large sample containing this proportion of DU was prepared to study the optimum time, temperature and pressure necessary for satisfactory moulding. In determining these conditions, it should be remembered that from the production point of view the time required for moulding should be as short as possible. Further, the better the moulding powder, the less soluble should it be in alcohol after moulding, as a result of chemical transformation in course of curing. In Table 2 are given the solubility of the original powder and the moulded product in hot and cold alcohol under varying conditions of moulding.

It will be observed from the results given in Table 2 that while other conditions were varied the curing time was kept at 3 min., since this was found to be optimum in this as well as in the case of the standard L-U-F powders. Similarly the optimum pressure and temperature of moulding were respectively 1·5 tons/sq. in. and 140-50°C. The hot alcohol-insolubles content in the moulded product (composition 30-35 g. of DU per 100 g. of shellac) was higher, but the slight increase is more than counter-balanced by the increased cost of DU. Hence for all practical purposes the use of 15 parts of DU per 100 parts of shellac has been considered to be the optimum. This agrees closely with the previous findings in the case of L-U-F moulding compositions (unpublished data), namely that, although 15 per cent urea and 50 per cent formalin on the weight of lac gave the best moulding compositions, the optimum amounts of urea and formalin required for satisfactory moulding were 9 and 25 per cent respectively.

TABLE 2 — HOT AND COLD ALCOHOL-INSOLUBLES IN MOULDED COMPOSITIONS

MOULDING CONDITIONS			HOT ALCOHOL-INSOLUBLES %	COLD ALCOHOL-INSOLUBLES %
Pressure *ton/sq. in.*	Curing time *min.*	Temp. *°C.*		
Original powder (without treatment)			42·41	75·47
1·0	1	140	43·12	74·35
1·0	2	140	44·36	75·46
1·0	3	140	53·17	76·80
1·5	3	140	53·87	81·19
1·5	3	150	57·21	81·59
2·0	3	140	57·99	81·50
2·0	3	150	57·61	80·50

Dry process — Having established the optimum conditions for the wet process, the optimum conditions for the dry process were determined. For this, all the ingredients used in the wet process, with the exception of methylated spirit, were intimately mixed between hot rollers (90-95°C.) for 10 min. The hot-rolled mass was taken out in sheet form, powdered

TABLE 3 — MOULDING TRIALS WITH SHELLAC-DU (AGED) MOULDING COMPOSITION WITH DIFFERENT MODIFIERS

MODIFIER *g./100 g. shellac*	DURATION OF HOT ROLLING AT 90-95°C. BEFORE ADDITION OF MODIFIER *min.*	DURATION OF HOT ROLLING AFTER ADDITION OF MODIFIER *min.*	DURATION OF BAKING AT 90-95°C. FOR BLISTER-FREE MOULDING *hr*	MOULDING CHARACTERISTICS OF COMPOSITION MOULDED AT 145°C., 1·5 TONS/SQ. IN. PRESSURE FOR 3 MIN.
Control	20	—	9	Soft composition with blisters; sticks to mould and unsuitable for hot moulding
Oxalic acid, 3·0	5	5	3	Blister-free moulding; very dull in appearance
Cinnamic acid, 3·0	10	2	3½	do
Phthalic anhydride, 3·0	10	16	4	do
Maleic anhydride, 3·0	10	13	3	Does not fuse properly; sticks to mould
Maleic acid, 0·5	10	20	7½	Composition rather soft for hot moulding
Maleic acid, 1·5	10	12	3	Hard composition; blister-free moulding; dull in appearance
Maleic acid, 3·0	10	6	1½	do
Lime, 1·0	10	2	6½	Very good gloss and flow, but had blisters which could not be cured by longer baking
Maleic acid, 1·0 + lime, 1·0	10	10	2	Good gloss and flow; slightly soft composition
Maleic acid, 2·0 + lime, 1·0	10	8	1½	Good gloss and flow; composition suitable for hot moulding
Maleic acid, 3·0 + lime, 1·0	10	8	1½	Good gloss and flow; composition suitable for hot moulding; gloss slightly inferior to preceding composition 11; suitable for hot moulding

TABLE 4 — MOULDING CHARACTERISTICS OF COMPOSITIONS WITH DU AGED FOR DIFFERENT PERIODS

SL NO.	DURATION FOR WHICH DU WAS AGED	MODIFIER (ON THE WT OF SHELLAC)	DURATION OF HOT ROLLING *min.*	DURATION OF PRE-HEATING AT 90-95°C. FOR BLISTER-FREE MOULDING *min.*	IMPACT STRENGTH *cm. kg./sq. cm.**	MOULDING CHARACTERISTICS OF COMPOSITIONS MOULDED AT 145°C. AT 1·5 TONS/SQ. IN. PRESSURE FOR 3 MIN.
1	Freshly prepared (alcohol-soluble)	nil	5	120	4·30	Satisfactory moulding
2	do	Maleic acid, 2%; CaO, 1%	10	45	4·33	Satisfactory moulding; slightly better gloss and flow than No. 1
3	One year (partially alcohol-soluble)	nil	12	120	—	Could not be properly moulded; soft composition
4	do	Same as in No. 2	15	60	4·33	Satisfactory moulding
5	Two years old (alcohol-insoluble)	nil	20	120	—	Could not be properly moulded; soft composition which sticks to mould
6	do	Same as in No. 2	18	90	4·33	Satisfactory moulding
7	Above three years (alcohol-insoluble)	nil	15	300	—	Very soft composition which sticks to mould; unsuitable for moulding
8	do	Same as in No. 2	47	180	4·20	Soft and sticky composition; moulding unsatisfactory

*Impact strengths for compositions which could not be properly moulded were not determined.

and pre-heated before moulding. The compositions thus obtained did not differ materially either in respect of moulding characteristics or properties of moulded products from those prepared by the wet process.

To explore the commercial possibilities of this process, moulding compositions were prepared employing the commercial grades of DU (15 parts per 100 parts of shellac) which was almost insoluble in alcohol. These compositions were found to be rather soft and hence unsuitable for moulding by the bakelite technique. Known methods of hardening, e.g. longer heat treatment during mixing between hot rollers, pre-heating before putting in moulds, or reaction with higher amounts of DU (30 parts), did not improve their moulding characteristics. On the other hand, identical compositions made with freshly prepared DU (alcohol-soluble) were quite satisfactory in all respects. In practice, however, the moulding compositions prepared should be based on the use of commercial or aged DU. To achieve this, various modifiers were tried, taking the following composition as the basis: shellac (100 parts), *Haldu* saw dust (100 parts), DU (stored for one year and alcohol-insoluble) (15 parts), aluminium stearate (3 parts), and pigment (4 parts). The ingredients were mixed between hot rollers at 90-95°C. and various modifiers added. Hot rolling was continued till the compositions left the rollers and came out in a sheet form. Of the various modifiers tried, the results obtained with the promising ones are given in Table 3.

It will be seen from the results of moulding trials given in Table 3 that with a single modifier, the moulded product was either dull in appearance or soft with blisters. Thus maleic acid, though promising, gave dull products; similarly lime imparted gloss but blisters appeared which could not be eliminated even by longer pre-heating. However, by incorporating a mixture of maleic acid and lime in the respective proportions of 2 parts and 1 part per 100 parts of shellac, satisfactory products could be obtained; the baking period for obtaining blister-free mouldings of such a modified composition was also found to be much shorter (1·5 hr). It may be mentioned that during hot rolling no smell of formaldehyde was noticed.

Since the transformation of DU on storage from alcohol-soluble to alcohol-insoluble form progresses with time, several types of DU, aged for different periods, were used. The results of moulding trials with these compositions, with or without modifiers, are given in Table 4.

The results given in Table 4 show that DU stored for two years may conveniently be used in combination with a modifier. Further, the use of modifiers along with freshly prepared (alcohol-soluble) DU, which by itself ensures satisfactory moulding, results in slightly improved compositions requiring much less baking time. The properties of such compositions (Table 5) are also comparable with those of standard L-U-F compositions prepared by the wet method using methylated spirit as solvent.

TABLE 5 — PROPERTIES OF MOULDING COMPOSITIONS

PROPERTY	STANDARD L-U-F COMPOSITION	S-DU COMPOSITION	S-DU COMPOSITION WITH MODIFIER
Sp. vol. of moulding composition (25 g.), ml.	47	48	48
Impact strength of moulded articles, cm. kg./sq. cm.	4·8	4·3	4·7
Water absorption of moulded articles (24 hr), %	0·97	1·20	0·98
Heat resistance of moulded articles (Marten's oven), °C.	82	82	82
Dielectric strength of $\frac{1}{8}$ in. thick specimen, V./mil	450	—	428
Surface resistivity at 3% humidity, ohm/cm.	$3{\cdot}2 \times 10^{15}$	—	$3{\cdot}0 \times 10^{15}$

Discussion

The efficiency of urea in reducing the polymerization time of shellac is well known. In the absence of any solvent, the rate of polymerization of shellac with urea is rapid and during hot rolling (90-95°C.), even if shellac had been pre-treated with formalin, the rate of polymerization becomes uncontrollable, and infusible products are obtained. On the other hand, DU has been found to have a milder reaction and the polymerization of shellac proceeds at a reasonably slow rate so that shellac-DU moulding compositions, almost as good as the standard L-U-F compositions, can be prepared by the dry method (Table 5).

One apparent disadvantage of DU is its tendency to undergo a sort of progressive change on storage under tropical conditions, as is evident from its gradual transformation from alcohol-soluble to alcohol-insoluble condition. This means that the use of commercial-grade DU, stored for varying periods, might give bad or non-uniform compositions. However, the use of modifiers (2 per cent maleic acid and 1 per cent lime on the weight of shellac used) practically eliminates this difficulty and gives successful moulding compositions, provided the age of stored DU does not exceed two years (Table 4). It is interesting to note that shellac-DU moulding compositions have much better keeping properties than DU itself; a moulding composition made with freshly prepared DU and stored for more than three years showed uniform moulding characteristics during the whole period of storage. In view of the satisfactory keeping quality of shellac-DU moulding powders, it would be worthwhile to utilize fresh DU in the manufacture of shellac-DU moulding powders, and at the same time incorporate modifiers so that the powders would have uniform moulding properties for durations as long as three years or more. The preparation of DU for this purpose should not prove difficult, since as stated earlier, the method is simple and needs no elaborate equipment or costly machinery. A further point of interest is that, as subsequent investigations have shown, the process of making DU need not be continued till the crystals of DU are obtained, but that the solution obtained by adding urea in a solution of formalin and barium hydroxide may be straightway used in place of DU. This greatly simplifies the manufacturing process.

In conclusion it may be stated that, with respect to the quality of the powder, or the performance of the moulded product, there is little to choose between S-DU composition prepared by the dry method or L-U-F moulding composition prepared by the wet method. Since solvents and machinery such as kneading and mixing machine, solvent recovery plant, etc., are not required for the preparation of S-DU — the only machine to be used is a pair of hot rollers — it can be prepared quickly, thereby lowering the overall cost of its preparation. The S-DU composition should, therefore, be preferred to the standard L-U-F powder on grounds of economy.

Acknowledgement

The authors wish to express their grateful thanks to Dr P. K. Bose and to Dr S. V. Puntambekar for their guidance and kind interest in this work and to Shri B. Mukhopadhyay for assistance in the preparation of the manuscript.

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International Council for Building Research — 1959 Congress

THE GENERAL CONGRESS OF THE INTERNATIONAL Council for Building Research Studies and Documentation for the year 1959 will be held in Rotterdam, the Netherlands, from 21 to 26 September 1959. Eight subjects of topical interest for the development of the building industry will come up for discussion. The subjects will be presented both in English and French in 44 reports, the texts of which will be sent to the participants in advance.

The reports will be drawn up by 54 experts from many countries. The subjects covered are: (1) Sociological and functional aspects of housing design, (2) Design and calculation of constructions: Safety coefficients, (3) Introduction to the standardization of dimensioning on the building site, tolerances and dimension control, (4) Research problems concerning large concrete elements in housing, (5) Mass housing in rapidly developing tropical and sub-tropical areas, (6) Flat roofs, (7) Fundamental aspects of transmission of knowledge, and (8) Heat insulation and moisture effects.

The Congress is open to the Council members and also to other interested persons on registration at the Congress Secretariat, c/o Bouwcentrum, Weena 700, P.O. Box 299, Rotterdam, the Netherlands.

REVIEWS

SCIENTIFIC MANPOWER IN EUROPE by Edward McCrensky (Pergamon Press Ltd, London), 1958. Pp. ix + 188. Price 40s. net

The two World Wars gradually shifted science from an individual to a national base. This is particularly true of European and other Western countries including America and Russia. Today the government is the largest single employer of scientific and technical personnel in every country. The first step was to organize scientific establishments. In the second, organization of scientists and scientific administration became increasingly important in the public service.

The book under review is a comparative study of scientific manpower in the public services of Great Britain and a few selected European countries. The systems followed in the U.S.A. and the U.S.S.R. have also been described to make the book more comprehensive.

In the Foreword, Mr Harry Melville, Permanent Secretary, Department of Scientific & Industrial Research, U.K., writes: " In technologically advanced countries the government is usually the largest individual employer of scientific manpower and therefore the biggest spender in scientific research. The management of this large body of scientists and technologists poses major problems that have hardly been faced even in the biggest privately owned industrial organization. Civil services have evolved over many years to meet gradually changing needs. Science advances so rapidly that the traditional methods of management are not necessarily suited nor sufficiently adaptable to meet modern needs. New methods have therefore got to be devised."

The author has admirably brought out the basic philosophy and difficulty involved in the administration of a special class of personnel who are to discharge a special kind of duty. Mr McCrensky has pointed out that the nature of administrative action to overcome obstacles arising in science administration has been found to differ radically from the customary practice for dealing with administrative situations. The usual situation, the author says, is that the government machinery is typically designed for a more static and orderly era, which is not applicable, for a good effect, in the field of scientific administration. Such static views are " shaken by the continuing demand for experimentation in methods and policies to meet the administrative singularities that recur in research administration ".

Scientific administration has many involved facets. The book deals with them in seven chapters: (1) Scientists in the government, (2) Attracting and holding scientists, (3) The payment of professional public service, (4) Representation of scientists, (5) Higher education of engineers, (6) Organization for research, and (7) Comparison among countries including United States and Russia.

Pay scales and service conditions are among the major issues in the administration. It is interesting to note from this book that the temporary or contract services generally fetch more pay than the permanent ones in the same cadre of service. The higher monetary value is obviously derived by equating with the other benefits in a permanent service which is not obtainable in a temporary or contractual position. The other important feature that emerges from an examination of the pay scales cited for the various countries is that the disparity of pay between the highest and the lowest posts in the cadres is remarkably moderate. The ratio of the highest to the lowest usually does not exceed a factor of 5, and for the most of these countries the factors hover around 3 or 4.

The methods of scientific administration, training programme, participation in the negotiation activities and other features vary from country to country as has been demonstrated by the author in presenting the practices prevalent in England, Norway, Sweden, Germany, Switzerland, France and some other countries. However, the recognition of the unique nature of the problem in scientific administration and its progressive character is generally indicated.

The lack of opportunity for merit promotions is a general difficulty experienced by the management. In most of the western European countries, the opportunity is provided only when a vacancy occurs in the hierarchy. And such opportunities are few and far between. This causes embarrassment to the management as well as frustration in the meritorious individuals. In the U.S.A. this difficulty is partially obviated by the flexibility of granting advancement due to the nature of increased responsibility of a particular competent scientist or engineer (rather than for personal merit or achievement).

In the Soviet Union, to put it in the author's language, " certain educational status combined with personal achievement are required for career advancement. A cash bonus is given for acquisition of an academic degree." The scientists and technologists enjoy a very high social and economic status in Russia. The advancement to a functional grade level is based primarily on scientific ability and training of an individual and not on the duties and responsibilities related to a specific position. Encouragement of staff to supplement their income and to enhance their reputation by accepting external consultant and other professional activities also favourably influence the role of the scientist. It is interesting that " another major aspect of the picture of science and engineering in Russia today is the great use made of professional womenpower. This continuing utilization of a source that is only lightly used in other countries appears to confer a substantial asset in trained human resources."

In the conclusion, the author has made a brief but significant observation. It is now generally recognized that stability and security in government service tend to deter speed and foster staleness. He quotes Sir G. P. Thomson who made the following comment on improving government research: " Government science would be much more fruitful if no man were allowed to stay more than ten or twelve years in one establishment so that he would be in at least three during a normal working life. He would lose some little time learning new jobs, but would bring a fresh outlook to them which would more than compensate."

The author during the study of the present problem consistently observed that " a wide gap uniformly appears to exist between the identification and full knowledge of major problems in better management of scientists in public service, specially the Civil Service, and the initiation of the action programme to modify and eliminate such problems. The sense of urgency felt by scientists for needed innovation does not seem to get communicated dramatically and fully toward those holding the key legislative and managerial positions." The author, therefore, concludes that " Adherence to an opinion that a government service is entitled to recruit and hold a fair share of the available scientific talent, unless accompanied by dynamic implementation, will not achieve its realization."

The book is timely and thought-provoking. The administrators who are interested in promoting scientific activities, particularly in the government and government-sponsored sectors, will find the book stimulating.

K. RAY

PHYSICAL ACOUSTICS AND THE PROPERTIES OF SOLIDS by Warren P. Mason (D. Van Nostrand Co. Inc., Toronto, New York, London), 1958. Pp. xii + 402. Price 67*s*. 6*d*.

This book is written with the object of providing an introduction to the uses of wave transmission in solids. The main text is divided into two parts. Part I is devoted to the basic principles of wave transmission in solids and their applications, such as mechanical filters and the study of fatigue. Transmission of waves in solids in general as well as in transducer materials has been discussed in detail. Part II deals with the analytical aspect of the process of sound transmission. Important topics such as attenuation due to thermal conductivity, grain scattering, domain boundary effects and interstitial diffusion have been specially treated.

In order to make the treatise useful to various professions, only limited mathematics has been used in the main text. Rigorous derivations connected with the subject have been included in a separate appendix.

The book fulfils a long-felt need for a work of this kind and should be a useful reference work to scientists and engineers working in various fields.

S.P.

INTRODUCTION TO THE THEORETICAL AND EXPERIMENTAL ANALYSIS OF STRESS AND STRAIN by A. J. Durelli, E. A. Phillips & C. H. Tsao (McGraw-Hill Book Co. Inc., New York, Toronto, London), 1958. Pp. xxx + 498. Price $ 12.50

This volume, which forms one of the McGraw-Hill Mechanical Engineering Series, has been written for graduate students and is " an outgrowth of a course given " at the Ecole Polytechnique in Montreal and at the Illinois Institute of Technology, Chicago. The book aims at giving " an overall picture and a balanced description of the several methods used " in theoretical and experimental stress analysis. The authors have succeeded remarkably well within this limited objective.

The book has five parts and an interesting introduction which contains several quotations, two of which given below are worthy of special note: " It is easier to go wrong looking at any equation than looking at the phenomenon it represents " and " The experiment is the only source of truth; only experiments can teach us something new; only they can give us certitude ".

The first part deals with Mathematical Method of Analysis and has nine chapters — Theory of Stress, Theory of Strain and Theory of Elasticity are some of the usual ones. Chapters 7 to 9 deal with Geometric Representations of the Two-dimensional State of Stress and Associated State of Strain at a Point, Properties of Special Families of Curves and Application to Two-dimensional Problems; several interesting practical problems have been tackled under the last subject.

The second part is another interesting feature of the book. In its three chapters are covered Fundamental Concepts in Strain Measurements, Statistical Methods and Their Application to Experimental Stress Analysis, and Dimensional Analysis — matters, though important, tend to be relegated to a secondary place in a book on Stress Analysis.

In part three, the writers have ably developed Grid Methods for the determination of stress.

In part four, which has four chapters dealing with Brittle-coating Methods, General Background and Stresses and Strains of Brittle Coating, Properties of Stresscoat, and Application of the Brittle-coating Method, the techniques and principles have been lucidly described and applied. A careful study of this chapter should enable an aspiring student to pursue this method of investigation further with profit.

Mechanical Strain Gauges have been dealt with in part five.

As stated earlier, the authors have succeeded remarkably well within the limited objective they have set for themselves. The Electrical Strain Gauge Techniques and Photo-elastic Techniques have been, it seems, deliberately assigned minor positions possibly because admirable texts on these are already available. The book does not claim to replace either the standard works on Theory of Elasticity or on Experimental Stress Analysis; it is not so encyclopaedic in character as Hetenyi's *Handbook of Experimental Stress Analysis*, nor is it a comprehensive text on elasticity, like that of Love or Timoshenko. But I believe that the book in many ways is a novel introduction to theoretical and experimental analysis of stress and strain. On the experimental side, perhaps, for collateral reading a student would profit by using Lee's *Introduction to Experimental Stress Analysis*.

The book is modern in its approach and definitely fills a gap in the available literature on Theoretical and Experimental Stress Analysis.

S. R. SEN GUPTA

REFLEX KLYSTRONS by J. J. Hamilton (Chapman & Hall Ltd, London; *Distributors in India*: Asia Publishing House, Bombay), 1958. Pp. xi + 260. Price 45*s*. net

Reflex klystrons, by virtue of their simplicity in design and ease of operation, have occupied an important place among microwave devices for several years. In fact, since the very inception of the field of microwaves during the Second World War, reflex klystrons have done the major bulk of work as low and medium power oscillators in the centimetre and millimetre wavelength ranges; their use as local oscillators in microwave receivers has not yet been seriously challenged during the past two decades. It is, therefore, surprising that the number of books dealing in detail with the design and operation of reflex klystrons is very few and, at present, most of the data are mainly available scattered in individual articles and other publications. The author of this book has attempted to integrate the presently available knowledge on reflex klystrons and to present it for the benefit of persons with limited training in electronics and to beginners in general. The extent to which this purpose has been fulfilled will be discussed later.

After an introductory chapter, a discussion of re-entrant cavity resonators and their output systems is given. Beginning with a simplified treatment, the second chapter goes on to consider design aspects and parameters that determine the performance of re-entrant cavities with special reference to reflex klystrons; methods of tuning and tests are also presented. The following chapter deals with a discussion of the electron dynamics in reflex klystron operation. The simple first-order theory is presented in some detail and then the various factors which cause the actual operation to be different from what is predicted by the simple theory are discussed. Such factors as finite transit-time, multiple transits beam-loading, non-linear reflector field, space charge, etc., are considered briefly and, in each case, necessary modifications in the first order theory to include these effects are indicated. Further topics considered in this chapter are starting current, efficiency, electronic hysterisis, modulation and mode interference.

The fourth chapter deals with the effect of external circuitry or load on the operation of the klystron. Mode charts, admittance spirals, Reike diagrams are discussed here. The principles are briefly indicated and larger space is devoted to the method of use of these charts. The next chapter 'Engineering Aspects' is devoted to mechanical design and constructional problems. In this, the author discusses choice of materials, metal-to-glass and metal-to-ceramic seals, cathodes and heaters, and processes required to make workable klystrons.

The last three chapters discuss various types of reflex klystrons beginning with klystrons in general use and going on to millimetre reflex klystrons and special designs for pulsed operation. The author also discusses unconventional klystrons such as coupled-resonator type, multiple reflection type, floating drift-tube type, etc. A quick review of past, present and future trends both in klystrons and other microwave devices forms the concluding chapter.

In order to present material which is essentially of an advanced nature to newcomers to this field and to people with limited training in electronics, the author has eliminated almost all mathematical development except in a few cases. The formulae required for design and for a proper understanding of reflex klystrons are often merely presented with a brief mention of the reasoning that goes behind the expression. In the opinion of the reviewer, this type of treatment actually does the opposite of what the author intended to accomplish, namely that the book has become rather difficult for beginners to read since none of the theories is developed from the very start. Although each chapter begins with elementary and diagrammatic treatment of the subject matter, a beginner would soon find himself at sea in the subsequent material that follows because the connecting link between the fundamentals is missing. On the other hand, a reader who has already had a basic training in the principles of reflex klystron operation but wishes that a more practical approach can derive more benefit from this book since it omits the elementary considerations and immediately gets to the operating formulae. The portion dealing with operational charts and engineering aspects is very praiseworthy from this viewpoint.

It might be mentioned in passing that the author in several places refers to figures and other material appearing later. This, too, may tend to add to the difficulty experienced by beginners in reading this book.

The book fills a very necessary lacuna by presenting, in a co-ordinated and brief form, the specialized practical material required for a designer or maker of reflex klystron oscillators. However, in order to derive full benefit from this work the reader should have previously acquainted himself with the theory developed from fundamental principles. He would also have to make constant reference to the excellent bibliography given in the work in order to get full details of the material covered.

B. H. WADIA

VAPOUR-LIQUID EQUILIBRIUM by Eduard Hála, Jiri Pick, Vojtech Fried & Otakar Vilim. Translated into English by G. Standart (Pergamon Press Ltd, London), 1958. Pp. xviii + 402. Price 90*s*. net

This is the first complete book on the specialized problem of vapour-liquid equilibrium. It provides a good knowledge of basic thermodynamics, experimental techniques and references to earlier work related to vapour-liquid equilibrium.

The volume is divided into three parts. The first part presents the theoretical background of studies on vapour-liquid equilibria and the different correlations of equilibrium data. The thermodynamics of solutions of non-electrolytes are described briefly and basic relations are derived. Numerical examples of the types of problems, which occur most frequently in practice, are worked out. The second part includes laboratory techniques for the determination of vapour pressures and boiling points of pure substances and P-T, X-Y data of binary and ternary systems. Various types of equilibrium stills employed are described. Thus a systematic review of instruments for the direct determination of the equilibrium compositions of the liquid and vapour phases of the systems is made. The appendix to this part is useful as it gives the charts for (i) generalized compressibility factor of gases and vapours, (ii) generalized fugacity and (iii) generalized expansion factor. The third part contains a review of the literature on the systems whose vapour-liquid equilibrium data had been measured and reported (up to February 1957). The arrangement of reported work on various systems is done according to the number of carbon atoms in the organic compounds.

This book will be of great utility for workers in research laboratories and industrial establishments dealing with distillation problems.

M. N. RAO

AIR INTAKE PROBLEMS IN SUPERSONIC PROPULSION: AGARDograph 27, edited by J. Fabri (Pergamon Press Ltd, London), 1958. Pp. xx + 82. Price 30*s*. net

The efficient design of supersonic jet aircraft requires the solution of many difficult problems relating to the proper matching of the engine and the air-frame in a well-integrated system that can behave satisfactorily under all conditions of flight. An important class of such problems relates to air intakes and these become more and more difficult as the Mach number increases in the supersonic region. In view of the general interest in such problems, the AGARD Combustion and Propulsion Panel has attempted to focus attention on important aspects by inviting four specialists in the field of air intake research to express their views on the matching problem. The four lectures contained in the volume were delivered at the Ecole Nationale Superieure de l'aeronautique (Paris, December 1956) during the Eleventh Meeting of the AGARD Combustion and Propulsion Panel.

The first paper, which is in French, " Role de la prise d'air dans le oilan propulsif d'un reaceur " by Prof. P. Carriere, deals with the various parameters involved in the design of supersonic air intakes. The significance of these parameters is illustrated by an example in which the performance of a supersonic ramjet is calculated.

In the second paper, DeMarquis D. Wyatt gives a review of supersonic air intake problems. He has indicated how in the final analysis the main difficulty is in subcritical operation at lower Mach numbers when a buzz type instability occurs.

The " Problems related to Matching Turbo Jet Engine Requirements to Inlet Performance as a

Function of Flight Mach Number and Angle of Attack" is the subject of the third paper by A. Ferri. He deals with the significance of the various parameters governing air intake design. The main parameter is the Mach number while the next in importance is the temperature of the air. He deals with the characteristics of the flow at subcritical Mach numbers. He discusses the properties of variable geometry intakes and bypass systems for minimizing losses and increasing efficiency. The application of these principles in any case would require considerable discrimination in relation to actual configuration of intake for any airplane. Such effects as variation with angle of attack will be quite different for different airplanes and have to be treated individually.

The fourth paper is mainly concerned with experimental aspects of air intakes using wind tunnel models. In his paper, L. Viaud has attempted to define the best experimental conditions and also introduces the concept of a standard air intake which will help to overcome uncertainties introduced by turbulence levels of wind tunnels, peculiarities of the airflow, humidity and so forth. Comparative experiments carried out with the standard air intake and the model under investigation would help to eliminate experimental errors.

The problem of designing air intake systems, which are not affected by Mach number variations in the operating range, is obviously one of great importance and in view of the fact that such studies are of considerable topical interest to Indian design engineers also, the appearance of this volume may be considered very opportune. It will not only be a very valuable addition to our aeronautical libraries but should also be a handy general reference book to engineers engaged in the design of air intakes. Detailed bibliographies are given at the end of the second paper and, taking all these together, we have in them practically all important unclassified information on air intake design available at present in the NATO countries.

P. NILAKANTAN

DYNAMICAL ANALOGIES by Harry F. Olson (D. Van Nostrand Co. Inc., Princeton, Toronto, New York, London), Second Edition, 1958. Pp. xi + 278. Price 51s.

Those who are acquainted with the first edition of this book know that the author has outlined the essentials of dynamical analogies and using differential equation has shown the basis for analogies between electrical, mechanical and acoustical systems, so that any one familiar with electrical circuits would be able to analyse the action of vibrating systems.

The general arrangement in the second edition is the same as that of the first edition, but a considerable amount of new material has been added. The principal additions are four new chapters, viz. Chapter XII — Noise and distortion; Chapter XIII — Feedback; Chapter XIV — Mobility analogy; and Chapter XV — Magnetic analogy. The titles and subject matter of the first eleven chapters are essentially the same as in the first edition. Three of these chapters have, however, been enlarged to increase their scope and to bring in line with the matter contained in the new chapters added in the second edition.

In Chapter I, a considerable number of terms have been added under the head 'Definition'. The number of terms included in the second edition under this head is almost one and a half times that of the first edition. A new section 'Publications' has been added giving a list of publications reported on the developments in the field since 1929 to 1957. In the opinion of the reviewer, the list does not do justice to the volume of literature published on the subject during this period.

In Chapter X on Theorems, the pertinent item of similarity theorem has been included in addition to the theorems included in the first edition, namely Reciprocity theorems, Thevanin's theorems, and Superposition theorem.

In Chapter XI on Applications, the items added are: Dynamic microphone, Dynamic phonograph pick up, and Hot air heating system.

The book furnishes a comprehensive source of information on classical analogies which have been adequately illustrated. A knowledge of the elements of alternating circuit theory and physics is enough to follow the text. The book should prove useful to those engaged in the study of mechanical or acoustical vibrating systems. These systems can be converted into the analogous electrical circuit for which analytical or experimental solutions are more readily obtained.

B. M. BELGAUMKAR

LIQUID SCINTILLATION COUNTING — Proceedings of a Conference held at North-western University, Illinois, U.S.A., August 20-22, 1957, Editors: C. G. Bell, Jr & F. N. Hayes (Pergamon Press Ltd, London, New York), 1958. Pp. xi + 292. Price 70*s*. net

The present volume contains the proceedings of a conference on liquid scintillation counting held in August 1957 at the North-western University, U.S.A. The papers presented at the conference cover a wide variety of topics starting with the physical theory of liquid scintillation counting and ending with its applications in industry, engineering, medicine and several of the physical sciences.

Liquid scintillation counting technique was established as an important tool in nuclear physics by the work of Reynolds, Kallmann, and their associates nearly nine years ago. During this short period its applications have rapidly expanded into many fields of pure and applied science. The principal advantages of the liquid scintillation (LS) method for the counting of beta particles are (1) freedom from limitations of self-absorption and window absorption, (2) simplicity of sample preparation, (3) short dead time, (4) proportional response, and (5) ease of absolute calibration. The method has, however, the following disadvantages: (1) relatively high cost of the counting apparatus, (2) difficulties caused by the fluorescence quenching and light absorption, (3) limitation to samples soluble or readily suspended in the liquid scintillator and, finally (4) greater electronic complexity, leading to problems of drift, reliability and precision. But none of these limitations is really very serious as means of overcoming them are readily available.

The subject matter of the conference has been divided into six parts under the headings: (1) Fundamental principles, (2) Instrumentation, (3) Chemistry of the counting sample, (4) General applications, (5) Specific applications, and (6) Developments in foreign (outside U.S.A.) laboratories.

In all, thirty-three papers were presented at the conference by leading authorities on topics covered under the six headings mentioned above and these have been included in the book under review.

The present volume is the first of its kind to be published on liquid scintillation counting techniques used in nuclear measurements and it is very comprehensive. All the advances in this field have been referred to and the literature and progress up to the date of the conference have been briefly reviewed. Of special interest is the round table discussion on the ' Chemistry of the counting sample ' in which seven authors have made valuable contributions. These form the subject matter of Part III of the book.

Research workers in nuclear physics and allied topics will find the present volume very useful and those who want to employ liquid scintillation counting techniques cannot afford to be without a copy of the book. The only drawback in the opinion of the reviewer is the fact that the cost of the book is a little too high.

R. S. KRISHNAN

THE CHEMICAL ANALYSIS OF FOODS AND FOOD PRODUCTS by Morris B. Jacobs (D. Van Nostrand Co. Inc., Toronto, New York, London), Third Edition, 1958. Pp. xxiv + 970. Price 103*s*. 6*d*.

This book, which claims to be a practical manual for use in routine chemical analysis and in general control work on food products, has been before the public since 1938 when the first edition was published. The second edition which came out in 1951 is now followed by the third edition. Together with three new chapters on radio-chemical determinations, pesticide residues and artificial sweetners, there are, in all, 24 chapters, arranged commodity-wise. Emphasis in each chapter is on analytical methods relevant to the particular food product. The fact that it has run through three editions justifies the claim that it is a helpful guide to analytical methods for the food chemist.

As stated by the authors, the book " is written with American Food Legislation in view, but some reference has been made to the Food Laws in other countries and the history of Food Legislation and Adulteration in this country ". So, comments on analytical methods relate to " the development and enforcement of standards of identity, purity, or value; problems of decomposition under either normal or abnormal storage conditions; studies designed to improve or control the quality of natural or processed foods; the determination of the nutritive value of foods for scientific, dietary, or labelling purposes; the technical control or supervision of raw materials being purchased; problems of a toxicological or forensic nature; or field testing ".

While the book has come to stay as an elder member of the family of text-books of this class, it is to be pointed out, without going into details, that one might wish to see, in later editions, improvements as would make for its being more critical, precise and exact, in the interests of wider appeal and utility.

M. SRINIVASAN

Publications Received

Introduction to the Physics of Many-Body Systems — Interscience Tracts on Physics & Astronomy, No. 5 — by D. ter Harr (Interscience Publishers Inc., New York), 1958. Pp. viii + 127. Price $ 3.85

Colorimetric Determination of Traces of Metals by E. B. Sandell (Interscience Publishers Inc., New York), Third Edition, Revised & Enlarged, 1959. Pp. xxii + 1032. Price $ 24.00

Nomography by L. Ivan Epstein (Interscience Publishers Inc., New York), 1958. Pp. x + 134. Price $ 4.50

Electroanalytical Chemistry by James J. Lingane (Interscience Publishers Inc., New York), Second Edition, Revised & Enlarged, 1958. Pp. xiv + 669. Price $ 14.50

Advances in Pest Control Research: Vol. I, edited by R. L. Metcalf (Interscience Publishers Inc., New York), 1957. Pp. vii + 514. Price $ 12.50

Industrial Hygiene and Toxicology: Vol. I — General Principles, edited by Frank A. Patty (Interscience Publishers Inc., New York), Second Revised Edition, 1958. Pp. xxviii + 830. Price $ 17.50

Number-Average Molecular Weights — Fundamentals and Determination by Robert U. Bonnar, Martin Dimbat & Fred H. Stross (Interscience Publishers Inc., New York), 1958. Pp. x + 310. Price $ 7.50

Adhesive Bonding of Reinforced Plastics by H. A. Perry (McGraw-Hill Book Co. Inc., New York), 1959. Pp. xi + 275. Price $ 8.75

Modern Transistor Circuits by John M. Carrol (McGraw-Hill Book Co. Inc., New York), 1959. Pp. xii + 268. Price $ 8.50

Modern Fishing Gear of the World, edited by Hilmar Kristjonsson (Food & Agriculture Organization, Rome), 1959. Pp. xxxi + 607

Yearbook of International Trade Statistics 1957: Vol. I (Statistical Office, Department of Economic & Social Affairs, United Nations, New York), 1958. Pp. 622. Price U.S. $ 6.00; 43/-stg.; Sw. fr. 26.00

Yearbook of International Trade Statistics 1957: Vol. II (Statistical Office, Department of Economic & Social Affairs, United Nations, New York), 1958. Pp. 155. Price U.S. $ 1.50; 11/-stg.; Sw. fr. 6.50

Polarography in Medicine, Biochemistry and Pharmacy by M. Brezina & P. Zuman. Translated from the Czech by S. Wawzonek (Interscience Publishers Inc., New York), Revised English Edition, 1958. Pp. xviii + 862. Price $ 19.50

The Indian Ephemeris and Nautical Almanac for the Year 1960 (India Meteorological Department, Ministry of Transport & Communications, Government of India, New Delhi), 1959. Pp. xxviii + 444. Price Rs 13.00 or 20*s.* 6*d.*

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NOTES & NEWS

Experimental evidence of the neutral cascade hyperon

EXPERIMENTAL EVIDENCE HAS BEEN obtained for the existence of the neutral cascade hyperon or the xi zero (Ξ^0), particle, one of the so-called ' strange ' particles. The detection of this particle in the 15-in. bubble chamber of the Lawrence Radiation Laboratory completes the list of presently predicted elementary particles, with the exception of a few anti-particles which have not been detected experimentally. The existence of the Ξ^0 particle was predicted several years ago by Murray Gell-mann and Kazuhiko Nishijima who in their theory introduced the concept of ' strangeness ' to explain the anomalous behaviour and properties of the Ξ particles. The xi zero particle has a mass about 40 per cent greater than that of the proton. It has no electrical charge and has a half lifetime of about 10^{-10} sec. The absence of charge makes its detection possible only by indirect evidence; among 70,000 photographs studied only one track was found containing the xi zero particle.

The xi zero particle was produced in a bubble chamber bombarded with a beam of high intensity negative K mesons (K^-) obtained by means of an elaborate magnetic filter system.

In one particular photograph was observed the track of a K particle entering the bubble chamber and then stopping. At some distance, two V-shaped tracks, made by other charged particles, were observed. In between, a gap, through which neutral particles, created by the interaction of the K^- particle with a proton, was observed to travel to the points at which they decayed giving rise to the V-shaped tracks. The double V is common in bubble chamber pictures taken with the bevatron. But one V was so askew that it could not have been made by a particle travelling direct from the K^- proton decay. From a detailed study of all the possibilities it was deduced that one particle generated by the K^- proton decay was the xi zero particle and that it travelled off at an angle and decayed into a neutral lambda hyperon which in turn decayed into a proton and a negative meson giving rise to a visible V [*Chem. Engng News*, **37** (11) (1959), 27 and *Sci. Newslett. Wash.*, **75** (1959), 163].

Decay of elementary particles

THE VALIDITY OF THE VECTOR-Axial vector law (V-A law), originally proposed in 1957 at an international conference at Padua, has been borne out by experimental evidence obtaining from a number of recent investigations. The V-A law is a single, universal law for all weak interactions responsible for the decay of various elementary particles into each other and explains all known decays including nuclear beta radioactivity and is derived from the chirality principle. The V-A law disagreed with the then existing results of four major experiments on weak interactions. Since 1957, more reliable experiments performed independently at a number of laboratories have shown that the earlier results are incorrect, thus confirming the V-A law.

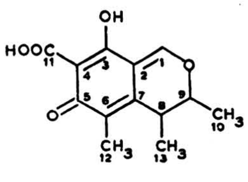
The V-A law, like the Lee-Yang theory, predicts that parity breaks down in all the decay processes, but that the reversal of time is conserved. This time-reversal concept means that the same physical laws hold if the sense of time is reversed. In contrast to the Lee-Yang hypothesis, the new law states that all fast particles (including the neutrino, which is involved in all the processes considered by Lee and Yang) are left-handed and not right-handed. The law also explains the original difficulty associated with the decay of K mesons into both 2 and 3 pi mesons [*Chem. Engng News*, **37** (7) (1959), 42].

New theory of sintering

A NEW THEORY WHICH MAY greatly influence the development of powder metallurgy has been suggested. Further development of the new theory may lead to the production of powder metallurgy materials with closer control of, and better physical properties. Hitherto the factors affecting porosity have been usually neglected in any consideration of the sintering process. The new postulate stresses that the variables of porosity largely affect diffusion as well as grain boundary movement taking place during the sintering process. In addition, the theory points out that the original porosity determines largely the grain structure and hence the physical properties of the sintered product. More than ten variables of porosity, such as total pore volume, total number of pores, pore size, pore shape, interconnected and closed pores, orientation of pores, etc., can be distinguished. Application of the concept envisaged by the theory leads to the conclusion that greater porosity and smaller pore size in the ' green ' compact contribute to a faster rate of material transportation during sintering and at the same time to a rather smaller rate of grain-boundary movement. Also a more uniform grain structure should be obtained when any orientation of the voids in the compact is avoided. The results of work on the sintering of loose stainless steel powders and on the slip casting of metal powders and metal-ceramic combinations have confirmed these theoretically derived conclusions. Work carried out at the U.K. Atomic Energy Authority on beryllium sintering based on this concept has resulted in a more ductile type of beryllium with improved physical properties [*Mech. Engng*, **81** (4) (1959), 94].

Biogenesis of citrinin

CITRININ ISOLATED AS A YELLOW coloured substance from the culture fluids of *Penicillin citrinum* has been shown to exert bacteriostatic activity against gram-positive organisms only. The structure of citrinin ($C_{13}H_{14}O_5$) can be written as follows:



In view of the suggestions made by Woodward regarding the biosynthesis of certain natural substances from polyacetic acids, it was presumed that the skeleton of citrinin consists of five acetic acid molecules combined in head to tail manner. Carbon atoms 1, 3, 5, 7 and 9 are derived from the carboxyl groups of acetic acid molecules, while the reamining 3 carbon atoms, 11, 12 and 13, are derived from some other source. It is likely that these carbon atoms are introduced into citrinin molecule through the transfer of methyl group of methionine, just as the transfer of the methyl group of methionine to carbon atom 28 of the sterol skeleton which takes place in the case of ergosterol biosynthesis in yeast.

Using sodium acetate-1-C^{14} and methionine methyl-C^{14} as tracers Schwenk *et al.* [*J. biol. Chem.*, **233** (1958), 1211] have investigated the mechanism of biogenesis of citrinin and they have found that carbon atoms 1 to 10 of citrinin are derived from labelled acetic acid and that the carbon atoms 11, 12 and 13 are derived from labelled methionine.

Protein synthesis and nucleic acid metabolism

EXTENSIVE EVIDENCE ON NUCLEIC acid and protein interrelationships of cytological, nutritional, isotopic tracer and enzymic natures have led to the current hypothesis that nucleic acids, and in particular ribonucleic acid (RNA), may serve as templates for the synthesis of proteins in the cell [J. Brachet, *Biochemical Cytology* (Academic Press, New York), 1957]. Compatible with this hypothesis is the demonstration that nucleic acid synthesis is a necessary precondition for the maintenance of enzymic induction in micro-organisms. To elucidate further the role of RNA in the intimate mechanism of enzyme protein synthesis, it would be of value to ascertain whether induced enzyme formation, which is generally accepted as representing *de novo* synthesis of enzyme protein, must be preceded by the synthesis of its nucleic acid template. Thus, a role might be assignable to the nucleic acids in the sequence of events leading to enzyme induction by its substrate.

For a study of the general relationships between protein synthesis and nucleic acid metabolism, induced enzyme formation provides a unique tool; this method has been employed in bacterial studies and has now been extended to mammalian systems. Parenteral substrate administration to mammals induces in certain instances, homologous enzyme formation. This phenomenon occurs *in vivo* and is presumed to represent stimulation in the synthesis of the enzyme protein, whose concentration may be readily ascertained by measurement of its catalytic activity. Tryptophan peroxidase induction may be initiated at will by its substrate and is of brief duration in the rat. This system permits the investigation of the kinetic relationship between nucleic acid and protein synthesis and gain further insight into the precise mechanism linking these two biochemically important classes of compounds.

P. Feigelson, M. Feigelson and C. Fancher [*Biochim. Biophys. Acta*, **32** (1959), 133] have studied the above interrelationships *in vivo*, employing radioactive phosphorus (P^{32}) and C^{14}-precursors of nucleic acids to assess the turnover of RNA and DNA, preceding the following tryptophan peroxidase induction in the rat. Parenteral administration of tryptophan in the rat produces a transient elevation in liver protein synthesis and in liver tryptophan peroxidase activity which results in an increased incorporation of inorganic P^{32} and C^{14}-glycine into RNA. The relative kinetics of these phenomena indicate that there is a burst of RNA synthetic activity subsequent to the period of active enzyme protein synthesis and that this increased RNA synthesis persists for 8 hr and then returns to control rate.

A working hypothesis is proposed in which it is suggested that increased enzyme protein synthesis utilizes and consumes pre-existent RNA and that this RNA is subsequently replenished. This hypothesis implies that RNA serves as a reactant which is consumed, rather than as a perfect catalyst of protein synthesis.

Total synthesis of coenzyme A

THE TOTAL SYNTHESIS OF COENZYME A has been achieved by H. G. Khorana and J. G. Moffatt of British Columbia Research Council, Vancouver. The synthesis not only established the structure of coenzyme A but has also been helpful in studying hitherto unknown biosynthetic reactions. The key to the success of the synthesis of coenzyme A is the use of phosphoromorpholidate intermediate rather than the unsubstituted phosphoroamidates.

The starting material, adenosine, is phosphorylated by standard techniques, when the resultant adenosine diphosphate is allowed to react with morpholine and dicyclohexylcarbodiimide. This step puts a phosphoromorpholidate group on the 5′ position of the ribose structure, and also makes a cyclic phosphate ring on the 2′ and 3′ positions of the ribose structure and thus making position 5′ more reactive. The phosphoromorpholidate intermediate then reacts with pantetheine-4′-phosphate in anhydrous pyridine for 15 hr at room temperature. The resultant product on hydrolysis and breaking of the disulphide bonds with 2-mercaptoethanol gave impure coenzyme A. The coenzyme was purified by elution from an ECTEOLA cellulose chromatographic column.

The synthetic coenzyme A, when tested against natural sulphhydryl-coenzyme A, is found to be identical chromatographically, electrophoretically and by biochemical assay. Further enzymatic degradation of synthetic coenzyme A gives adenosine-3′-5′-diphosphate [*Chem. Engng News*, **37** (12) (1959), 38].

Aromatic fluorocarbons

A NEW GENERAL METHOD DEVEloped for the preparation of a large number of polyfluorobenzenes represents a major contribution to fluoro aromatic chemistry and opens up a new field. Only two overall stages are involved, namely fluorination of a hydrocarbon followed by the defluorination. The process can be extended to cover the preparation of hydrogen containing aromatic fluorides.

Alicyclic fluorocarbons are prepared by the vapour phase fluorination of toluene, ethyl benzene, *p*-xylene, diphenyl and decalin respectively, in the presence of cobaltic fluoride as the catalyst. The method of defluorination consists in passing the fluorocarbon in a constant stream of nitrogen through a metal tube packed with small pieces of iron gauge, and heated to 400-600°C. The reaction products are collected in a trap immersed in liquid air. Other metal packings, for example nickel, are also effective. The metal fluoride produced in the defluorination process is reduced to metal by the passage of hydrogen to enable further defluorination to be carried out.

The new compounds so far prepared have the properties anticipated and appear to be fairly resistant to chemical attack. Evidence for their identity has been provided by the determination of molecular weight, based on the mass of the parent molecule ion formed on electron impact, using a mass spectrometer, and by their ultraviolet and infrared spectra [*Nature, Lond.*, **183** (1959), 588].

Total synthesis of a tetracycline

A TOTAL SYNTHESIS OF A TETRAcycline antibiotic, ± dedimethylamino - 12a - deoxy - 6 - demethylanhydrochloro tetracycline, has been accomplished by the scientists working at Lederle Laboratories, Pearl River, New York. The synthesis consists of 24 stages, beginning with a common industrial substance, cresol, and yields the tetracycline derivative identical with one produced by partially degrading material made by fermentation.

The starting material *p*-chloro-*m*-cresol is converted to anisole and then to 2-chloro-5-methoxybenzyl bromide, which itself is converted to benzyl malonic ester and then the homologous dinitrile. The dinitrile is subjected to alkaline hydrolysis to be converted to a substituted benzylglutaric acid, which is then cyclized to form a second ring upon treatment with polyphosphoric acid. The acid, so formed, is converted to acid chloride and finally to an aldehyde by reduction. The aldehyde is then condensed with excess of cyanoacetamide, hydrolysing to a diacid, and then esterifying to a diester which is cyclized by sodium hydride to give the third ring of the tetracycline molecule. The resulting tricyclic ester is partially aromatized, converted to the carboxylic acid and then to acylmalonate, which upon cyclization with sodium hydride gives the fourth ring. The ethyl ester is transformed smoothly into the desired amide by fusion with ammonium formate. Direct dealkylation by hydrochloric acid in acetic acid removes the protective groups to form the desired product [*Chem. Engng News*, **37** (10) (1959), 36].

Gas chromatography in amino acid analysis

THE POSSIBLE APPLICATION OF GAS chromatography to the analysis of a number of amino acids has been demonstrated by workers at the Fordham University and Institute of Applied Biology, New York. The advantages claimed for gas chromatography over the methods currently used (paper chromatography and paper electrophoresis) are its speed, sensitivity and the automation of the method. The only drawback is that amino acids are non-volatile and, therefore, cannot be determined by gas chromatography directly. In the proposed method amino acids are converted into volatile derivatives suitable for gas chromatographic analysis. Ninhydrin oxidation and decarboxylation have been used for the purpose.

In ninhydrin oxidation procedures the amino acid and ninhydrin solutions together with an appropriate organic solvent are introduced into a 1-ml. glass ampoule. Chlorinated hydrocarbons, such as carbon tetrachloride and tetrachloroethane, available in spectral grades, are best for this purpose because their specific density is greater than that of water. The ampoule is sealed and shaken constantly for 20 to 30 min. in boiling water. It is then cooled in an ice bath and centrifuged in an upside-down position in order to force all the liquid into the small conical top portion of the ampoule, the heavy hydrocarbon settling at the bottom. When the ampoule is opened, the bottom hydrocarbon layer can be withdrawn conveniently with the syringe used for the injection of the sample into the gas chromatography apparatus, the sample size being between 20 and 40 μl.

In the decarboxylation procedure the amino acid (0·1 mM) is weighed directly into an ampoule, and either 50 mg. of the aldehyde or 1 ml. of the hydrocarbon is added. The ampoule was sealed and heated in an oil bath until the reaction gets terminated, as judged by evolution of carbon dioxide. In general, the reaction with the aldehyde is faster and proceeds at a lower temperature than with the hydrocarbon. With the aldehyde, a homogeneous melt is obtained; the amino acid dissolves in the hydrocarbon only upon decarboxylation. The contents of the ampoule are transferred to a distillation apparatus and the amine formed is steam-distilled into 0·01*N* HCl. The extent of the reaction is determined by back-titrating the excess acid with 0·01*N* NaOH.

In no case quantitative decarboxylation is obtained. The diphenylmethane procedure gives higher yields in all cases, except with glycine, lysine, serine and threonine. With these amino acids charring occurs during the heating, which probably accounts for the lower yields [*Ann. N.Y. Acad. Sci.*, **72** (1959), 641].

Phosphorimetry

A NEW ANALYTICAL TECHNIQUE, phosphorimetry, has been developed by means of a new device, the spectrophosphorimeter. The new instrument is based on the fact that many organic molecules containing multiple bonds phosphoresce when excited by ultraviolet light. The phosphorescence of each such molecule is unique. Thus, for qualitative analysis the frequency, lifetime, quantum yield and vibrational pattern can be used. And since the phosphorescent intensity depends upon concentration, the two can be correlated to get a quantitative analysis.

In the instrument, light is emitted from a high pressure mercury lamp and dispersed by a grating monochromator. Wavelengths between 200 and 800 mμ can be selected manually or the whole range scanned automatically. The radiation passes through a fixed slit system on the excitation monochromator and a phosphorescope and strikes the sample submerged in liquid nitrogen to prevent deactivation from collision of the molecules. The fixed slit system keeps the excitation radiation from reaching the photomultiplier tube.

Phosphorescence emitted by the sample is dispersed by the photomultiplier tube and converted to an electrical output. The output signal fed to a photometer for amplifying is read out on a meter, or it can be coupled to the vertical axis of an oscilloscope or to a recorder, which are used to plot the spectra and decay curves.

Compounds which will phosphoresce include ethylene derivatives, hydrocarbons, nitro compounds, aldehydes, ketones and porphyrin-like substances. The method has also been applied to some vitamins, sterols and amino acids [*Chem. Age*, **81** (1959), 574].

A new phosphorylating agent

A NEW, SIMPLE AND POWERFUL phosphorylating agent, β-cyanoethyl phosphate, with alkaline labile protecting groups has been developed. The reagent overcomes a number of difficulties encountered by the use of monobenzyl phosphate as a phosphorylating agent. Its use is illustrated in the following experiment. Reacting 1 millimole of 5′-*O*-tritylthymidine, 2 millimoles of β-cyanoethyl phosphate and 8 millimoles of dicyclohexylcarbodiimide (DCC) in 15 ml. of pyridine at room temperature for two days leads to the complete utilization of tritylthymidine. Treatment of the residue, obtained after removal of pyridine *in vacuo*, with 80 per cent acetic acid at 100°C. for 20 min. gives β-cyanoethyl thymidine-3′-phosphate as the sole ultraviolet absorbing material when checked by paper chromatography. This product is directly converted to thymidine-3′-phosphate on treatment with 0·5*N* lithium hydroxide at 100°C. for 2 min. Excess phosphorylating agent is removed by heating the alkaline solution for 1 hr more. The solution is then deionized by passing through a Dowex 50 (H^+) ion-exchange column. Finally thymidine-3′-phosphate is precipitated as its barium salt. The yield is 91 per cent and the product synthesized by this procedure is identical with an authentic sample prepared from a different procedure [*Chem. & Ind.*, (1959), 543].

Separation of Sr-90 from Ca

A NEW METHOD HAS BEEN DEVEloped at the Australian Atomic Energy Commission, New South Wales, for the separation of Sr-90 from calcium and its determination in such biological materials as milk, bone and coral which contain considerable proportions of calcium. The method is simple, requires only a small column and reduces considerably the time required for each determination. The method makes use of the differing stability constants of calcium and strontium ethylenediamine tetracetic acid complexes ($\log K_1\mathrm{Sr} = 8{\cdot}63$, $\log K_1\mathrm{Ca} = 11{\cdot}0$).

Strontium or calcium ions (25 mg.) and 1 g. of disodium ethylenediamine tetracetic acid are used with a 10 ml. resin column (0·9 cm. internal diam.) in the sodium form. At *p*H 5·25 strontium, present in the cationic form, is quantitatively retained on the resin, while calcium is complexed by the ethylenediamine tetracetic acid and passes through.

These results have been confirmed by the method employed for the separation of strontium from prepared strontium-calcium mixtures to which prior addition of calcium-45 as tracer had been made. The recovery of strontium is checked by eluting the resin with 3*N* hydrochloric acid and precipitating the strontium as carbonate and weighing. The activity of the carbonate precipitate gives a measure of the degree of contamination of the strontium with calcium. This is less than 1 per cent.

The recovery of strontium from strontium calcium mixtures is achieved with the use of very small columns and can be applied for routine determinations of strontium-90 [*Nature, Lond.*, **183** (1959), 674].

Estimation of Sr in animal bone

X-RAY FLUORESCENCE SPECTROscopy has been successfully utilized for the estimation of strontium in biological material. The advantages obtained in this method over the optical emission spectroscopy and flame spectrophotometry are: (1) the sample is not destroyed during analysis; (2) the spectra of the major constituents, calcium and phosphorus, do not interfere with the strontium K_α spectral line used in this analysis; (3) any of the heavier elements which may interfere are present in such small amounts that their effects can be ignored and (4) no internal comparison element is necessary and a direct measurement of intensity on the strontium K_α line is sufficient to give the concentration of strontium.

The preparation of specimen, for giving reproducible results, is carried out as follows. The sample of bone ash (2 g.) is ground to 200 mesh, 2 drops of flexible collodion added as a binder and the mixture ground in acetone to achieve a uniform distribution. The dried powder is then compressed in a suitably shaped die, using a sheet of polished high tensile steel for the working face of the specimen, to a pressure of 8 tons. The resultant disc has sufficient strength to be self-supporting, and offers an exactly identical surface to the X-ray beam in every sample, giving the desired reproducibility.

The high compression also ensures that a maximum quantity of material is available at the immediate surface for the generation secondary radiation. As the sample is self-supporting its surface can be placed directly in the primary beam for obtaining maximum intensity.

The standards used in the construction of the working curve are made from human bone ash to which increments of strontium are added in the form of an aqueous solution of strontium nitrate containing 0·2415 g. in 100 ml. [*Nature, Lond.*, **183** (1959), 887].

New colour reaction of dieldrin and endrin

A NEW COLORIMETRIC METHOD FOR the detection of dieldrin and endrin, used as insecticides, is described. The method depends on heating benzene solutions of the insecticides with boron trifluoride-diethyl ether complex to yield ketones. On treating ketones with tetraethylammonium hydroxide in ethanolic solution, a red colour is produced, corresponding to 2: 4-dinitrophenyl hydrazones produced in the usual way. Under controlled conditions as little as 10 µg. of these materials can be visually detected by this method. The colour reaction is stoichiometric [*Chem. & Ind.*, (1959), 539].

Estimation of nitrogen in proteins

A METHOD FOR THE ESTIMATION OF microgram quantities of nitrogen in proteins and other organic substances is described. The method requires much less material than the well-established methods due to Dumas and Kjeldahl and compares favourably in accuracy with the standard methods. The sample is decomposed by digestion in sulphuric acid and the ammonia is determined by means of indanetrione hydrate.

The sample (0·05-0·10 ml. serum) is digested in 0·5-1·0 ml. sulphuric acid to which is added 3-5 mg. of a mixture of copper sulphate, potassium sulphate, mercuric oxide and selenium (5: 15: 5:1 parts by weight respectively). The sample is heated in a standard Kjeldahl flask for 45 min., when it should have cleared. If the acid digest is not clear after 45 min., the flask is cooled and 0·2 ml. of hydrogen peroxide solution (100 vol.) is added drop by drop and the contents of the flask are reheated. The solution becomes clear immediately and the heating is continued for 2 hr.

The digested sample is dissolved in 0·4*M* sodium citrate buffer solution, *p*H 5·0 (25 ml. buffer solution for 0·5 ml. sulphuric acid). An aliquot, normally 0·5 ml., of this solution, diluted further if necessary with buffer solution to make 2·0 ml., is mixed with 2·0 ml. of a 2 per cent indanetrione hydrate solution [2·0 g. indanetrione hydrate; 50 ml. methyl ' Cellosolve ': 25 ml. 4·0*M* sodium acetate buffer solution *p*H 5·5; 25 ml. water; 0·08 g. stannous chloride dihydrate (analytical reagent)]. The mixture is heated in a water bath at 100°C. for 30 min., cooled and diluted with 6 ml. of a solution of ethanol-water (1: 1 by volume) and the colour of the solution determined.

When determined in a Uvispek spectrophotometer, a solution containing 0·4 µ*M* of ammonia has an optical density of 0·805 (±0·008) for 1 cm. path length at a wavelength of 570 mµ. The optical density of the control solution, that is 1·0 ml. sulphuric acid (microanalytical reagent) diluted in the same manner, varies between 0·045 and 0·960 [*Nature, Lond.*, **183** (1959), 262].

Uranium hexafluoride

A NEW CONTINUOUS PROCESS FOR the production of uranium hexafluoride has been developed by the Atomic Energy Commission, U.S.A. The starting material for the process is uranium trioxide, which is produced by solvent extraction of the ore concentrates or from spent reactor fuels. The uranium trioxide is then converted to uranium dioxide continuously in a fluidized bed. The fluid beds are electrically heated twin units, 14 in. in diameter and 5 in. high, with the bottoms tapered to 10 in. diameters. Cracked ammonia, for fluidization, enters a sintered stainless steel diffusion plate at the bottom of the beds. Uranium trioxide particles are then injected into the bottom of the first bed, where three-quarters of the trioxide is converted into dioxide by reduction with hydrogen (from cracked ammonia) at 1000°F. Any unreduced trioxide is reduced in the second bed, and excess hydrogen is burned and filtered to recover any uranium present. Hydrofluorination of the dioxide to uranium tetrafluoride is done continuously and countercurrently in three ribbon screw reactors arranged in series. Yield of UF_4 at this step is between 90 and 99 per cent. Uranium tetrafluoride is then fluorinated to hexafluoride in a vertical water-cooled flame reactor with fluorine gas at 600°F. Dust is removed from the gaseous uranium hexafluoride in a cyclone washer, after which the product is collected by freezing, liquefied and stored [*Chem. Engng News*, **37** (12) (1959), 40].

Saline-free water by solvent extraction

A SOLVENT EXTRACTION PROCESS IS reported for desalting saline waters. The solvents employed are secondary and tertiary amines containing 5-6 carbon atoms, and glycol and glycerol ethers and appear to be promising from the economic point of view. The solvent acts by tying up water through hydrogen bonding between the hydrogen of the water and the nitrogen of an amine or oxygen of an ether. In practice, salt water is contacted with a solvent at about 25°C. using centrifugal extractors. The solvent-water phase from the extractor is heated to about 60-80°C. Then the bond severs and two immiscible liquids, water and solvent, are formed which are separated by simple decanting. The solvent is cooled by heat exchange and recycled.

Solvents, which act in the manner described above, have a relatively low consolute temperature — temperature at which the solvent picks up water in equilibrium with release of water. The water dissolved in the solvent phase has less affinity for salt than does the water in the brine. Hence water extracted by the solvent is fresh with respect to the brine in equilibrium with the system. Complete miscibility of solvent and brine must be avoided over the operating temperature range, otherwise extraction would not be possible. Preliminary studies have shown that solvent extraction process gives best results with saline waters with a total salt concentration of 5000-20,000 p.p.m. [*Chem. Engng News*, **37** (5) (1959), 40].

The Fifth Indian Standards Convention

THE CONVENTION ORGANIZED BY the Indian Standards Institution will be held at Hyderabad from 27 December 1959 to 2 January 1960. The technical sessions will deal with the following subjects: Implementation of Indian Standards; Certification for Small Industry Products; Standardization as a Prerequisite to Productivity; Preparation of Standards in Terms of Metric Units; Design for Industrial Experimentation; Tropicalization of Electrical and Electronic Equipment; Latest Techniques in Chemical Analysis; Non-ferrous Metals Industry and Standardization; and Documentation. Contributors of papers are requested to send a synopsis of the papers before 15 July 1959 and the full texts of the papers not later than 1 September 1959. Papers should be in English and should not exceed 2500 words. Details can be had from Shri J. S. Gulati, Organizing Secretary, Indian Standards Convention — 1959, Manak Bhavan, 9 Mathura Road, New Delhi 1.

British Association for the Advancement of Science

THE ANNUAL MEETING OF THE Association for the year 1959 will be held during 2-9 September 1959 at York. The Presidential Address will be delivered by Sir James Gray on 2 September 1959. The subject of his address will be ' The Proper Study of Mankind is Man '. As in the previous year, a programme of illustrated lectures for young people from schools in York area and a school science exhibition are being organized.

The following addresses will be delivered by the Sectional Presidents: Mathematics and Physics — *The visualization of magnetic processes* (Prof. L. F. Bates); Chemistry — *Medical aspects of carbohydrates* (Prof. M. Stacey); Geology — *Recent developments and trends in palaeontology* (Prof. O. M. B. Bulman); Zoology — *Man and the world fauna* (Dr L. Harrison Matthews); Geography — *Trends in urban expansion* (Prof. K. C. Edwards); Economics — *How much science?* (Prof. J. Jewkes); Engineering — *The critical importance of communication and transport* (Sir Ewart Smith); Anthropology — *The nature and scope of archaeology* (Prof. I. A. Richmond); Physiology and Biochemistry — *Artificial organs; biological applications* (Prof. A. Hemingway); Psychology — *Perception, attention and consciousness* (Prof. Magdalen D. Vernon); Botany — *The influence of pathogenic factors within the rooting space on the development of even-aged plantations* (Mr W. R. Day); Education — *What are our schools for?* (Sir James Robertson); Agriculture — *Balance in British farming* (Dr H. G. Sanders); and Assembly of corresponding societies — *Living with science* (Countess of Albemarle).

Solid State Circuits Conference

THE SEVENTH ANNUAL SOLID STATE Circuits Conference, sponsored jointly by the Institute of Radio Engineers and the American Institute of Electrical Engineers, will be held during 10-12 February 1960 at Philadelphia. The conference deals with applications and circuit design techniques of a large variety of solid state devices. Papers representing original contributions in the field are invited. The papers may deal with any one of the following subjects: Microcircuit techniques for improved speed or utilization of volume, weight, cost and increased reliability; solid state devices performing an integrated or alterable circuit function, i.e. counting, translation, etc.; significant contributions to the semiconductor circuit art in flexibility, bandwidth, gain, stability, reliability, solid state memory, storage and logic devices such as thin films, multi-aperture magnetics, twistors, optoelectrics; significant contributions to solid state microwave electronics such as parametric amplifiers, masers, parametrons; and low temperature solid state electronics for memory, logic, i.e. cryoelectrics.

Abstracts, in about 300 words, of the papers explaining the nature and significance of the contributions and giving the theoretical and experimental results should be sent, not later than 15 September 1959, to the following address: Tudor R. Finch, Chairman, Programme Committee, 1960 Solid State Circuits Conference, Bell Telephone Laboratories Inc., Murray Hill, New Jersey, U.S.A.

Roger Adams Award for Organic Chemistry

A NEW INTERNATIONAL CHEMISTRY award, sponsored by Organic Reactions Inc. Organic Synthesis Inc. and the American Chemical Society, has been instituted. The award consisting of a medal, an honorarium of $ 5000 and travel expenses will be made every two years for outstanding contribution in organic chemistry. The award is named in honour of Prof. Roger Adams, Emeritus Professor and former Head of the Department of Chemistry and Chemical Engineering at the University of Illinois. One of the world's outstanding organic chemists, Prof. Adams was one of the founders of the both *Organic Synthesis* and *Organic Reactions* and was their first editor. The first award goes to Prof. D. H. R. Barton of Imperial College, London, well known for his analysis of the relation of steric effects to reaction rates in cyclic compounds.

Collected Works of Irving Langmuir

THE COMPLETE WORKS OF THE LATE Dr Irving Langmuir are being collected for publication in a set of six volumes by the Pergamon Press Ltd, London. Dr Langmuir, who was associated with the General Electric Research Laboratory from 1909 until his death in 1957, was widely recognized as one of the most versatile scientists of the twentieth century and was the first American industrial scientist to receive a Nobel Prize. Among the scientific areas in which Dr Langmuir made outstanding contributions are high vacuum, solid surfaces, heat conduction, thermionic and gaseous discharges, monolayers, structure of liquids, aerosols and nucleation.

A group of 29 leading scientists drawn from all parts of the world will serve as members of the editorial advisory board for this undertaking. Because of the broad scope of Dr Langmuir's scientific interests, the publishers expect that a minimum of six volumes will be required. Each volume will be devoted to one or more fields of service in which Dr Langmuir worked. His papers will be supplemented in each volume with special articles written by other scientists analysing the influence of Dr Langmuir's contributions on science in the past, present and future. The series will also include a large number of previously unpublished works. A biography of Dr Langmuir will also be included in the final volume of the series. The first set of volumes is expected to be out before the end of 1959.

1958 Book of ASTM Standards

THE AMERICAN SOCIETY FOR TESTing Materials (ASTM) has recently completed publication of its 10-part 1958 *Book of ASTM Standards*. The different parts are as follows: Part 1: Ferrous metals specifications (except test methods), 1620 pp., 291 standards ($ 12.00);

Part 2: Non-ferrous metals specifications (except test methods), Electronic materials, 1386 pp., 251 standards ($ 10.00); Part 3: Metals test methods (except chemical analysis), 992 pp., 121 standards ($ 10.00); Part 4: Cement, concrete, mortars, road materials, waterproofing, soils, 1456 pp., 338 standards ($ 12.00); Part 5: Masonry products, ceramics, thermal insulation, sandwich and building constructions, acoustical materials, fire tests, 1142 pp., 210 standards ($ 12.00); Part 6: Wood, paper, adhesives, shipping containers, cellulose, leather, 1040 pp., 219 standards ($ 10.00); Part 7: Petroleum products, lubricants, tank measurements, engine tests, 1516 pp., 260 standards ($ 12.00); Part 8: Paint, naval stores, aromatic hydrocarbons, coal, coke, gaseous fuels, engine anti-freezes, 1632 pp., 353 standards ($ 12.00); Part 9: Plastics, electrical insulation, rubber, carbon black, 2056 pp., 380 standards ($ 14.00); and Part 10: Textiles, soap, water, atmospheric analysis, wax polishes, 1524 pp., 280 standards ($ 12.00). The complete set is priced $ 116.00.

This publication is the largest publication venture of the American Society for Testing Materials. The increase from 7 to 10 parts in 1958 was necessitated by a growth in the size of individual parts to the point where they could no longer be bound economically and were becoming unwieldy in size. Within the 10 parts are contained 2450 standard specifications, methods of test, definitions of terms, and recommended practices. These occupy 13,600 pages. Each part is complete in itself, with a detailed subject index and a list of standards in numerical sequence. To keep this book up to date, supplements to each part will be issued later in both 1959 and 1960. As a service, a complete index is furnished without charge with each set of the *Book of ASTM Standards.*

Tetrahedron Letters

THE PERGAMON PRESS LTD HAVE commenced the publication, from March 1959, of a new periodical under the title *Tetrahedron Letters*, to serve as a medium for the rapid publication of shorter notes and preliminary communications in organic chemistry which were previously finding a place in *Tetrahedron*. The new journal will be published every two to four weeks.

The communication for *Tetrahedron Letters* may include experimental or theoretical results of organic chemical interest which are considered novel and significant; they may also be of a speculative nature. To facilitate quick handling, communications should be addressed to *Tetrahedron Letters*, Pergamon Press Ltd, 4 Fitzroy Square, London W.1.

Russian Journal of Inorganic Chemistry

Zhurnal Neorganicheskoi Khimii, published by the Academy of Sciences of the U.S.S.R., is being made available commencing with the January 1959 issue, in a cover-to-cover English translation. The English edition is published in London by the Chemical Society with the support of the Department of Scientific & Industrial Research. It is translated by Infosearch Ltd and distributed by Cleaver-Hume Press Ltd, London. Specification: size $8\frac{1}{2} \times 11 \times$ about 1 in., twelve issues per year, each of about 250 pages, with line and halftone illustrations.

Subscription: per annum £ 30 or $ 90.00 (Universities and Technical Colleges, £ 22 10*s*. or $ 67.50). Single issues £ 4 or $ 12.00.

Journal of Biochemical and Microbiological Technology and Engineering

THE INTERSCIENCE PUBLISHERS Ltd, London, have commenced the publication, from February 1959, of a new international quarterly, the *Journal of Biochemical and Microbiological Technology and Engineering* (subscription £ 5 15*s*. per year). The aim of the new journal is to gather into a single publishing medium all the papers dealing with the many current and increasingly complex problem requiring biochemical, chemical engineering and biological knowledge, which hitherto have been scattered over a great variety of specialist journals. The major subjects to be covered are: isolation of chemical products from natural sources, industrial fermentation, industrial enzymology, biological waste treatment, brewing and wine making and food processing.

Journal of Medicinal and Pharmaceutical Chemistry

WITH A VIEW TO HAVE A UNIFIED record of the developments in medicinal chemistry, the Interscience Publishers Ltd, London, have started publishing, from February 1959, a new international quarterly, the *Journal of Medicinal and Pharmaceutical Chemistry* (subscription £ 5 15*s*.). The journal is intended to serve as a forum for the presentation of information concerning the design and synthesis of medicinal and biologically active chemicals and their metabolism and biological actions. This will also include articles concerning the mode of action of drugs in terms of their chemical and physico-chemical properties.

Journal of Lipid Research

THE FIRST ISSUE OF THE *Journal of Lipid Research* (subscription $ 6.00 per annum) published at the University of Tennessee, U.S.A., will be appearing in September 1959. The journal, a quarterly, will publish original articles dealing with the chemistry, biochemistry, enzymology, histochemistry and physiology of the lipids. In addition, it will contain review articles and a list of new lipid methods published in other journals. Further information can be had from the Editorial Office, University of Tennessee, U.S.A.

Catalogue of Nuclear Study Courses in U.K.

FOR THE GUIDANCE OF THE OVERSEAS students who wish to undertake specialized, formal training in the nuclear energy field, the Science Department of the British Council has compiled a catalogue of courses in pure and applied sciences concerned with the use and development of nuclear energy. The catalogue includes all full time courses of one week or more in duration. It lists the title of the course and the institution at which it is conducted, the duration and frequency and fees for the course, and whether it is a degree, diploma or a certificate course. The catalogue also gives an index of institutions, subject index and addresses for enquiries and applications. The catalogue can be obtained free on request to the Science Department, British Council, 65 Davies Street, London W.1.

Literature Review on Fats and Oils — 1957

THIS 88-PAGE ANNUAL PUBLICATION, ninth in the series, brought out under the auspices of the Vanaspati Research Advisory Committee of the Council of Scientific & Industrial Research, follows the pattern of earlier volumes in the arrangement and presentation of topics. The present volume is divided into six chapters: (1) Statistical survey; (2) Oilseeds; (3) Processing of oils and fats; (4) Spoilage; (5) Chemistry, characteristics, composition and analysis of oils and fats; and (6) Nutrition and metabolism. There are two appendices at the end: Appendix I provides data on the characteristics and composition of newly recorded vegetable, animal and microbe oils and fats, and Appendix II lists new books, periodicals and other publications brought out during the year, and brief notes on technical meetings, symposia and lectures held during the year.

INSTRUMENTS AND APPLIANCES

Automatic reader for high-precision balances

THE U.S. NATIONAL BUREAU OF Standards has developed a primary research tool for obtaining a better understanding of balance errors which may lead to improved balance designs.

The working of the instrument can be understood from the following: A narrow beam of light is reflected, by a mirror on the balance beam, back to the slit at the front of a photocell. Besides swinging with the motion of the balance, the light beam has a small 60 c/s. vibration of its own (amplitude of *c.* 1 minute of arc). A servo loop maintains the photocell slit centred on the light beam. A photoelectric reader provides data on the motion of the balance pans as (1) a voltage whose magnitude represents the instantaneous position of the beam, or (2) numerical data representing turning points from which masses may be calculated. A plot of the output voltage on a recorder forms a graph that can be used to evaluate the dynamic characteristics of the oscillating structure. The turning points are read from a dial that ordinarily indicates the instantaneous position of the beam, but which remains stationary for a brief interval after each turning point is reached.

The device reduces the errors in precision mass measurements primarily by reducing the period of balance operations during which changes in ambient conditions usually result in errors. The faster operation of the reader increases the ' on scale ' range of the balance and permits the use of larger sensitivity weights. The zero stability of the apparatus has a peak value of *c.* 0·002 in./hr.

The effectiveness of the automatic reader for investigating errors in precision balances has been demonstrated in trials with experienced telescope observers taking readings simultaneously by the old and new methods. The readings taken on the new device lie on a smoother curve and are less disturbed by random fluctuations than those obtained by the earlier method.

The reader has been used to show the effects of errors associated with a certain type of arrestment mechanism and also to estimate the reloading error in a balance of one design when operated without arrestment. The device is currently being used to evaluate mechanical features of a short-period high-precision automatic weighing system [*Tech. News Bull. Nat. Bur. Stand.*, **43** (1959), 10].

Transistorized power meter

A NEW FULLY TRANSISTORIZED microwave power meter of the self-balancing kind, to provide accurate, automatic, direct-reading measurements of continuous wave or pulsed power, has been announced by the Narda Microwave Corporation, Mineola, New York. The instrument offers greater stability and accuracy than any other available power meter and may be used with all 100 or 200 ohm bolometers or thermistors — positive or negative temperature coefficient — requiring any bias current up to 18 ma., in any frequency range for which there are bolometer or thermistor mounts.

The meter provides wide power range with 0·001-0·01 mW. and 0·003 to 0·03 mW. scales, in addition to the five standard scales up to 10 mW. The exclusive new low range scales are recommended for use with bolometers (positive temperature coefficient) only and under stable ambient temperature conditions.

The instrument is powered by a nickel-cadmium battery, rechargeable overnight or during operation and providing accurate readings completely independent of line voltage fluctuations. The battery operates for 16 hr before a recharge is required; only 15 hr are required to fully recharge a completely discharged battery. 115 V., 60 c/s. power can be used for recharging; the battery cannot be damaged by excessive charging. Battery operation also eliminates warm-up periods and errors from internal heating caused by vacuum tubes.

Progress Reports

NUTRITION RESEARCH LABORATORIES, COONOOR

DURING THE YEAR 1957-58, THE NUTRITION RESEARCH Laboratories undertook a comparative study of the social, cultural and environmental conditions of the tribes in the Nilgiris, viz. Todas, Kotas, Irulas and Kurumbas, particularly with a view to determining how far these conditions influence the dietary and nutritional status of the tribal population. A seminar on the growth and physical development of Indian children was conducted during 17-21 June 1958, with a view to provide preliminary training and background information to workers selected to work at different units sponsored by the Indian Council of Medical Research, under the Second Five-Year Plan Projects. A brochure containing menus for low cost balanced diets and school lunch programmes suitable for South India has been prepared. A survey of the incidence of coronary heart disease and factors related to atherosclerosis initiated at the recommendation of Cardiovascular Diseases Subcommittee of the Indian Council of Medical Research has been completed among industrial labour, officers and other ranks of the armed forces. The investigation includes determination of serum cholesterol and phospholipids, coagulation time, blood pressure and electrocardiography in representative population groups at different periods.

A summary of the work done in the various sections of the Laboratories is given below.

Studies on proteins, vitamins and mineral salts — As a result of study on the effect of supplementation of a large number of cereals with pulses and green leafy vegetables on the growth promoting property of the resulting protein mixture, it has been concluded that all the cereals, when mixed with pulses and green leafy vegetable, are capable of regenerating haemoglobin and plasma protein effectively, although at a slower rate than that observed with skim milk. Also, vitamin B_{12} content of livers of rats maintained on vegetable protein diets is significantly greater than that of the weanlings. Contrary to the earlier views that human erythrocytes synthesize pyridine nucleotides from nicotinamide and glucose, it was observed that washed red blood cells (r.b.c.) of the rat were unable to synthesize pyridine nucleotide (PN) under conditions similar to those employed in experiments with human erythrocytes. Examination of r.b.c. of different species of animals showed that the species that were unable to synthesize PN had a higher PN content in blood as compared to the guinea-pig and human blood. It is suggested that the major site of NMN synthesis in these species might be a tissue other than blood.

The results of experiments to determine if the level of protein intake influences the rate of depletion of liver stores of vitamin A in rats kept on vitamin A free diets, have shown that rats on high protein diet have a higher requirement for vitamin A than those on low protein diets. The amount of vitamin A left in the liver at the end of the experiment was maximum at the 6 per cent level.

Clinical investigations — Investigations on the presence of ferritin in kwashiorkar, and in nutritional oedema of adults have confirmed that the source of ferritin in blood circulation is the liver. Visible oedema due to low protein diets disappears 8-12 days after the institution of high protein therapy. Serum albumin levels increase but slowly. The response to water load determined three weeks after the institution of therapy has shown a return to normal. It is concluded that ferritin in blood stimulates the pituitary and probably causes increased secretion of the anti-diuretic hormone. This coupled with the decreased ability of the liver to inactivate the hormone can be expected to raise the blood hormone level leading to oliguria and oedema formation.

The effects of different dietary fats on the whole blood clotting time and prothrombin time in a group of human volunteers have been investigated and the results show that the feeding of butter and hydrogenated vegetable fat (10 days) resulted in some increase in serum cholesterol while the feeding of sesame oil caused a decrease in the latter. The changes in serum cholesterol observed are not reflected in serum cholesterol or squalene.

Field investigations — A study of anaemia among plantation workers in the Nilgiris reveals that children and women are the important groups among whom anaemia is a major problem. It is found that in the case of women, those with larger number of pregnancies are more severely anaemic than women with fewer pregnancies. A survey of the dietary habits indicated that the diets were deficient in calories, fat, vitamin A and riboflavin. The average iron intake was 21·5 mg. per day. Therapeutic trials have indicated the prevalence of iron deficiency type of anaemia among the poor. This has been further supported by a number of feeding trials in school children, which have shown that both iron and protein supplements considerably improve haemoglobin levels.

Under the Second Five-Year Plan projects a comprehensive investigation on the chemical composition of milk in 191 mothers belonging to the poor socio-economic group, in different stages of lactation and of different parities, have been carried out. The results indicate that there is no striking difference between the values for proximate principles observed in the present series and those reported from other parts of the world. The vitamin values are considerably lower. The calcium content of the South Indian milk samples is higher than the values reported from other parts of the world. This is interesting in the light of the low intake of calcium in these subjects.

Extended surveys in protein malnutrition have been undertaken in Andhra Pradesh and West Bengal. Dietary survey in Andhra Pradesh reveal that the intake of protein and calories especially from the age of 30 months onwards is comparatively higher than that observed among children in some other parts of

South India. The dietary practices of the low income families in West Bengal are more or less akin to those observed among similar groups in South India.

In Andhra Pradesh dyspigmentary hair changes, enlarged liver and moon face were observed in 6-26 per cent of the children examined while in West Bengal signs like dyschromotrichia, enlarged liver and moon face were found in about 0·2 to 11 per cent of children in different areas.

A detailed study on the nutritive value of Indian foodstuffs has been undertaken and a large number of samples of cereals, pulses, beans, fruits and vegetables have been analysed. The object of this project is to provide detailed information on the proximate principles, vitamins and minerals in common Indian foodstuffs with a view to determining the extent of regional variations in the composition of foodstuffs grown in India.

The energy cost of some important jobs performed in the textile industry has been determined in two textile mills at Coimbatore using the portable Kofranyi-Michaelis respirometer, followed by analysis of the expired air in a Haldane gas analyser. In addition to this, a survey has been made in different departments of the mills to know how the workers spend their time during working hours. For this, minute to minute record of the activities of some workers has been maintained.

INTERNATIONAL TIN RESEARCH COUNCIL

THE ANNUAL REPORT OF THE INTERNATIONAL TIN Research Council for the year 1958 records many newly discovered facts about tin, its alloys and its chemical compounds which are of considerable interest to the electroplating, canning and packaging, electrical and metal industries. During the year, the Tin Research Institute at Greenford, England, and the Council's 8 overseas branches have provided technical assistance in the case of 986 enquiries coming from practically every industrial country and covering almost every known application of tin. Besides its usual publication, *Tin and Its Uses*, 22 new technical publications were published by the Council in 1958.

Close contact with industry through technical service has been helpful in guiding research into topically useful channels, the results of which have in turn been useful to the industry. For example the problem of stress-corrosion in packing a solution of a poly-azo dyestuff in cans experienced by the packing industry has been investigated and the probable causes have been analysed. It was found that in some conditions the solution of the dye concerned and also solutions of certain other poly-azo dyes could remove tin from tinplate and could cause cracking of stressed tinplate steel. The above reactions are aided by the absence of water, by the presence of traces of inorganic chlorides and by the use of particular solvents. The solvents themselves have no action but the combination of some dyestuffs with some solvents causes the undesirable effect. It seems likely that the formation of complexes of tin and iron with the dyestuffs may have a strong influence in causing the corrosion.

Another enquiry led to the development of an improved laboratory apparatus for flow-brightening electro-tinplate coatings. The more versatile equipment developed enables the variation of the rate of heating and the rate (400-1000 ft/min.) of entry of the specimen into the quenching medium. A marked improvement in the flow-brightening technique is possible with this equipment for the preparation of standard and test specimens. It has been observed that the rates of heating, lineal speed of quenching and quench temperature have marked effects on the grain size of tin coatings.

A number of instances where a procedure, a technique or an improvement, arrived at as a result of the Council's work, and which have been sought or adopted by the appropriate industry with beneficial results, have been reported. They are: (1) manufacture of steel-backed, 20 per cent tin aluminium-tin strip for internal combustion engine bearings, (2) the method of producing electro-tinned coatings in a finish which is bright as it comes from the bath and needs no polishing, (3) the applications of tin-nickel electroplating in a number of cases, e.g. rubbing contacts for electrical work, solderable finishes for tags, wires and electrical components and many decorative, combined with protective applications, e.g. in watch and scientific instrument industries and (4) the Institute's ' direct chloride ' method for tinning cast iron which is applicable to all types of cast iron and gives excellent finish at a sufficiently low cost (the method has opened up a new range of uses for cast iron to be finished in pure tin).

Other developmental activities in which the Institute and its branches are engaged are: (1) continuous casting of tin bronzes, (2) preparation of standard methods of analysis of tin ingots and tin-lead solders, and (3) development of tin-nickel coatings for a wide variety of applications where freedom from corrosion, good wearing properties and ease of soldering are essential, e.g. in finished moving machinery parts, scientific instruments, railway signalling devices, telephone cables, etc.

Some of the other important researches carried out under the Council's Institute and its branches are summarized below:

Hot-tinning — A simple technique for obtaining a satisfactory and uniform tin coating and for wiping narrow light-gauge copper strip at speeds up to 300 ft/min. has been developed. Tinning at these high speeds is achieved by the use of a special fluxing technique employing a mildly corrosive flux. The flux can be used, with certain modifications, for tinning of steel also. In this method, the tinned strip is passed between two ' edges ' formed from polytetrafluoethylene. These edges are disposed a few inches apart and on either side of the strip and are offset with respect to the strip pass-line. Their wiping action thus depends on strip tension and coating thickness is controlled by controlling this tension.

Electrochemistry and corrosion — Pilot scale study of the process developed for the electro-deposition of tin in bright form using an addition agent based on selected wood tars has enabled to evaluate and prescribe conditions for the maintenance of commercial bright plating baths; details of production of a ' revivifying agent ' for the electrolyte have been worked out. Studies on the component responsible for the brightening effect resulted in the recovery, by displacement chromatography, of an apparently homogeneous active material; it appears probable that the active material is unstable when separated from the parent material.

An electrochemical method for providing a numerical index of the porosity of metal coatings, including those of tin and tin alloys, has been devised. The metal carrying the coating is made the anode in a test cell; the electrolyte and current density are chosen so as to ensure that the current is carried only by the exposed basis metal and that polarization of the basis metal is insensitive to small changes of current. The variation of the measured potential of the test piece with changes of applied current is then governed by the resistance of the electrolyte contained in the pores. The resistance value for the pores thus obtained depends on the number, area, shape and length of pore channels. Values obtained reflect well the behaviour of the coatings in corrosive environments.

Fundamental studies on corrosion of tinplate regarding the effect of tin-iron alloy layer have led to improved techniques for isolating the alloy layer as a discrete and unencumbered film. The separated alloy is found to be strongly cathodic to both tin and steel. In air-free citric acid, the corrosion of tin is stimulated by contact with the alloy but the corrosion of steel is apparently not much influenced.

Tin alloys — Data on important physical properties of a number of tin-base alloys have been obtained. Attempts to produce new alloys of improved mechanical properties have led to an examination of the ternary tin-rich alloys containing antimony and indium. An alloy containing 10 per cent antimony and 2·5 per cent indium has been found most satisfactory. The alloy has a stable hardness of 30 V.P.N. which makes it suitable for application of the alloy as a bearing material. Work on the effect of aluminium on the bonding to steel and on the structure of tin-base bearing alloys showed, contrary to expectations, that aluminium in amounts up to 0·02 per cent has no adverse effect on bond strength; however, also no intergranular corrosion was found in the particular antimony alloy containing traces of aluminium. The observed effect may probably be due to the scavenging effect of antimony upon aluminium with which it forms an intermetallic compound.

Investigations on the effect of small additions of other metals on the recovery from work-softening of a standard pewter alloy pointed to the conclusion that the additions may have useful effects and that, with manipulation in the casting of the alloy, regular production can be undertaken with confidence. Addition of 1-2 per cent of lead, magnesium or thallium, or 0·1 per cent of silver gives, to the worked and heat treated alloy, a strength higher than that of the as-cast material.

Powder metallurgy of the titanium-tin alloys has been investigated, employing titanium powder (sieved fraction from sodium-reduced material); the porosity of the compacts prepared by pressing and sintering has been found to be satisfactorily low. Tin has been observed to confer marked strength on titanium. The method of preparation offers attractive commercial prospects. Use of an electrolytic cell for polishing microsections of titanium-tin alloys has given a rapid and simple method of specimen preparation which is eminently suitable for the repetitive nature of the work.

Tests on two compositions of nodular cast irons in sections up to 3 in. have indicated that small additions of tin suppress ferrite without risk of the formation of massive cementite. Additions of tin can promote a substantially wholly pearlitic matrix without prejudice to the mechanical properties until the level of addition is well beyond the dosage required.

Organo-tin compounds — Investigations on the addition reactions involving organo-tin hydrides have indicated that on the one hand these reactions open up a new way for the preparation of a number of functionally substituted organo-tin compounds which have been hitherto extremely difficult to prepare and on the other hand, they have shown possibilities of developing polymeric substances some of which may prove to have useful properties. Studies on the deterrent effect of selected organo-tin compounds on certain wood-destroying insects showed that the compound, Brestan, available in Germany, can be used on agricultural crops with benefit.

Supplement

ABSTRACTS

of Published Research Papers from National Laboratories and
Sponsored Research Projects of C.S.I.R.

JANUARY-MARCH 1959

No. 3, JULY 1959

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ALPHABETICAL SUBJECT INDEX

ABSTRACTS

[For the classification of abstracts both the Colon and the U.D.C. systems have been adopted. The numbers on the left-hand side of the subject titles refer to Colon Classification while those on the right-hand side refer to the U.D.C.]

C PHYSICS 53

C216 Crystallography 53 : 548.0

177. BANERJEE, B. C. & GOSWAMI, A.: The structure of electro-deposited nickel, *J. electrochem. Soc.*, **106** (1959), 20

An electron diffraction study has been made of the crystal structure, orientation, and mode of growth of nickel deposits from sulphate-chloride-boric acid and chloride-boric acid baths under various bath conditions. The effect of *p*H, temperature, concentration, current density, mechanical stirring, etc., and of additions of hydrogen peroxide, nickel nitrate, and sodium chloride on polycrystalline substrates has been investigated. Depending on bath conditions, various preferred orientations (one-degree), mixed or otherwise, are developed and their causes have been discussed. These have been correlated also with the mode of cathodic crystal growth.

178. PANDYA, N. S. & SHAH, C. J.: Etch figures on tin and zinc, *J. sci. industr. Res.*, **18B** (1959), 85

Studies on the characteristics of etch figures on tin and zinc have shown that cast tin etched with dilute hydrochloric acid discloses grains with different shapes of etch pits, such as square, boat-shaped or chisel marks. Cleavage planes of single crystals of zinc, when etched with acetic acid, give hexagonal figures, and in some cases hexagonal spirals.

C5 : 3-71 Absorption Spectroscopy 535.34

179. SURESH CHANDRA & SRIVASTAVA, B. P.: Absorption of microwaves in planetary atmospheres, *Z. Astrophys.*, **47** (1959), 127

The absorption of microwaves due to various gases in the atmospheres of different planets has been investigated. The integrated absorption due to oxygen present in the earth's atmosphere is found to be 0·16, 0·099 and 0·092 db. at $\nu=1$, 0·33 and 0·1 cm.$^{-1}$ respectively. The absorption due to nitrous oxide in Mars and Venus and the absorption due to ammonia in Mars, Venus and Jupiter have also been calculated. The absorption due to earth's ionosphere has been found to be negligible at these frequencies. Total absorption values at $\nu=1$, 0·33 and 0·1 cm.$^{-1}$ are: Earth, 0·16, 0·099 and 0·092 db.; Mars, 0·087, 0·019 and 0·002 db.; Venus, 0·17, 0·037 and 0·003 db.; and Jupiter, 29·498, 6·374 and 0·505 db. The atmospheres of most of the planets except Jupiter appear to offer negligible attenuation to microwaves.

C6 : 141 Dielectrics 537.226

180. MURALIDHARA RAO, V.: Ultrahigh frequency absorption in liquid mixtures, *J. sci. industr. Res.*, **18B** (1959), 103

The dielectric constant and the dielectric loss of two liquid mixtures have been studied in the ultrahigh frequency region using the standing wave method of Roberts and Von Hippel. The mixtures studied are *n*-butyl alcohol + glycerol (both associated) and isobutyl alcohol + *n*-propyl bromide (associated + non-associated). Two peaks have been observed in both cases in the ϵ''-frequency and ϵ''-temperature curves. Schallamach's suggestion that the process of dielectric relaxation cannot be directly connected with individual molecules but is a disturbance over an appreciable region in the liquid does not appear to be valid in the mixtures investigated.

181. MURTY, C. R. K.: On calculation of relaxation times, *Indian J. Phys.*, **32** (1958), 580

An empirical equation for calculation of relaxation times of polar molecules in non-polar solvents has been suggested from measured data of dielectric constant and viscosity of the solvent and polarizability of the solute molecule.

182. NARASIMHA RAO, D. V. G. L.: Calculations of dipole moments of H_2Se and AsH_3, *Trans. Faraday Soc.*, **55** (1959), 19

Theoretical studies on dipole moments have been extended to the molecules H_2Se and AsH_3. While the observed moment of H_2Se can be explained on the basis of sp-hybridization alone as given by the bond angle, about 7 per cent ionic character has to be assumed for the As-H bond to account for the observed moment of AsH_3.

183. NARASIMHA RAO, D. V. G. L.: Calculations of dipole moments of tri-substituted benzenes — 1:2:3-, 1:2:4- and 1:3:5-Substitutions, *Indian J. Phys.*, **32** (1958), 547

Previous calculations on the dipole moments of 1:2:4-tri-substituted benzenes have been revised and calculations have been extended to the other two — 1:2:3 and 1:3:5 — substitutions. The equations of Frank have been used in computing the induced moments, since the dielectric constant of the internuclear space is introduced directly in these equations to account for its effect on the induced moments. The equations have been applied in the first instance to a few typical molecules. The calculated and observed values are found to agree.

C9B3-7 Nuclear Magnetism 539.1 : 538

184. NAGARAJAN, V.: Observations on nuclear magnetic resonance: Variation of spin relaxation time with concentration of paramagnetic ion and viscosity of the medium, *J. sci. industr. Res.*, **18B** (1959), 84

Using the super-regenerative oscillator technique, observations have been made on proton signals in different alcohols of both normal and iso-types. The variation of spin-lattice relaxation time with paramagnetic ion concentration and viscosity of the medium has also been studied. A quantitative estimate of 'g' value for fluorine has been made.

185. RAGHUNADHA RAO, E. V.: Some observations on nuclear magnetic resonance using super-regenerative oscillator technique, *J. sci. industr. Res.*, **18B** (1959), 125

Observations on nuclear magnetic resonance in ferric chloride solutions have been made using a super-regenerative oscillator developed in the laboratory. Qualitative observations have been made on the variation of spin-lattice relaxation time with the concentration of paramagnetic ion in the specimen and the viscosity of the medium. The observations agree qualitatively with the results obtained by bridge methods.

D ENGINEERING 62

D344 Quicklime 666.924

D344e *Apparatus* 666.924 : 620.1.05

186. SASTRY, S. L.: A rapid method for measuring the porosity of quicklime, *J. sci. industr. Res.*, **17B** (1958), 252

Porosity of solids can be determined directly by extraction and measurement of pore-air or indirectly from their true and apparent specific gravities. The air extraction method, besides being time-consuming, is inapplicable to limes derived from tufaceous, coralline, foraminiferal and crystalline limestones and involves practical difficulties such as mercury absorption. The indirect method involves the determination of the bulk volume of lime samples.

The apparatus described enables the measurement of the bulk volume of solids, of which lime is a particular case. It is useful when a large number of determinations have to be carried out rapidly. The measurement is rapid and can be applied to limes derived from a large number of sources of widely varying characteristics. The porosity so determined lies between the porosity calculated from the bulk volume determined by mercury displacement and the porosity measured in M'Gee apparatus, and is very close to the latter.

D39 (F5895) Paints 691.57

187. KAPSE, G. W. & PATWARDHAN, N. K.: Weathering studies on house paints, *Paintindia*, **8** (12) (1959), 30

The results of natural and accelerated weathering on thirty-eight samples of ready mixed oil paints in different shades, conforming to Indian Standard Specification, are presented. The overall durability, the correlation of natural and accelerated weathering, the best time for painting, etc., have been discussed.

D515 Rolling Stock Materials 625.2

D515 : 81 *Wear Tests* 625.2 : 620.178.16

188. DAS, B. N. & CHOUBEY, R.: Friction and frictional wear, *Trans. Indian Inst. Metals*, **11** (1958), 67

The effect of load on friction and the resulting wear and loss of rolling stock materials through frictional wear in the case of rolling with about 10 per cent sliding motion have been investigated. In repeated rolling the dominating factor contributing to wear is the abrasive action of hard wear products formed during the process. The effect of abrasive wear has been eliminated in the present investigation by removing the surface wear products soon after their formation. The increase in the surface hardness of the materials has also been determined to assess its relationship with friction and the rate of frictional wear. It has been concluded that the mechanism involved in the wearing process due to friction is predominantly pitting fatigue.

D53 Aeronautical Engineering 629.13

189. RAO, D. M. & RAMACHANDRA, S. M.: Suction and power requirements of a ventilated wall ' half-nozzle ' at transonic speeds, *J. aero. Soc. India*, **10** (1958), 63

Experiments conducted with a slotted wall (9·4 per cent open) and a perforated wall (18·2 per cent open), fitted in a two-dimensional half-nozzle configuration (i.e. occupying only one side of a rectangular nozzle) and employing plenum suction, indicate suction flow requirements considerably in excess of the quantities needed by normal ventilated nozzles, in the Mach number range 0·8-1·05. Measurements of diffuser power show substantial benefits of employing suction with a half-nozzle. Effects of nozzle length/height ratio and divergence angle on suction and power have been studied and it has been found that an optimum combination of divergence and suction yields useful tunnel power reductions in the entire transonic speed range.

D65e Electronic Devices 621.38 : 620.1.05

190. AMARJIT SINGH & RAO, R. A.: A proposed ferrite-tuned magnetron, *J. Instn Telecomm. Engrs*, **5** (1959), 72

A method is proposed for tuning a magnetron by suitably placing a ferrite material in the resonator, and varying its effective permeability by means of a biasing magnetic field. It is shown that an inverted interdigital magnetron with a coaxial line coupled to the region enclosed by the fingers is well suited for the purpose. The ferrite, placed near the shorted end of the line, and biased by a radial field, is kept out of the main magnetic field of the magnetron, so that the interference of one with the other is avoided.

E CHEMISTRY 54

E : 213 Chemical Kinetics 541.12

191. VENKATACHALAPATHY, M. S., RAMASWAMY, R. & UDUPA, H. V. K.: Kinetic study of the oxidation of toluene by manganic sulphate, *Bull. Acad. Pol. Sci.*, **6** (1958), 487

The kinetics of reaction in the oxidation of toluene by manganic sulphate have been studied. Under the conditions employed, the methyl group in the ring is attacked chiefly, yielding a stepwise oxidation of toluene to benzaldehyde. Disruption of the aromatic nucleus does not take place and no benzyl alcohol is detected in the products of oxidation. Resinous substances and self-condensation products of certain intermediates are formed. The reaction is of the first order with respect to the concentration of manganic sulphate.

E : 2133 Phase Systems 541.121

192. KATTI, P. K. & CHAUDHRI, M. M.: Application of the ' quasi-crystalline ' model for predicting the vapour-liquid equilibrium of some binary mixtures by using their boiling points, *Proc. nat. Inst. Sci. India*, **24** (1958), 330

The boiling points of the systems (1) carbon tetrachloride/toluene, (2) carbon tetrachloride/carbon disulphide, (3) benzene/ethylene dichloride, (4) benzene/carbon disulphide, (5) benzene/chloroform, (6) chloroform/carbon tetrachloride, and (7) cyclohexane carbon tetrachloride have been shown to be in conformity with the quasi-crystalline model proposed by Guggenheim. The possibility of using this model for the prediction of the vapour-liquid equilibrium data for the above systems has been discussed.

E : 2136-22 Hydrogen Ion Concentration 541.132.3

193. INDRA SANGHI & PARTHASARATHY, N. V.: Influence of surface active agents on spectrophotometric determination of *p*H, *Proc. Indian Acad. Sci.*, **49A** (1959), 144

The *p*H of a solution, containing an indicator and surface active agent, when determined colorimetrically, shows an apparent shift from the true Sorenson value. The *p*H shifts for thymol blue in the presence of Manoxol OT, Teepol and dodecyl-benzene-sodium sulphonate have been studied and in all cases the *p*H as determined spectrophotometrically is found to be less than the true Sorenson value. Attempts have been made to explain the results on the basis of the theory of Krishnappa *et al.* [*Proc. Indian Acad. Sci.*, **23A** (1946), 1]. It is suggested that some additional factors, particularly the micelle formation, should also be taken into account.

E : 218 Molecular Structure 541.1 : 539.2

194. Somayajulu, G. R.: Dependence of force constant on electronegativity, bond strength and bond order (VII), *J. chem. Phys.*, **28** (1958), 814

The relationship between the force constants and the electronegativities of bonded atoms, the strengths of the bond orbitals and the bond order has been investigated. The expression $k\mathrm{AB} = (k\mathrm{AA}.k\mathrm{BB})^{\frac{1}{2}}+\Delta$, where k's are the force constants of the given types of bonds AA, AB and BB and Δ is an ionic contribution term, has been suggested. For single bonds, $\sqrt{\Delta}$ corresponds to the difference in the electronegativities of the atoms A and B in their valence states. In the case of multiple bonds $\sqrt{\Delta}$ leads to the proper value for the percentage ionic character of the bond. The force constant has been shown to be proportional to the product of the strengths of the bond orbitals and to be linearly related to bond order.

195. Somayajulu, G. R.: On covalent bond length and bond order (VIII), *J. chem. Phys.*, **28** (1958), 822

Relationships between lengths of CC bonds and of bonds between other atoms have been discussed and a method of estimation of fractional bond order from bond length has been presented.

E : 22 Electrolytes 541.135

196. Srivastava, S. C.: Relationship between adiabatic compressibility and concentration of solutions of electrolytes, *Indian J. Phys.*, **32** (1958), 340

An equation showing the relationship between adiabatic compressibility and concentration of solutions of electrolytes has been derived.

E : 237(C2 : 7) Osmotic Pressure 532.712

E : 237(C2 : 7)e *Apparatus* 532.712 : 53.07

197. Joshi, R. M.: A proposed osmotic balance, *J. Polym. Sci.*, **35** (1959), 271

An osmotic balance for measuring small osmotic pressures, incorporating a linear variable differential transformer and a silica or steel spring as a balancing device, has been described.

E : 24 Thermochemistry 541.11

E : 24e *Apparatus* 541.11 : 542.2

198. Bhattacharya, S. N. & Das, S. K.: A microcalorimeter for measurement of small heat changes, *Indian J. Phys.*, **33** (1959), 36

A calorimeter has been designed for determining the heats of mixing of binary liquid systems. The vapour phase has been eliminated and the principle of thermally lagged multi-jacket has been achieved in practice. The accuracy of the calorimeter is better than ±0·5 per cent and sensitivity is 0·002 J./mm.

E : 26 Electrochemistry 541.13

199. Ghosh, B. N. & Ghosh, S.: Evaluation of the true zeta-potential of hide and leather diaphragms, *J. Indian chem. Soc.*, **35** (1958), 704

The electro-osmotic flow of water through membranes of hide and leather in equilibrium with dilute solutions of sodium chloride of constant *p*H, but of varying specific conductivity, has been studied. The apparent electrokinetic potential ζ_a, calculated from the experimental data, using the Smoluchowski equation, has been found to vary with the bulk specific conductivity, K, of the electrolyte solutions used, according to the equation:

$$\frac{1}{\zeta_a}=\frac{1}{\zeta}+m\cdot\frac{1}{K}$$

where m is a constant and ζ represents the true electrokinetic potential. The significance of the results obtained has been discussed.

200. Indra Sanghi & Fleischmann, M.: Electrochemical behaviour of zinc in alkaline solutions: Part II — Constant over-voltage measurements, *Proc. Indian Acad. Sci.*, **49A** (1959), 6

The constant over-potential technique has, for the first time, been applied to the study of the electrochemical behaviour of zinc in alkaline solutions. A special apparatus consisting of a suitable oscillator, a modulator, a demodulator and a stable d.c. amplifier has been described. Potential curves for equilibrium current rates, achieved in 0·1 V. and 25 mV. steps after 1 min. each, have been obtained for 6, 1 and 0·1N potassium hydroxide and zincate solutions over the range of −1·3 to about −2·0 V. with

Hg/HgO/KOH reference electrode. It is found that in the first truly active region, the main electrode reaction is the formation of zinc ions while after the passivation it changes to gas evolution. Potentiostatic techniques reveal intermediary stages, undisclosed by constant current methods, of pseudo-passivation and current-plateau regions in which the anodic layer thickens, controlled by the high field cation transport. These observations and explanations are further confirmed by plotting rate-time transients obtained by suddenly dropping the potentials to lower values, when the rates are found to cut off. Certain anomalies and sudden reversal of currents, observed with increasing over-voltages, have been discussed.

201. NARAYANAN, U. H., SUNDARARAJAN, K. & NARAYANASWAMI, A.: Some recent investigations on the redoxokinetic effect, *J. sci. industr. Res.*, **17B** (1958), 413

A new derivation is given for the redoxokinetic potential. The final formula obtained is identical with that of Doss and Agarwal but differs from that of Oldham. The causes for this difference have been examined and it has been shown that the redoxokinetic potential as involved in Oldham's derivation cannot be identified as a constant d.c. component.

202. RAMANATHAN, VR. & INDRA SANGHI: Some polishing experiments on copper in a hyperbolic cell, *Proc. Indian Acad. Sci.*, **48A** (1958), 284

Polishing experiments have been carried out on copper anodes in a hyperbolic cell designed by Gilmont and Walton, using orthophosphoric acid as the electrolyte. The results obtained have been compared with those obtained in similar experiments with a Hull cell. Similar bands of different reflectivity and polishes are formed in both the cases. These bands shift with time and a study of such displacements has been made.

203. SATHYANARAYANA, S. & UDUPA, H. V. K.: Electrode potential studies in the anodic oxidation of glucose, *Bull. Acad. Pol. Sci.*, **6** (1958), 493

The electrode potentials in the electrochemical oxidation of glucose at graphite anodes have been measured using (1) a rotating anode, (2) a stationary anode with an auxiliary stirrer and (3) a stationary anode without any stirrer. The anode potential at (1) is steady and reproducible and at (2) and (3) erratic and irreproducible. The anode polarization is found to be small for (1), even at fairly high current densities, which explains the high current efficiency obtained at the electrode.

204. VENKATACHALAPATHY, M. S., RAMASWAMY, R. & UDUPA, H. V. K.: Anodic oxidation of manganous sulphate in aqueous sulphuric acid, *Curr. Sci.*, **28** (1959), 63

The results of investigation on the oxidation of a paste of manganous sulphate in 55 per cent sulphuric acid using lead, antimonial lead and lead dioxide anodes have been reported. The current efficiency of the process using stationary and rotating anodes has been determined and the variation of the same with the anode potential has been discussed.

E : 26e *Apparatus* 541.13 : 542.2

205. INDRA SANGHI & RAMANATHAN, VR.: A simple probe electrode for comparative study of current distribution at surfaces, *Curr. Sci.*, **28** (1959), 23

A simple probe electrode for studying the comparative current distribution over the surface of an electrode during polarization has been described. The probe has been used for elucidating the banded structure produced in the electropolishing of copper.

E : 26 (C2 : 6) Electrocapillary Phenomena 541.13 : 537.36

206. DOSS, K. S. G. & VENKATESAN, V. K.: Electrocapillaryphoresis, a potent cause of desorption peaks and polarographic maxima, *Proc. Indian Acad. Sci.*, **49A** (1959), 129

The effect of sodium dioctylsulphosuccinate on the differential capacity of dropping mercury electrode in 0·1*M* potassium chloride solution has been studied. At the desorption potential, vigorous directed movement of liquid occurs at the mercury-aqueous interface. This movement is responsible for the desorption peak in the differential capacity-potential curve. The cause of the directed movement has been examined. The directed movement of liquid also occurs, although to a less extent, at potentials far removed from the desorption potential.

E : 305(C52) Ultraviolet Spectrum Analysis 544.63

207. SANTHAMMA, V.: The near ultraviolet absorption spectrum of pyrrolidine, *Proc. nat. Inst. Sci. India*, **25A** (1959), 77

The absorption spectrum of pyrrolidine in the vapour phase has been investigated in the region 2300-2800 A. under various experimental conditions. The bands are broad and diffuse and appear in groups, each group consisting of four components. Analysis is presented on the basis of the C_s symmetry of the molecule, and with the help of five ground state frequencies and six upper state frequencies.

E : 306 Electroanalysis 545.3

208. DOSS, K. S. G., NARAYANAN, U. H. & SUNDARARAJAN, K.: Redoxokinetic titration — A new electroanalytical technique, *Analyst*, **1** (5) (1958), 11

A new electroanalytical technique (redoxokinetic titration), based on the ' redoxokinetic effect ', using constant current conditions, is described.

E : 35-85 Volumetric Analysis: Acid-base Indicators 545-32

209. VERMA, M. R. & RAMJI DASS: Acid-base indicator from *ratanjot* root, *Chem. Anal.*, **48** (1959), 12

An acid-base indicator has been obtained by extracting the *ratanjot* root (*Onosma echioides*) with ether and dissolving the brown amorphous mass obtained in alcohol. The colour change is from pinkish red in acidic solution to bluish violet in alkaline solution. The *p*H interval for the colour transition is 7·5 to 8·8.

Titrations with 0·1 and 0·01*N* sulphuric, acetic and hydrochloric acids using *ratanjot* extract as indicator have given results comparable to those obtained with phenolphthalein. The end point obtained in the titration of sodium hydroxide or acid solutions containing large amounts of either ethanol or acetone is sharper than that obtained in pure water solution. The alcoholic solution of the indicator has a shelf life of at least two weeks.

E149 : 305 Thorium: Optical Estimation 546.841 : 545.823

210. DATTA, S. K.: Ultraviolet spectrophotometric determination of thorium with 2,4-dichlorophenoxyacetic acid, *Analyt. Chem.*, **31** (1959), 195

The possibility of using the spectrophotometric method for the determination of small amounts of thorium has been investigated. The thorium salt of 2,4-dichlorophenoxyacetic acid is soluble in an aqueous ammonium carbonate solution. The solution of this compound shows maximum absorbence at a wavelength of 230 mμ and follows Beer's law. The spectrophotometric determination of thorium is based on the measurement of the absorbence of this solution. The sensitivity of the method is 0·019 γ of thorium per sq. cm., but the accuracy is poor in the case of samples containing less than 2 mg. of thorium. The common metals do not interfere, but iron, cerium (IV) and zirconium exhibit strong interference. The best results are obtained in a concentration range between 2 and 14 mg. of thorium per litre.

E1691 : 3406 Uranium: Polarographic Estimation 546.791 : 545.33

211. SUBBARAMAN, P. R., JOSHI, N. R. & GUPTA, J.: Polarographic reduction of hexavalent uranium in sodium tripolyphosphate: Part I — General studies, *Analyt. chim. acta*, **20** (1959), 89

The behaviour of some tripolyphosphate complexes like the uranyl tripolyphosphate complex at the dropping mercury electrode has been examined. The uranyl ion in alkaline tripolyphosphate medium undergoes an irreversible one-electron reduction with an $E\frac{1}{2}$ of $-1{\cdot}07$ V. vs S.C.E. at *p*H 9. Indifferent salts shift the $E\frac{1}{2}$ to more positive potentials whereas maximum suppressors have an opposite effect. The wave obtained in presence of 0·01 per cent camphor is well defined and suitable for use in uranium analysis.

212. SUBBARAMAN, P. R., JOSHI, N. R. & GUPTA, J.: Polarographic reduction of hexavalent uranium in sodium tripolyphosphate: Part II — Estimation of uranium, *Analyt. chim. acta*, **20** (1959), 190

A polarographic method of estimating uranium, based on the reduction of its tripolyphosphate complex at the dropping mercury electrode, has been developed and applied to uraniferous tantaloniobates and monazite. In the presence of elements such as copper, iron and vanadium, which interfere with the cathodic reduction of the uranyl complex, a preliminary separation as uranyl ammonium phosphate in presence of EDTA is necessary.

E192 Rare Earths 546.65

213. SUBBARAMAN, P. R., RAJAN, K. S. & GUPTA, J.: Ion-exchange separation of light rare earths using sodium tripolyphosphate, *Curr. Sci.*, **28** (1959), 63

A new method for the separation of light rare earths, excluding cerium, by cation-exchange elution of the mixed oxides with sodium tripolyphosphate has been worked out. Under suitable conditions lanthanum is retained in the column and is thus completely separated from praseodymium. The fractionation between praseodymium and neodymium is good. A 1 : 1 mixture of neodymium and samarium is separated in the column with a satisfactory volume gap.

E144-5 Zirconium: Organic Compounds 546.831 : 547.25

214. KAPOOR, R. N. & MEHROTRA, R. C.: Organic compounds of zirconium: Part VI — Reactions of zirconium tetrachloride and isopropoxide with fatty acids, *J. chem. Soc.*, (1959), 422

Studies on the reactions of zirconium tetrachloride and isopropoxide with fatty acids have shown that zirconium tetrachloride forms tetracarboxylates directly with fatty acids. With zirconium isopropoxide only oxygen-bridged compounds of the type $(R.CO_2)_3Zr.O.Zr(CO_2R)_3$ are obtained. The latter reaction is found to be straightforward to the dicarboxylate stage, after which side reactions occur.

E150-110 Hydrazine 546.17'11

215. JOGARAO, A. & SASTRI, B. S. R.: Formation of hydrazine under the influence of electric discharge, *J. sci. industr. Res.*, **18B** (1959), 38

The formation of hydrazine from ammonia gas, under the influence of silent electric discharge in an ozonizer and also of a.c. and semi-wave discharges, has been studied. The yields of hydrazine for different rates of and amount of ammonia passed have been investigated and the results discussed.

E5 : 4 Organic Synthesis 547 : 542.91

216. DESAI, N. B. & VENKATARAMAN, K.: Raney nickel reductions: VIII — A synthesis of 1 : 2-benzanthracene and its 3'-methyl and 4-methyl derivatives, *Tetrahedron*, **5** (1959), 305

1 : 2-Benzanthracene and its 3'-methyl derivative have been prepared by Raney nickel reduction of the sulphuric esters of the leuco derivatives of 1 : 2-benzanthraquinone and 4'-chloro-3'-methyl-1 : 2-benzanthraquinone, followed by dehydrogenation. 3-Hydroxy-1 : 2-benzanthraquinone is methylated in the 4-position with formaldehyde, sodium hydrosulphite and sodium hydroxide solution (the Marschalk reaction). Simultaneous reduction of the nuclear hydroxyl and quinone groups is effected by Raney nickel reduction of the trisulphuric ester of 3 : 9 : 10-trihydroxy-4-methyl-1 : 2-benzanthracene, and the resultant hexahydro-4-methyl-1 : 2-benzanthracene is dehydrogenated to 4-methyl-1 : 2-benzanthracene. The preparation of 3 : 4 : 9 : 10-dibenzopyrene from Mayvat brilliant red AF by Raney nickel reduction of the sulphuric ester of the leuco derivative and subsequent dehydrogenation is described.

217. KANE, V. V., KULKARNI, A. B. & SHAH, R. C.: Studies in xanthones: Part VII — Synthesis of polyhydroxy and methyl polyhydroxy xanthones, *J. sci. industr. Res.*, **18B** (1959), 28

A number of xanthones have been synthesized from *o*-hydroxybenzoic acids such as salicylic, *o*-vanillic, *o*-veratric, *o*-cresotic and *m*-caesotic acids by condensation with phenols such as phloroglucinol, orcinol, pyrogallol and resorcinol. In cases where hydroxybenzophenones are obtained as intermediates, the synthesis of xanthones has been effected by cyclization of hydroxybenzophenones according to the method of Dutta and Watson.

The methods for the preparation of *o*-veratric and *o*-vanillic acids have been improved. *o*-Veratric acid is obtained by methylating *o*-vanillin to 2 : 3-dimethoxybenzaldehyde with dimethyl sulphate in alkali followed by permanganate oxidation of the aldehyde (yield 72 per cent). *o*-Vanillic acid is obtained by demethylating *o*-veratric acid with hydrobromic acid (yield 70 per cent).

218. KANE, V. V., KULKARNI, A. B. & SHAH, R. C.: Xanthones: Part VIII — Elbs-Seshadri per-sulphate oxidation of xanthones, *J. sci. industr. Res.*, **18B** (1959), 75

Nuclear oxidation of a number of xanthones has been effected by Elbs-Seshadri persulphate oxidation method and the polyhydroxy xanthones obtained have been characterized. Though this procedure yields polyhydroxy xanthones directly from the hydroxy xanthones, in the case of 1 : 3- or 1 : 6-dihydroxy-3-methyl xanthones, it is necessary to partially methylate the xanthones before oxidation to obtain the polyhydroxy derivatives.

219. MUKHERJEE, S. L. & DUTTA, P. C.: Synthesis of 6β-acetoxy-5 : 5 : 9-trimethyldecal-3-one, *Proc. chem. Soc., Lond.*, (1958), 351

The synthesis of 6β-acetoxy-5 : 5 : 9-trimethyldecal-3-one is described. 2 : 3 : 4 : 5 : 6 : 7 : 8 : 10-Octahydro-1 : 10-dimethyl-2-oxonaphthalene is methylated with methyl iodide and potassium 1 : 1-dimethylpropoxide in benzene, reduced with sodium and ethanol, acetylated and oxidized with *tert.*-butyl chromate or with sodium dichromate in glacial acetic acid. On hydrogenation in presence of 10 per cent palladium-charcoal in ethanol a mixture of the diastereoisomeric saturated ketones is formed. The isomers have been obtained separately and their structure analysed.

220. RAO, D. S. & TILAK, B. D.: Thiophenes and thiapyrans: Part XIX — Cyclodehydration of phenacyl phenyl sulphide and its derivatives, *J. sci. industr. Res.*, **18B** (1959), 77

Cyclodehydration of phenacyl phenyl sulphide and its derivatives has been reported by Banfield *et al.* to result in the formation of 2-phenylthionaphthene to the practical exclusion of the expected 3-phenyl isomer. Re-investigation of the work has indicated that both the isomers are formed. This is further confirmed by the unambiguous synthesis of 3-phenylthionaphthene by the dehydrogenation of 1-(3′-thionaphthyl)-cyclohexene-1. A reaction mechanism to account for the formation of the two isomers has been proposed.

221. TIKOTKAR, N. L., BHIDE, G. V., PAI, N. R. & TILAK, B. D.: Synthesis of 3-desoxy-B-nor-6-aza-D-homoequilenin, *Tetrahedron*, **4** (1958), 420

Equimolecular quantities of *trans*-decaline-1 : 5-dione and phenylhydrazine are refluxed in acetic acid, and treated with boiling hydrochloric acid. From the acid-soluble fraction *cis*-4 : 11-2′ : 3′-(1′-oxocyclohexano)-1 : 2 : 3 : 4-tetrahydrocarbazolenine is isolated along with unchanged decaline-1 : 5-dione.

The acid-insoluble portion, when treated with Girard's reagent T, yields a mixture from which 3-desoxy-B-nor-6-aza-D-homoequilenin is separated by fractional crystallization. The non-ketonic acid-insoluble fraction yields 3 : 4 : 7 : 3 : 9 : 10-hexahydronaphtho-*bis*-(1 : 2-b, 5 : 6-b)-indole which is isolated through its picrate.

222. VERMA, J. P. & AGGARWAL, J. S.: Fries transformation of condensates of sebacic acid with phenols — 1 : 8-Dibenzoyl-octanes, *J. Indian chem. Soc.*, **36** (1959), 41

Diaryl esters have been obtained, in high yields, by condensing sebacic acid with several monohydric phenols in presence of sulphuric acid catalysts. In the case of α- and β-naphthols and resorcinol, the Fries transformation to the corresponding diketones takes place partly; with other dihydric phenols, the esterification results in the formation of resinous products. The diaryl esters, converted by the Fries transformation to the corresponding diketones, have further been reduced by the Clemmensen reduction.

E92 Alkaloids 547.94

223. ADITYACHAUDHURY, N. & CHATTERJEE, A.: Studies on the alkaloids of *Rauvolfia sumatrana* (Miq.) Jack and *Rauvolfia fruticosa* Burck: Part I, *J. sci. industr. Res.*, **18B** (1959), 130

The presence of ajmaline, rauwolscine, yohimbine, aricine, δ-yohimbine, serpentine and an unidentified base in the root of *R. sumatrana*, and of yohimbine, ajmaline, serpentine and an unidentified alkaloid in the stem bark of *R. fruticosa* has been revealed by paper chromatographic examination of the alcoholic extracts of the plants. Ajmaline has been isolated in pure and crystalline state from *R. sumatrana* in a yield of 0·0015 per cent.

E92Z Amino Acids 547.466

224. SEETHA N. GANAPATHY, KRISHNAMURTHY, K., SWAMINATHAN, M. & SUBRAHMANYAN, V.: Studies on the non-protein nitrogenous constituents of resting and germinated *Lathyrus sativus* seeds, *Ann. Biochem.*, **18** (1958), 157

The free amino acids in resting and germinated *Lathyrus sativus* seeds have been analysed. The free amino acids content is found to increase with increasing period of germination. Neither, β-amino-propionitrile nor γ-glutamyl-β-amino-propionitrile (the toxic factors present in *L. odoratus*) is found in the 50 per cent alcoholic extract of the seeds.

E982 Enzymes 577.15

225. KRISHNAMURTHY, K., TASKAR, P. K., RAMAKRISHNAN, T. N., RAJAGOPALAN, R., SWAMINATHAN, M. & SUBRAHMANYAN, V.: Effect of heat processing on the trypsin inhibitor and nutritive value of the proteins of soyabean, *Ann. Biochem.*, **18** (1958), 153

The effect of variation in the moisture content of soyabean on the destruction of the trypsin inhibitors and improvement of the nutritive value of the proteins by different methods of heat treatment has been investigated. A higher initial moisture content in the material favours rapid destruction of the trypsin inhibitors by heat.

E996 Sterols 547.92

226. KRISHNA MURTY, T. & SANKARA SUBRAMANIAN, S.: Isolation of ergosterol from *Roccella montagnei*, *J. sci. industr. Res.*, **18B** (1959), 91

The isolation and characterization of ergosterol from *Roccella montagnei* is described for the first time.

E998 Tannins 547.98

227. Banerjee, M. & Datta Banik, G. M., Microscopical study on the origin and location of tannins in plant bodies, *J. Indian Leath. Technol. Ass.*, **7** (1959), 77

Results of microscopical study on tannins in plants (*Phyllanthus emblica* and *Terminalia chebula*) are presented.

E9G *Biochemistry* 577.1

E9G : 4 Synthesis 577.1.07

228. Nath, M. C. & Belkhode, M. L.: Studies on the synthesis of glucose-cyclo-acetoacetate and biosynthesis of ascorbic acid in germinating *mung* bean (*Phaseolus radiatus*), *Proc. Soc. exp. Biol., N.Y.*, **99** (1958), 544

Studies on the synthesis of glucose-cyclo-acetoacetate (GCA) have shown that GCA is formed during the process of germination from glucose and acetoacetate. Thiamine and pantothenic acid accelerate the biosynthesis of GCA while their anti-vitamins depress such synthesis. GCA is found to be an intermidiary product in the biosynthesis of ascorbic acid during the process of germination of legumes.

E9(G : 33) Metabolism 577.12 : 576.8.095

229. Ghosh, S., Roy, (Miss) Dolly & Guha, B. C.: Effects of some folic acid analogues on the growth of *S. faecalis*, *L. arabinosus*, and *E. coli*, *Ann. Biochem.*, **18** (1958), 161

The synthesis of the thiosemicarbazone, semicarbazone and *p*-chloroanil derivatives of 2-amino-4-hydroxypteridine-6-aldehyde has been described and their effects on the growth of *Streptococcus faecalis*, *Lactobacillus arabinosus* and *Escherichia coli* discussed. The ultraviolet absorption spectra of these derivatives have also been studied.

All the three compounds show fairly strong inhibitory effect on *S. faecalis* and *E. coli*: but the effect on *L. arabinosus* is feeble. The compounds are competitive antagonists of both folic acid and folinic acid in regard to the growth of *S. faecalis*. Pteridine aldehyde derivatives are found to interfere with the biological transformation of folic acid to folinic acid.

F TECHNOLOGY 66

F : (E98) Polymerization 66.095.26

230. Brahme, P. H., Doraiswamy, L. K. & Pai, M. U.: A process study of the polymerization of vinyl chloride, *J. sci. industr. Res.*, **18B** (1959), 17

A process study has been made of the suspension polymerization of vinyl chloride in stainless steel tubes. The effect of catalyst/monomer ratio, temperature, polymerization period and suspending agent concentration has been investigated. The results obtained have been discussed in the light of those reported in literature.

F191 *Metallurgy* 669

F191 : (E21) Corrosion 669 : 620.193

231. Rajagopalan, K. S. & Ramaseshan, G.: Atmospheric corrosion at Karaikudi, *J. sci. industr. Res.*, **17B** (1958), 438

Experiments on atmospheric corrosion of steel and zinc at Karaikudi (South India) have shown that maximum corrosion is observed in May-July when the highest mean temperature and high humidities are prevalent, and diurnal variations in temperature bring about condensation of moisture in the early hours of the day. These results corroborate Compton's observations on tropical corrosion.

232. Rajagopalan, K. S. & Ramaseshan, G.: Relative corrodibility of zinc and steel in unpolluted atmospheres, *J. sci. industr. Res.*, **18B** (1959), 87

The relative corrodibility of zinc and steel in unpolluted atmospheres has been investigated. It is shown that in the absence of atmospheric pollution zinc corrodes faster than steel under conditions of high humidity and restricted circulation of air.

F191 : (E21-895) Corrosion Protection 669 : 620.197

233. Rajagopalan, K. S.: Potential studies on passivity to corrosion induced by pretreatment processes for metals: 1—Aluminium, *J. electrochem. Soc.*, **106** (1959), 113

Potential and polarization characteristics of aluminium subjected to various chemical oxidation processes have been reported. It is shown that a more negative initial electrode potential is recorded by the treated metal as compared to the untreated metal. The cathodic polarization curve of the treated metal is also much steeper. These results are satisfactorily explained by the application of the Glasstone, Laidler, and Eyring theory of electrode processes to the potential of a corroding metal.

234. RAJAGOPALAN, K. S.: Vapour phase corrosion inhibitors: Part II — Applications, *Bull. (India Sect.) electrochem. Soc.*, **7** (1958), 37

The mechanism by which vapour phase inhibitors give protection against corrosion and the application of vapour phase inhibitors are discussed.

235. RAJAGOPALAN, K. S. & BALAKRISHNAN, K.: Polarization studies on chromate-treated zinc, *Curr. Sci.*, **27** (1958), 387

The fundamental mechanism by which chromate treatment of zinc increases the corrosion resistance of the metal has been elucidated by polarization studies. The formation of the film on the metal has been shown to increase anodic as well as cathodic polarization of the metal surface. This is further enhanced by the presence of hexavalent chromium in the corroding medium.

F191 : (E26) Electroplating 669 : 621.357.7

236. ROY, D. L., UDUPA, H. V. K. & DEY, B. B.: Co-deposition of cobalt and tungsten from an aqueous ammoniacal citrate bath, *Proceedings of the Eighth Meeting of the International Committee of Electrochemical Thermodynamics and Kinetics* (Butterworths Scientific Publications, London), 1958, 469

Coherent semi-bright deposits of cobalt-tungsten alloys containing 60-66 per cent tungsten have been obtained with a current efficiency of up to 17 per cent using a bath completely free from sodium ions and having ammonium citrate, ammonium tungstate, cobalt sulphate and ammonia as constituents. Optimum temperature is found to be 60-90°C., *p*H and current density ranges being 7-8·5 and 10-15 amp./sq. cm. respectively. Deposits with highest percentage of tungsten are obtained by using a solution containing a total of 1 mole of cobalt and tungsten in the ratio 1: 19. The best results are obtained by using a solution containing 38-39 g./litre of citric acid, the required *p*H being maintained by the addition of ammonia. The influence of rotation of the cathode, and of interrupted d.c. on the current efficiency, tungsten content and appearance of the deposit has also been studied.

F191 : (E26)e *Apparatus* 669 : 621.357.7 : 620.1.05

237. SATYANARAYANA, S. & ROY, D. L.: Anodic stripping method for the determination of local thickness of electroplates: Part I — Design of electronic relay and its application to measurement of thickness of chromium electrodeposits, *J. sci. industr. Res.*, **18A** (1959), 75

A method based on anodic stripping has been developed for the determination of the local thickness of electrodeposits. An improved stripping cell of simple design, a simple low-cost and efficient stainless steel gasket, and an electronic relay circuit constructed for the purpose are described.

A small spot on the surface of the test piece is anodically dissolved using a large stainless steel cathode which is designed to serve as a container for the electrolyte. At the moment of completion of anodic dissolution of the electrodeposit, the change in the anode potential (due to the basis metal coming in contact with the electrolyte) is fed to a two-stage d.c. amplifier, and is made to actuate a relay which stops an electric timer and indicates the stripping time automatically. The stripping time is directly related to the thickness of the electrodeposit.

The accuracy of the technique and its applicability to the measurement of the thickness of thin chromium deposits on industrial basis metals like steel, nickel, brass and copper have been examined. The method is comparable with the microscopic method in its accuracy and is particularly suitable for measuring the thickness of very thin electrodeposits.

F191 : (E895) Passivation 669.004.4

238. INDRA SANGHI & SUBRAMANIAN, P. V. S.: Modern theories of passivation of metals, *J. industr. Engng*, **3** (1958), 34

Modern theories of passivation of metals have been reviewed and correlated with the basic nature of passivity. A simplified and generalized theory of passivation, based on the fundamental concept of formation of thin coherent oxide surface layers, is presented. The special passive nature of certain corrosion-resistant alloys like stainless steel is discussed.

F191, 172 : (E5-86) Manganese : Electrolytic Extraction 669.743.27

239. ARAVAMUTHAN, V. & GOPAL, S.: Electrowinning of manganese from low-grade manganese ores through production of manganese chloride, *Indian Min. J.*, **7** (1) (1959), 5

In the production of manganese chloride from low-grade manganese ores economy has been effected by (1) reacting the ore with hydrochloric acid and treating the resulting solution with a mixture of manganous oxide and magnetic oxide of iron obtained by the conventional roast reduction procedure, (2) reacting a mixture of manganous oxide and magnetic oxide of iron with byproduct ferric chloride in the aqueous phase, (3) reacting the mixture of manganous oxide and magnetic oxide of iron with byproduct ammonium chloride in aqueous phase and (4) chlorinating the low-grade manganese ores in the presence of cheap fuels like lignite and reacting a mixture of manganese and ferric chloride with a mixture of manganous oxide and magnetic oxide of iron in the aqueous phase. Chlorine is obtained as a valuable byproduct by employing sodium chloride solution as anolyte instead of the conventional manganese-ammonium chloride anolyte. Loss of ammonium chloride is thus eliminated.

F4414 Refractory Materials 666.76

240. Banerjee, J. C. & Nandi, D. N.: Studies on the refractoriness underload of firebricks, *Bull. cent. Glass Ceram. Res. Inst.*, **5** (1958), 149

Moderate and high heat duty firebricks have been tested for their various properties, particularly the refractoriness underload. It has been found that the moderate heat duty bricks have satisfactory properties unlike the high heat duty bricks. The properties of high heat duty firebricks made with the addition of bauxite is considerably improved if they are fired at a minimum temperature of 1350-1400°. The bauxite used should be of good quality and should be calcined at a high temperature (1500°) before it is added to the batch for making the bricks.

F53 *Food Technology* 664

F53(J37) Fruits 664.85

241. Bhatia, B. S., Siddappa, G. S. & Girdhari Lal: Tin content of some canned jackfruit products, *Indian J. agric. Sci.*, **28** (1958), 133

The tin content of canned jackfruit products stored at room temperature and 2-5°C. has been found to be considerably below the permitted limit of 285 mg./kg. At 37°C., the values are comparatively higher and in some samples the values exceed the limit. Negligible quantities of tin are dissolved in raw fruit canned in curried style.

242. Pruthi, J. S. & Girdhari Lal: Studies on passion fruit juice (*Passiflora edulis* Sims.) concentrate and powder, *Food Sci.*, **8** (1959), 1

Changes in the physico-chemical composition of passion fruit juice during vacuum concentration and dehydration have been discussed. With increasing concentration, there is a gradual increase in °Brix, acidity, viscosity and colour, there being no change in °Brix/acid ratio but gradual and slight fall in *p*H. The changes in viscosity are very pronounced after three-fold concentration. The ascorbic acid and carotene losses during vacuum concentration of the juice range from 6·0 to 10·1 per cent and 3·2 to 6·9 per cent respectively, the ascorbic acid content of the final concentrate (72°Brix) being 110·1-228·2 mg./100 g. and carotene 1·85-3·92 mg./100 g. depending upon the initial ascorbic acid and carotene content of the parent juice. The losses in ascorbic acid and carotene during vacuum drying range from 5·1 to 10·4 per cent and 2·5 to 4·7 per cent, the overall losses during vacuum concentration and dehydration in the two vitamins being of the order of 11·1-20·5 per cent and 5·1-9·0 per cent respectively.

F53(J37) : (E3) *Analysis* 664.85 : 543

243. Pruthi, J. S. & Girdhari Lal: Chemical composition of purple passion fruit (*Passiflora edulis* Sims.), *J. Sci. Fd Agric.*, **10** (1959), 188

Data on the chemical composition of purple passion fruit based on 504 analyses conducted during 1952-54 are presented. On an average, a purple passion fruit weighs an ounce and yields 36·8 per cent juice, 49·6 per cent peel or skin, and 13·6 per cent residue (comprising mostly seeds and coarse pulp). The juice is rich in easily digestible carbohydrates (14·4-21·9°Brix), ascorbic acid (21·9-69·9 mg./100 g.) and carotene (1073-1547 I.U. vitamin A/100 g.), and is a good source of nicotinic acid, riboflavin and mineral matter.

F53(J381) Rice 664 : 633.18

244. Desikachar, H. S. R., Majumder, S. K., Pingale, S. V. & Subrahmanyan, V.: Discolouration in rice: Some studies on its nature and effect on nutritive value, *Cereal Chem.*, **36** (1959), 78

The brownish discolouration of a commercial sample of rice has been investigated. The browning causes a slight reduction in the solubility of the protein and its growth-promoting value. Discolouration is induced in white polished rice within 48 hr by incubation of the rice containing 25 per cent moisture. The discolouration is found to be microbiological in origin.

F53 (J58) : (L573) Oilseeds : Nutrition 665.117 : 613.2

245. Krishnamurthy, K., Tasker, P. K., Indira, K., Rajagopalan, R., Swaminathan, M. & Subrahmanyan, V.: Nutritive value of the proteins of cocoanut meal and a low-cost protein food containing cocoanut and groundnut meals and Bengalgram (*Cicer arietinum*), *Food Sci.*, **7** (1958), 363

A low-cost protein food has been prepared by mixing roasted cocoanut flour, low-fat groundnut flour and roasted Bengalgram flour in the ratio 1: 2: 1. The biological value of the above protein food has been studied by the rat growth method; the results have shown that the proteins are of fairly high biological value.

F53 (J581) Peanuts 664 : 634.58

246. Subrahmanyan, V., Bhatia, D. S., Kalbag, S. S. & Subramanian, N.: Integrated processing of peanut for the separation of major constituents, *J. Amer. Oil Chem. Soc.*, **36** (1959), 66

A new process for the integrated utilization of peanut yielding good grade fat, protein and carbohydrate fractions is described. The results of the bench-scale experiments on the process using 100 lb. of material per batch have been presented. Nearly 30 per cent of the fat in the peanut is obtained by subjecting the groundnut kernels to the Skipin process. The residual paste is dispersed in water at optimum conditions of *p*H and the dispersion is clarified to get the carbohydrate meal (15·7 per cent moisture-free). The clarified dispersion is centrifuged to obtain another 12·0 per cent of the fat and the skimmed dispersion is acidified to isolate the protein (21·9 per cent moisture-free). The scope for increasing the yield of oil is discussed.

F53 (J93) Root Vegetables 664.83

247. Bhatia, B. S., Tucker, C. G. & Gooding, E. G. B.: Observations on the rate of dehydration of root vegetables in heated air, *J. Sci. Fd Agric.*, **10** (1959), 130

A four-stage counterflow hot air drying system with interstage heating has been developed for the dehydration of vegetables in strip or shred form and compared with a less complex system of fewer stages for drying strips of scalded carrot or potato. Satisfactory drying is possible in some cases in 6-7 hr even in a single-stage system, though not always with good thermal efficiency. The possibility of bacterial hazards associated with low initial drying temperatures has been discussed.

F53 (λ332) Fish 664.95

248. Visweswariah, K., Moorjani, M. N., Bhatia, D. S. & Subrahmanyan, V.: Effect of chlortetracycline (aureomycin) on the keeping quality of fresh-water fish under tropical conditions, *J. Fish. Res. Bd Can.*, **16** (1959), 1

Round and eviscerated fresh-water fish, when stored at 30°C. after a dip treatment for 1-6 hr in 25-100 p.p.m. of chlortetracycline, does not show any improvement in keeping quality as revealed by organoleptic and chemical evaluation tests. On the other hand, a dip treatment in a 5-p.p.m. chlortetracycline solution for 1 hr almost doubles the storage life of fillets from such fish.

F551 Coal Technology 662.66

249. Agrawal, D. P., Krishna, M. G. & Zaheer, S. H.: Briquetting of Hyderabad coals: Part III — Effect of moisture, mixing time and temperature, method of application of binder and particle size of coal on briquette strength, *J. sci. industr. Res.*, **18B** (1959), 33

The effect of varying the moisture content of the lime-tar mixture, temperature and duration of mixing, method of application of binder and particle size of coal on the strength of briquettes prepared from high-ash coal fines of a non-caking Hyderabad coal has been studied. The moisture content of the mixture, mixing temperature and duration of mixing have been found to be interrelated. A moisture content of 15-20 per cent in the mixture and a mixing temperature of 50-70°C. are considered optimum. A premixed binder gives better strength than one prepared *in situ*. Briquette mixture composed of 30 per cent each of $-10+20$ and $-20+40$ mesh B.S.S. fractions of coal gives the strongest briquettes. The presence of $-\frac{1}{8}$ in.$+10$ mesh and -60 mesh fractions is also essential to give a packing of maximum density.

F94 Oils & Fats 665.3

250. Kaparthia, R. & Chari, K. S.: Laboratory investigations on the extraction of oil from vegetable oil cakes with ethanol, *J. Amer. Oil Chem. Soc.*, **36** (1959), 81

Data are reported relating to the extraction of oil from mowrah cake, safflower cake, peanut cake and cottonseed cake in a 2-kg. batch extractor designed and built in the laboratory. The results indicate that excessive dilution of alcohol can be prevented by drying the cake to 1 per cent moisture. Residual oil content depends on the particle size of cake. Oil of better quality is obtained with 95·6 per cent alcohol than with 98·6 per cent alcohol. In the case of cottonseed meats, cooking followed by extraction gives oil of lighter colour in higher yields.

251. KAPARTHIA, R. & CHARI, K. S.: Solubilities of vegetable oils in aqueous ethanol and ethanol-hexane mixtures, *J. Amer. Oil Chem. Soc.*, **36** (1959), 77

The solubilities of vegetable oils in aqueous ethanol and ethanol-hexane mixtures have been determined using a specially designed apparatus. The solubility of vegetable oils in ethanol depends on the concentration of alcohol and temperature of the system. Addition of hexane increases the solubility and decreases the solubility temperature. The method is found to be more reliable than other methods.

F943 (J781, 178) : (L573) Cottonseed Oil : Nutrition 665.335.9 : 613.2

252. KUPPUSWAMY, S., NARAYANA RAO, M., SWAMINATHAN, M., BHATIA, D. S. & SUBRAHMANYAN, V.: Nutritive value of crude, refined and hydrogenated cottonseed oil, *Indian J. Physiol. all. Sci.*, **13** (1959), 6

The comparative nutritive values of crude, refined and hydrogenated cottonseed oil, groundnut oil and cow's ghee have been studied by observations on young albino rats fed on adequate synthetic diets containing the different fats at 10 per cent level. No significant difference in the growth-promoting value of the different fats is observed. The effect of the different fats on calcium and phosphorus metabolism has also been studied. The percentage of calcium utilized in the case of rats fed on diets containing cottonseed oil and cow's ghee is found to be slightly higher.

F(D39) : (E3) Plasters : Testing 666.8 : 66.017

253. SUDHIR SEN & SRIKANTAN, G. M.: Testing and evaluation of plaster of Paris, *Bull. cent. Glass Ceram. Res. Inst.*, **5** (1958), 142

Indigenous plasters of Paris along with some foreign plasters have been analysed and tested for their physical properties like normal consistency, setting time, crushing strength, density and water absorption. It has been found that the Indian plasters are made from inferior quality gypsum and are generally overcalcined. Differential thermal analysis has been employed to identify and determine the amount of impurities. The appearance of two peaks in the exothermic region indicates the formation of plaster of Paris in two ways: either by direct calcination of gypsum to the hemihydrate level or by the calcination of gypsum to soluble anhydride and subsequent re-absorption of moisture to form the hemihydrate.

F(J781, 178) Cottonseed 633.853.59

254. CHARI, K. S., HARWALKER, V. R., SALETORE, S. A. & ZAHEER, S. H.: Studies on indigenous cottonseed: Part VI — Delinting and hulling, *J. sci. industr. Res.*, **18A** (1959), 66

The yields of linters, hulls and meats from a commercial variety of cottonseed subject to ' mill-run ' cut and two-stage cut are compared; both the operations are followed by hulling and separation. The quality of linters under the two processing conditions has been assessed. The power consumed for delinting and hulling operations has been determined.

The yield of linters is higher in ' mill-run ' cut although the quality of linters obtained by the first cut in the two-stage cutting is superior. The power consumption for cutting linters by ' mill-run ' is lower than that for two-stage cutting.

F(M6) Glass Technology 666.1

255. SASTRY, B. S. R. & HUMMEL, F. A.: Studies in lithium oxide systems: III — Liquid immiscibility in the system Li_2O-B_2O_3-SiO_2, *J. Amer. ceram. Soc.*, **42** (1959), 81

Glasses within the ternary system Li_2O-B_2O_3-SiO_2 containing less than 25·6 per cent LiO_2 have been broadly classified into three groups according to their behaviour during cooling or heating. The first group, containing either more than 18 per cent Li_2O or less than 20 per cent SiO_2, yields clear glasses during slow or rapid cooling. The second group, containing approximately 5-15 per cent Li_2O and 26-90 per cent SiO_2, yields dense white opal glass during slow or rapid cooling. The third group cools to room temperature as clear glasses but develops opacity when reheated to temperatures between 550° and 880°C. It has been shown by electron microscopy that the opacity is due to liquid immiscibility, the matrix glass containing well-formed spheres of the dispersed phase. Some of the clear glasses of both groups consist of two immiscible phases. The size of the dispersed units in the spontaneous opal glasses and also the reheat opal glasses can be controlled by the variation of the reheat treatments. The phases are non-crystalline.

F(M97) Leather Technology 675

256. De, J. K., Roy Chowdhury, P. C. & Ghosh, S. K.: A method for the manufacture of artificial degras, *J. Indian Leath. Technol. Ass.*, **6** (1958), 172

The general properties and composition of natural degras have been discussed and a process for the preparation of degras by blowing air through fish oil and emulsifying has been described. The composition of natural and the artificial degras has been compared.

I BOTANY 58

I22 Algae 582.26

257. Iyengar, M. O. P.: A new type of lateral conjugation in *Spirogyra*, *J. Indian bot. Soc.*, **37** (1958), 387

A new type of lateral conjugation has been observed to be a normal phenomenon in a new species of *Spirogyra*, *S. Jogenis* sp. nov., collected from Jog Falls in the Mysore State, and in a new variety of the same species, var. *minor* var. nov., collected from Periyar in Travancore. During this direct lateral conjugation, the male gamete fuses directly with the female gamete by perforating the septum separating the two cells without the formation of any terminal conjugation tubes. The structure and the mode of life of the two algae appear to be well adapted to the conditions under which they are living.

258. Iyengar, M. O. P.: Three new species of *Temnogametum* from South India, *J. Indian bot. Soc.*, **37** (1958), 203

Three new species of *Temnogametum* W. and G. S. West have been recorded from South India, viz. *T. indicum*, *T. cylindrosporum* and *T. tirupatiense*. The structure and reproduction of these three new species are discussed.

I(J372) : 73 Citrus : Embryology 581.3 : 634.3

259. Ranga Swamy, N. S.: Morphogenetic response of *Citrus* ovules to growth adjuvants in culture, *Nature, Lond.*, **183** (1959), 735

The histoembryological responses of ovules of *Citrus microcarpa* to growth adjuvants like malt extract, coconut milk and tomato juice have been investigated. In all the media used the ovules have been found to become hypertrophied and irregular in outline, especially with malt extract. A periderm-like tissue is formed from the outer integument in almost all the treatments. Proembryos when excised and cultured on the basic medium show no growth, whereas in cultures of whole ovules the embryos exhibit normal growth and differentiation. The artificial induction of budding of proembryos obtained by exogenous application of growth factors such as tomato juice to whole ovules is significant as a possible source of securing identical progeny.

K ZOOLOGY 59

K81 Crustacea 595.3

260. Krishna Pillai, N.: Development of *Balanus amphitrite* with a note on the early larvae of *Chelonibia testudinaria*, *Bull. Res. Inst. Univ. Kerala, Ser. C*, **6** (1) (1958), 117

Adult specimens of *Balanus amphitrite* var. *communis* have been reared in the laboratory to obtain the larvae. In the normal environment with optimum salinity during the dry season, the liberation of the larvae is found to be maximum. During the rainy season, when the salinity is low, larvae are held in the brood pouch without liberation. Altogether six naupliar stages have been observed.

L MEDICINE 61

L : 3 Physiology 612

261. Friebel, H., Sommer, S. & Varadan, K. S.: Eine photoelektrische Methode zur Messung lokomotorischer Aktivitaet (A photoelectric method for recording locomotor activity), *Arzneim-Forch*, **8** (1959), 126

A photoelectric method for the registration of locomotor activity of small laboratory animals is described. Movements of a number of mice treated with drugs and control animals are recorded simultaneously in a single experiment. The method is especially suited for testing the relative potency of a series of drugs.

L : 4 Diseases 616

262. Zaidi, S. H., Srivastava, G. N., Chakravarti, R. N. & Singh, G. B.: Effect of arsenicals on 'spontaneous' and histamine induced eosinophilia in guinea-pigs, *Indian J. med. Sci.*, **13** (1959), 87

Studies on the etiology and pathogenesis of 'spontaneous eosinophilia' have been carried out. It has been found that eosinophilia of guinea-pigs is characterized by leucocytosis and high eosinophil count. The administration of acetylarsan in therapeutic doses to guinea-pigs suffering from 'spontaneous eosinophilia' causes depression of peripheral eosinophil granulopoiesis. Similar eosinophil depression is also observed in normal guinea-pigs. Eosinophilia is induced in guinea-pigs by repeated intraperitoneal injections of histamine dihydrochloride. A single injection of acetylarsan in therapeutic doses prior to histamine administration prevents the rise of both peripheral and bone marrow eosinophils. The mechanism of arsenic action in arresting the rise in eosinophil count has been discussed. *In vitro* studies of the action of Novarsinobillon show no effect on the number of leucocytes and eosinophils of blood within a period of 3 hr at 37°C.

L : 441 Poisons 615.9

263. Aravindakshan, I. & Braganca, B. M.: Oxidative phosphorylation in brain and liver mitochondria of animals injected with cobra venom, *Biochim. biophys. acta*, **31** (1959), 463

Minute quantities of heated cobra venom, which contains the toxic factor, have been shown to uncouple oxidative phosphorylations when added to mouse brain and liver mitochondria. In conformity with the results obtained from *in vitro* experiments, it has been shown that cobra venom can depress the P: O ratio in the brain and liver of animals injected with the toxin. Experimental evidence is presented to indicate that lecithinase A can penetrate the central nervous system in the intact animal, and it is suggested that the above inhibitions are produced by the direct action of lecithinase A on tissue phospholipids.

L : 573 : (F943) (J781, 178) Nutrition : Cottonseed Oil 613.2 : 665.335.9

264. Narayana Rao, M., Kuppuswamy, S., Swaminathan, M. & Subrahmanyan, V.: The digestibility of crude, refined and hydrogenated cottonseed oil, *Indian J. Physiol. all. Sci.*, **12** (1958), 143

The coefficient of digestibility of crude, refined and hydrogenated cottonseed oil, refined groundnut oil and cow's ghee has been determined with adult albino rats. The digestibility is found to be of the order of 95 per cent in all the cases. Studies on the *in vitro* digestibility of the different fats using castor and pancreatic lipases have shown that the rate of digestion of the different fats is almost the same.

L : 573 : (J781, 178) Nutrition : Cottonseed Flour 613.2 : 665.117

265. Krishnamurthy, K., Pantulu, A. J., Narayana Rao, M., Swaminathan, M., Raghunatha Rao, Y. K. & Subrahmanyan, V.: Supplementary value of low-fat cottonseed flour to poor vegetarian diets based on certain cereals, *Indian J. Physiol. all. Sci.*, **13** (1959), 20

The supplementary value of alcohol-extracted cottonseed flour to poor vegetarian diets based on wheat, *ragi*, rice and *jowar* has been investigated in rats. The biological value of the proteins of expeller-pressed and alcohol-extracted cottonseed flour has also been studied. The results show that the proteins of cottonseed flour are of fairly high biological value, and supplement to a marked extent those of wheat and *jowar*.

L(E9G986) Hormones 612.018 : 577.17

266. Kar, A. B., Karkun, J. N. & Das, R. P.: Effect of cadmium chloride on the response of the genital organs of gonadectomized male and female rats to homologous sex hormones, *Indian J. med. Res.*, **47** (1959), 20

Studies on the effect of cadmium chloride on the response of the genital organs of gonadectomized rats to homologous sex hormones have been carried out. The stimulatory action of testosterone propionate on the accessory genital organs of castrated rats is inhibited by cadmium chloride. The atrophy of these organs following castration is further attenuated by cadmium chloride. These effects are specific.

Cadmium chloride exerts a similar opposing action on estrogen as shown by the response of the uterus of ovariectomized rats. However, cadmium chloride *per se* has no effect on the uterus.

267. Roy, S. N., Karkun, J. N. & Mukerji, B.: Effect of graded doses of testosterone propionate on the adrenal cortex of prepubertally castrated male mice, *Indian J. med. Res.*, **47** (1959), 30

Treatment of prepubertally castrated mice with testosterone propionate has been found to cause disappearance of X-zones of the adrenal cortex at lower dose levels and to decrease the weight of the adrenals. In spite of total disappearance of the X-zones at higher dose levels of androgen, the weight of the adrenal is not diminished much due to marked hypertrophy of the fascicular zone, which is under control of pituitary ACTH.

268. ROY, S. N., KARKUN, J. N. & ROY, S. K.: Effect of graded doses of testosterone propionate on the adrenal cortex of young male rats, *Indian J. med. Res.*, **47** (1959), 25

Administration of testosterone propionate in graded doses to young male rats has been found to evoke varied changes in the weight, the histology, and the ascorbic acid and the total cholesterol contents of the adrenals.

U GEOGRAPHY 91

U28 Meteorology 551.5

269. TANTRY, B. A. P. & SRIVASTAVA, R. S.: Waveforms of atmospherics with superimposed pulses recorded with an automatic atmospherics recorder, *J. atmos. terr. Phys.*, **13** (1958), 38

An automatic atmospherics recorder has been constructed and used for studying the waveforms of atmospherics with superimposed pulses. Of the various types of superimposed pulses recorded, the ' stepped ' pulses from a lightning source superimposed on the waveform due to a different lightning discharge have been observed for the first time.

U296 Ionosphere 551.510.535

270. RAMACHANDRA RAO, B., BHAGIRATHA RAO, E. & RAMANA MURTY, Y. V.: Effect of magnetic activity on drifts of the F_2 region, *Nature, Lond.*, **183** (1959), 667

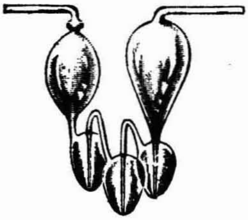
The nature and the extent of the dependence of drift velocity of the F_2 region on magnetic activity have been studied on the basis of F_2 drift speeds obtained by the spaced receiver method over a period of 16 months from February 1956 to May 1958 at Waltair (mag. lat. 9°30′N). The graph of the average drift speed against the magnetic K index shows a decrease of drift speed with increase of K index whereas at higher latitudes it has been established that F_2 drift speed increases with magnetic K index. The variation of NS and EW components with K index has been compared with the variation of the two components observed at high latitudes.

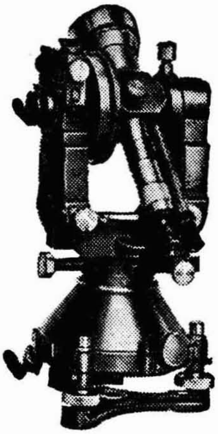
271. SATYANARAYANA, R., BAKHRU, K. & KHASTGIR, S. R.: Triple splitting of the F echoes, *J. atmos. terr. Phys.*, **13** (1959), 201

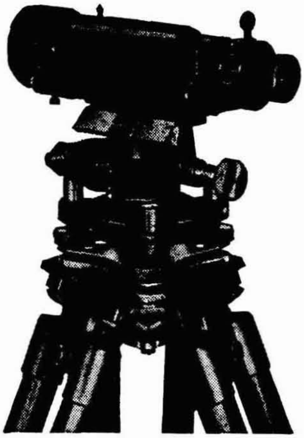
Polarization studies have been carried out on the triple F echoes, obtained by employing pulses of waves of frequency 3 Mc/s., at vertical incidence. The first component after the ground pulse is the normal extraordinary component having a right-handed sense of rotation, the second component is the normal ordinary component having a left-handed sense of rotation and the third component is the Z component having a left-handed sense of rotation. In addition to the coupling process (suggested by Eckersley and Rydbeck) between the ordinary and extraordinary waves, operative only in high geomagnetic latitudes, the partial reflection and transmission at the level of ionospheric reflection for the ordinary component have been considered as a plausible process leading to the Z component; the occasional presence of the Z component at low latitudes has been attributed to the partial reflection and transmission process. The view that the Z component actually corresponds to the left-handed ordinary component suffering reflection at the level corresponding to $p_o^2 = p^2 + p.p_H$ has been supported.

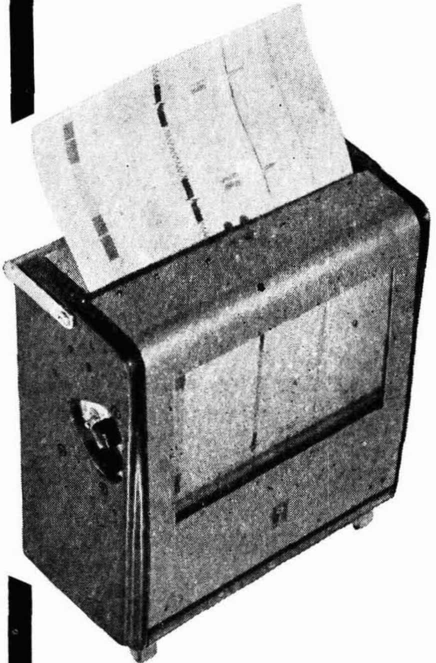
272. SHARMA, S. K.: Effect of thermal expansion of the F_2 region of the ionosphere on the absorption of high frequency radio waves, *J. sci. industr. Res.*, **18A** (1959), 17

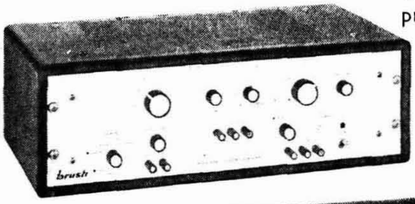
The total absorption of radio waves in the ionosphere has been measured by the pulse technique at vertical incidence at different hours of the day. For frequencies below the critical frequency of F_1 layer, only one maximum of total absorption is generally observed while at frequencies sufficiently above the critical frequency of the F_1 layer, two maxima, one before and the other after the local noon, are observed. The maximum observed before noon has been attributed to the thermal expansion of the F_2 region of the ionosphere under adiabatic equilibrium, the effect of which is more pronounced in the lower latitudes.







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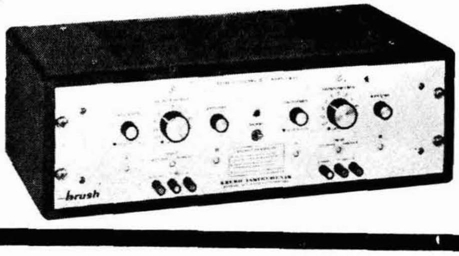
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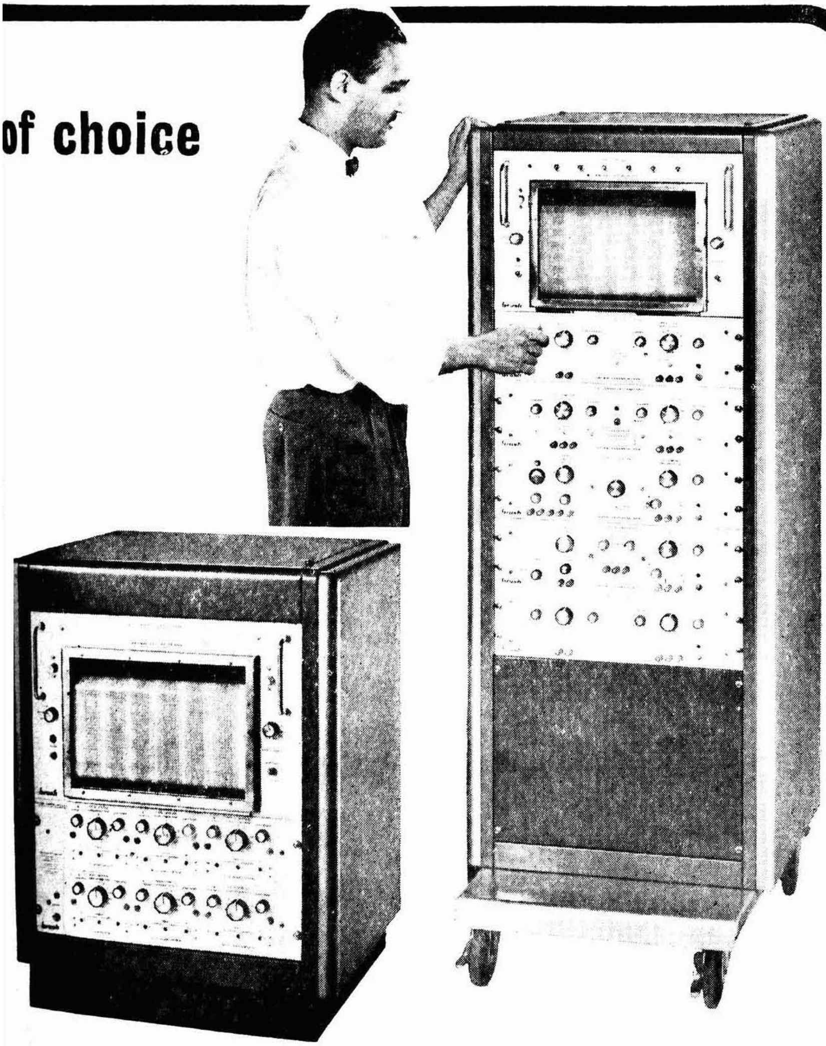


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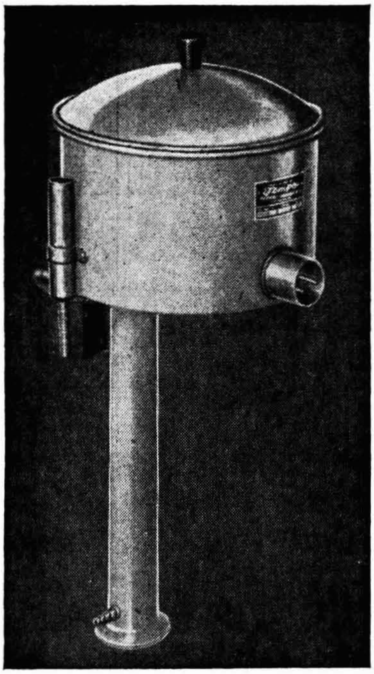

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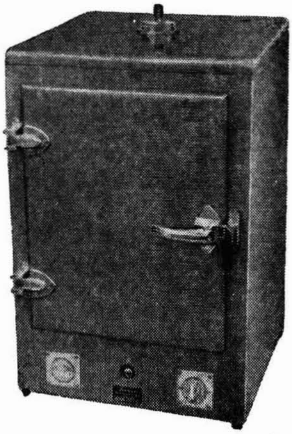

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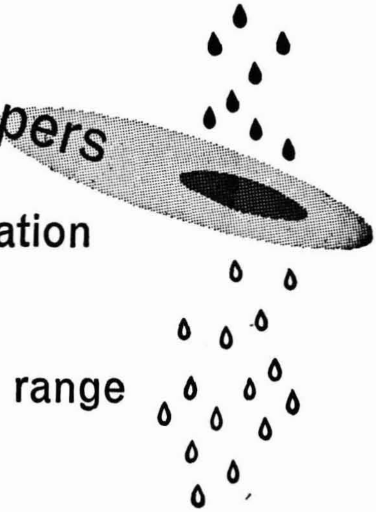

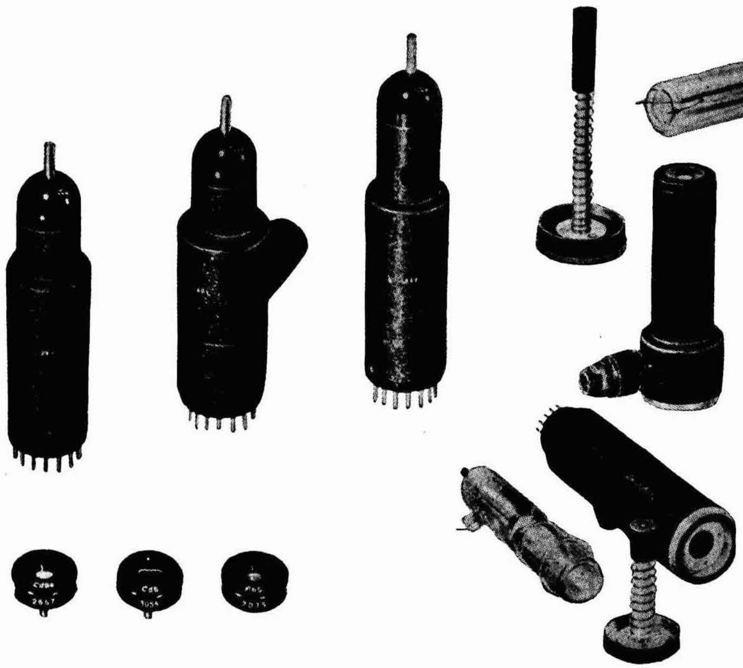

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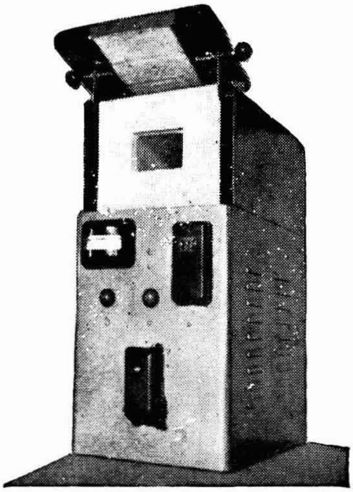

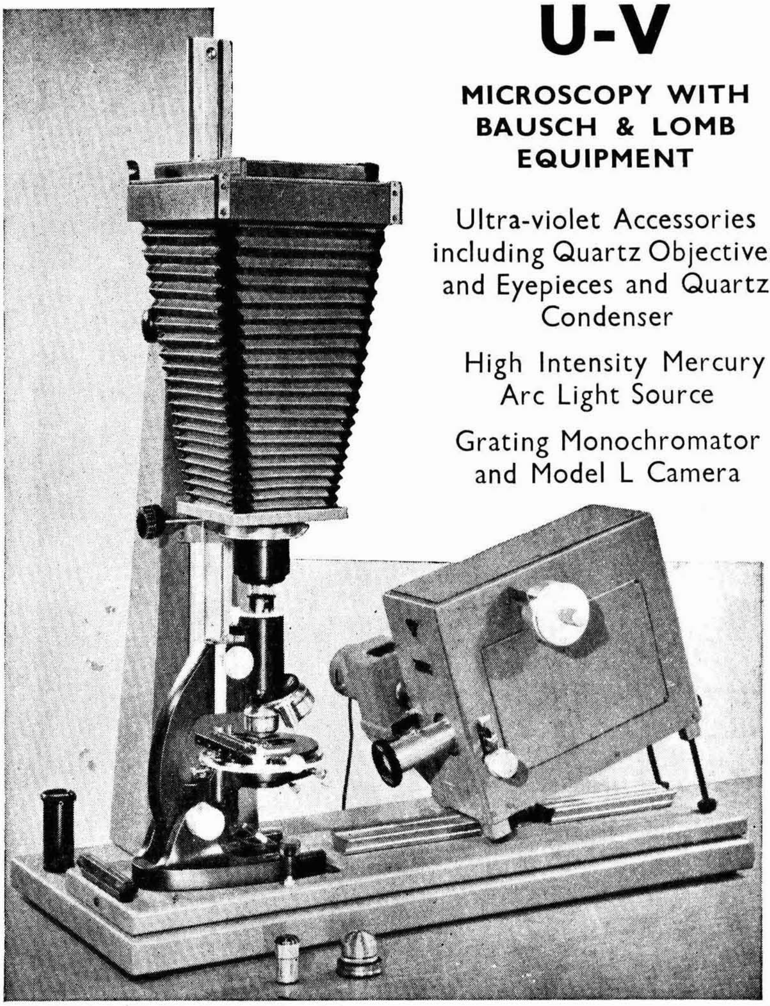

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