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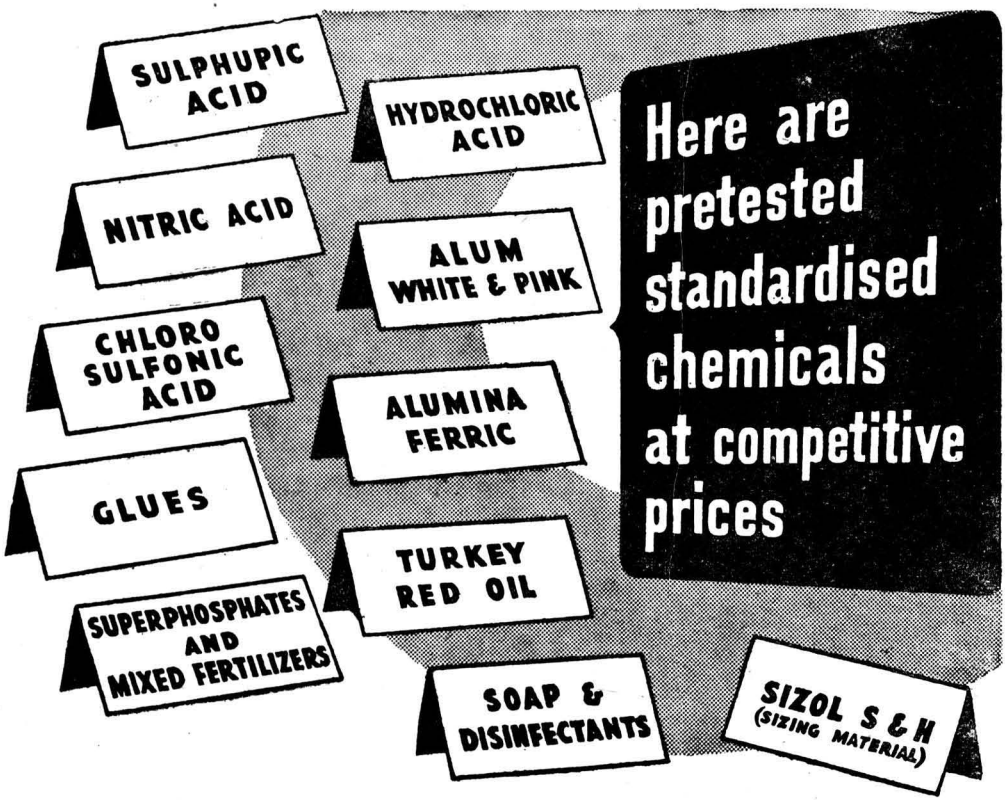

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Scientific Manpower

THE report of the Sub-committee of the Scientific Manpower Committee, (*Chairman*: Sir S. S. Bhatnagar), which was adopted at a meeting held on 22nd and 23rd August, will be read with considerable interest as the recommendations contained in it will form the basis of a plan for the "expansion of facilities for scientific and technical education, research and training" in this country. The Committee was faced at the outset with paucity of data for the quantitative and qualitative assessment of the manpower requirements, and its very first action was to suggest to the Government that a team of special officers should be appointed to collect relevant statistical information. Ten officers have since been appointed to carry out the survey, and before long the Scientific Manpower Committee will have before it all the information required for formulating detailed proposals for augmenting the educational and training facilities in this country for meeting all the personnel requirements.

That there is an urgent need for expanding the output of trained personnel is well recognised. Scientific and technical education has been neglected in the past. There is a tremendous backlog of unfilled needs in the country; the efforts to increase the efficiency and output of industry, and to develop health, education and social services are creating a demand for men with high professional and administrative qualifications, and unless the demand is met, economic and social progress may be seriously impeded. This was recognised some years ago when it was repeatedly stressed that the paucity of trained personnel is the main "bottleneck in the execution of the many post-war plans for the development of natural resourses and social services." To remedy the shortage, a few hundred students selected on the basis of their academic qualifications were sent overseas for specialized studies, but uptil now a planned programme for the training of scientific personnel was not attempted. The appointment of the Scientific Manpower Committee in April last is the first positive attempt to take stock of the situation and to concert measures for the training of scientific and technical personnel in a really satisfactory manner.

Output and Standards of Universities Must be Raised.

The report of the Sub-committee makes a strong plea for the expansion of universities and educational institutions. "A substantial increase in the facilities for education in general science upto the I. Sc. and B. Sc. standards is clearly an immediate necessity, so that the output from these courses may be adequate in quantity, as well as in qualily, to feed the professional and post-graduate institutions, which it will be necessary to improve, expand and multiply to meet India's immediate and future needs for scientists, technologists, engineers and medical men", says the report, and to meet the increased demand, the "running of double shifts" in collegiate institutions is recommended. Although the

Committee does not "whole-heartedly" support the measure, it, nevertheless, recommends its adoption "in such institutions where there is a certain amount of spare equipment, provided a completely new set of staff is engaged for lectures and laboratory work in the second shift." There are ample human resources in this country not only for raising the number of scientific workers many-fold but also for simultaneously raising the standards of scientific and technical services. In the discovery and education of research personnel, who constitute the backbone of scientific services, the responsibility of the universities is supreme. It is from the rank and file of research workers that emerge gifted men who are capable of inspiring and leading research teams and who have the ability to found new schools of research. Skilled laboratory assistants and workshop technicians, who constitute the auxiliary service in the carrying out of experimental research, are drawn from those who have passed through the secondary schools and I. Sc. courses. A stepping up in the output of these institutions is urgently called for. The greatest and most persistant obstacle to the expansion of educational institutions in India is the inadequacy of trained teachers, and what is needed, as an immediate measure, is a vigorous recruiting compaign for a large number of science teachers with adequate qualifications. The quality and standard of scientific and technical institutions will be determined largely by the standard and efficiency of university education, and a sustained effort for raising the standards of instruction is essential in the interests of progress. Men are far more important than equipment or buildings in the field of education and research. The tendency in the United Kingdom and in the United States of America is to step up the standard of academic discipline in the universities and to impart a sound and liberal education designed to inculcate in the Student breadth of vision and critical faculties so essential for his success as a research worker. No narrow and materialistic view of university education can be permitted. The proposals of the Committee for increasing the output of students will have to be carefully examined in the light of the ideals and objectives of university education.

The primary requirement, then, for the expansion of university education is the recruitment of teachers. In view of the many demands on the available manpower resources, which are admittedly limited, there is a manifest need for preparing an order of priorities, In such a list of allocations the top place must be assigned to teaching and fundamental research. During the past few years, a number of young men of high academic distinction have been sent to the United kingdom and in the United States of America for higher studies. As many among them as possess the requisite aptitudes and qualifications should be assigned to universities for teaching and research. The problems of staff requirements and recruitment should be taken up by the Inter-University Board, which provides a forum for the discussion of problems affecting higher education in India at all levels and in all fields, in consultation with the Scientific Manpower Committee.

The report emphasizes the need for making the teaching profession attractive to qualified and competent scientists. In the competition for the services of able men, the universities are not so well placed as industry or Government departments, because from the point of view of emoluments the academic career offers little attraction. It should be realised, both by Government departments and industry, that in their own interests, the teaching profession should be made sufficiently lucrative to attract men of the highest calibre and character.

In any scheme of university expansion, and the parallel secondary school expansion, a point which needs consideration is the quality of the student. There should be no bar, economic or other, to any young person with the requisite aptitude and ability to take advantage of the increased facilities for scientific education. A national stock-taking is called for, and the pool from which the nation's supply of scientists, technologists, professional men,administrators and scholars are drawn, must be greatly widened.

Optimum Utilization of Available Manpower

Any consideration of the expansion of scientific manpower involves also the question of the utilization of existing manpower. The Committee has addressed itself to this problem. The report points out: "A good proportion of the available scientific manpower in this country has not been made use of in a fruitful way, in asmuchas owing to the existing conditions of recruitment to services

and other factors, many qualified men have not had suitable opportunities of contributing all they could in the sphere of scientific activity. The prevention of this kind of wastage or drift of scientific talent should engage our immediate attention." The Committee has set itself the task of collecting information on the wastage and drift of scientific talent as a preliminary to the assignment of trained personnel to positions to which they are fitted by their qualifications.

It is essential to remember that without the optimum utilization of the available scientific manpower it may be difficult to achieve the expansion contemplated. The need for preparing a list of priorities in the allocation of manpower has been already stressed. A second point to be considered is the provision of skilled assistance to research workers and university teachers to free them from routine duties and to permit them to devote their time wholly to the special problems demanding their attention. The trainiug of skilled technicians to help research workers engaged in experimental research has not received sufficient consideration in this country, and this is an aspect to which the Committee can usefully direct its attention.

Research Aids to Industry

The disciplines necessary for the development of industries demands consideration. Industries in India, with notable exceptions, are not research minded. This position must be frankly recognised. A very large number of industries in India come under the category of 'small-scale' industries and they do not have the means to finance research. There is an urgent need to awaken them to a full awareness of what science can do to raise their efficiency and to improve the quality of their products. This is a task which has to be tackled in the interests of national progress. The formation of Development Councils or of Technical Clinics, as in America, whose main function will be to raise the level of intelligence applied to techniques and processes in industry, is a measure that deserves consideration. Whatever be the organization that may be set up to aid industry, it is necessary to ensure that the importance of science is appreciated at the managerial level. The manufacturing concerns should have on their staff, officers who can assimilate, interpret and apply scientific knowledge as it becomes available, and the industry must be rendered receptive to scientific knowledge. The need for a large number of trained information officers and for scientific information services is apparent. The Indian Delegation to the Empire Scientific Conference (1946) emphasised this much-neglected aid to industry but there is hardly a mention of it in the report. It should be emphasised that for a scientific manpower policy to be effective, the public must be educated to appreciate the methods of science and the benefits that accrue by the application of knowledge gleaned through research and inquiry.

The training of specialists for "development work" both in industry and in agriculture is a requirement which demands the special attention of the Committee. The gap between laboratory research and application to factory and farm practice, which is very wide today, should be closed, and this requires the services of trained workers versed in the methods and techiques of "operational research". Also, industry requires for its development scientific iustruments and capital goods designed and fabricated according to its needs. There has been a sizeable activity in the manufacture of instruments and of plant and machinery in this country, but the attention given to the development of these industries has been altogether insignificant. The skills necessary for the consolidation and expansion of these two basic industries have to be promoted for ensuring industial progress.

Enough has been said to indicate the diversity and importance of the problems that come under the purview of the Scientific Manpower Committee. The cultivation of knowledge both for its own sake and for the material benefit of mankind requires the services of men and women of high ability, integrity and character, and when it is realised that such men and women are far more important than money or equipment, the importance of the labours of the Manpower Committee which is engaged in formulating measures for discovering talents and training them for national service, becomes apparent. On the ability and skill of men, and the conditions provided to them for their labours, depend the efficient and wise use of the abundant material resources of the country; on the gifted men and women of India lies the responsibility for blazing new paths into the unknown and raising the prestige and status of science in this country.

A World-wide Assemblage of Statisticians

THE first opportunity in nearly ten years for the leading statisticians of the world to get together and plan their role in international affairs, was presented recently in Washington. D.C. The twenty-fifth session of the *International Statistical Institute* convened at the invitation of the Government of the United States was also held concurrently (Sept. 6-18, 1947). Meeting at the same time and place in related sessions was the first session of the *Inter-American Statistical Institute*, the *Econometric Society* and a group which proposes to organize an *International Income Conference*. During these sessions, and inter-meshed with them, was the *World Statistical Congress*, convened by the United Nations and consisting of a limited programme of general meetings designed to focus attention upon the statistical needs and activities of the United Nations, the specialized agencies and non-governmental organizations.

Statistical groups of official international bodies such as the *Statistical and Population Commission* of the United Nations, the *Conference of Labour Statisticians* of the *International Labour Organization*, and other similar organizations also held meetings during this period so that participating members had ample opportunities to attend and participate in these sessions.

The *World Statistical Congress*, which was recommended by the *United Nations Statistical Commission* and endorsed by the *Population Commission*, afforded an opportunity for statistical officials of the United Nations and Specialized Agencies (a) to ascertain at first hand the statistical problems-, both general and specific-, which a world-wide representative assembly of statisticians would wish the Statistical Commission and the Statistical Office of the United Nations to consider during the next few years; (b) to explain to the statisticians of various countries the programme of work on which the Statistical Commission, the Population Commission, the Statistical Office of the United Nations, the Specialized Agencies and the non—Governmental organizations are at present engaged or are contemplating; and (c) to explore and develop the means by which the statistical activities of the specialized agencies, quasi-governmental and non-governmental organizations might be related to each other and to those of the United Nations in fostering international co-operation in the improvement of statistics.

Included in the programme were discussions on the present status of international income data with an outline of the United Nations Organization in the field, and the development of the international standards and of comparability of statistical data in international trade, balance of payments and individual classifications. Dr. V. K. R. V. Rao of Delhi University was the official Indian delegate to these discussions.

Population problems occupied a large part of the discussions. Besides evaluation of the methods of measuring net fertility and factors of urban growth, recent demographic trends in India, morbidity statistics and sampling of human populations and arrangements for the forthcoming world census of agriculture and population was also considered. Professor K. B. Madhava was the official Indian representative on these conferences.

Statistical organizations, Governmental and private, constitute the foundation of all recent advances in the use of statistics in business, industry and administration. A heavy agenda on this subject was included in the programme and Mr. S. Subramaniam, Statistician to the Economic Adviser to the Government was India's representative for this part of the World Statistical Congress.

Sampling theories, quality control and sequential analysis, evaluation of recent developments in sampling procedures in different countries, factor analysis, public opinion research and statistical training methods and materials, were among the subjects in which Dr. P. V. Sukhatme, Statistical Adviser to the *Indian Council of Agricultnral Research*, and Mr. R. C. Bose, now visiting lecturer in Statistics in America participated.

Prof. P. C. Mahalanobis F. R. S., permanent representative of India on the *Statistical Commission* of the United Nations Organization was the leader of the Indian delegation.

Such topics as the future of international statistical societies, the role and work of specialized agencies in international statistics and ratification of organization plans, claimed his special attention.

The *American Statistical Association* sponsored an exhibition in which were displayed examples of the latest technical developments in equipment including adding and calculating machines, book keeping and accounting machines, visible records filing systems, metered mailing systems, duplicating and mimeographing machines, dictating and recording equipment, computing devices, statistical typewriters and micro-film. Recent statistical research monographs and textbooks, as well as other scientific publications of interest to participants, were exhibited by leading American publishers. The *Association* also arranged a non-commercial graphics exhibition the purpose of which was to display typical methods of visual presentation of statistical data used by American business, industry and government. The U. S. Government Printing Office had on display a booth at which sample copies and lists of official U.S. Government publications were available to delegates and guests of the conferences.

On Monday, September 8, the members of the conferences were greeted by the President of the United States in the Garden of the White House, and in the afternoon, the Honourable Trygve Lie, Secretary General of the United Nations, and the Honourable W. Averell Harriman, Secretary of Commerce of the United States, addressed the members. This was followed by an official reception arranged by the Government of the United States.

Other events to which delegates were invited include receptions arranged by the United Nations, Pan American Union, and the *American Statistical Association;* a visit to Dumbarton Oaks; a Sunday excursion into the nearby countryside to view model American farms; and a farewell dinner arranged by the Joint Arrangements Committee.— (Courtesy, Prof. K. B. Madhava)

A World Standard for Screw Threads

By KAARE HEIBERG
(Norwegian Standards Association, (Oslo.)

THE resumption on a broad basis of the international standardization work and the creation of the *International Organisation for Standardization (ISO)* has again made urgent the question of a world standard for screw threads.

When we know that the difference between the American Sellers'— and the British Whitworth system raised the war expences by more than $ 1,000,000,000,— one milliard dollars—, and when we furthermore take into consideration that the metric SI-system (Systeme International) to a great extent is used on the continent of Europe, it is not astonishing that the task to get these 3 systems replaced by a single world system, at the international conference on standardization in London in October 1946, was regarded as being probably the most important task for the newborn *ISO*.

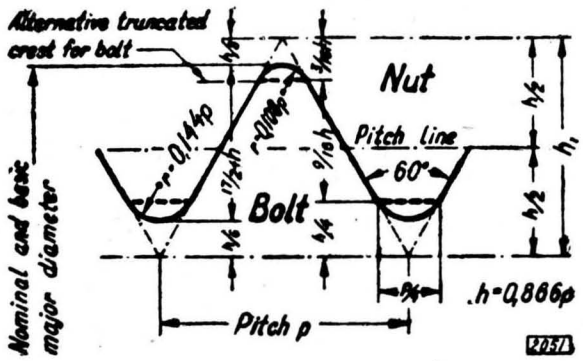
But how can this problem be solved? Is it possible to get one of the present 3 systems recognised, as it is, as a single world system? Or is there any possibility by minor changes in two of the present systems to overcome the difficulties caused by the difference between the two of them, and leave out the third? Or is the only solution to the problem to set up an entirely new system?

It is evident that the solution of the task at hand will encounter difficulties not only of technical, economic and psycological nature, but also of prestige, of which the latter, by sad experience, is not the least difficult to solve in every, and particularly in international, standardization.

If this is taken into consideration, and as two of the present systems are based entirely on inch measures and one of them is metric, it should seem almost inconceivable to agree on only one of them, unless this particular one is not only superior to the other ones in

a technical respect, but will also meet completely with the requirements which will have to be expected of a screwthread system of to-day and to-morrow.

But is this the case with any of our present systems ? The answer to this question will unconditionally have to be: No ! Each of the three systems have advantages which the other systems do not have, but they also have disadvantages that could, no doubt, be corrected by minor changes. This becomes evident whenever there is a question of demanding somewhat more from the screw threads, for instance, that they shall stand up against vibrations or dynamic stresses—,



British Standard Unified Form
Fig. 1—Profile of ABC System

Table I.—*Theoretical Figures*

	Diameter		Standard Threads			Fine threads A		
			Threads	Pitch		Threads	Pitch	
	d		per. 1"	p		per. 1"	p	
No.	inch	mm.	n	inch	mm.	n	inch	mm.
1·6	0· 16	4·064	28	0·036	0·907	40	0·025	0·635
1·8	0 18	4·572	26 ½	0·038	0·959	37 ½	0·027	0·677
2·0	0· 20	5·080	25	0·040	1·016	35 ½	0·028	0·715
2·2	0·224	5·670	23 ½	0·043	1·081	33 ½	0·030	0·758
2·5	0· 25	6·350	22 ½	0·044	1·129	31 ½	0·032	0·806
2·8	0· 28	7·112	21	0·048	1·210	30	0·033	0·847
3·2	0·315	8·001	20	0·050	1·270	28	0·036	0·907
3·6	0·355	9·017	19	0·053	1·337	26 ½	0·038	0·959
4·0	0· 40	10·160	18	0·056	1·408	25	0·040	1·016
4·5	0· 45	11·430	17	0·059	1·494	23 ½	0·043	1·081
5·0	0· 50	12·700	16	0·063	1·588	22 ½	0·044	1·129
5·5	0· 56	14·224	15	0·067	1·693	21	0·048	1·210
6·0	0· 63	16·002	14	0·071	1·814	20	0·050	1·270
7·0	0· 71	18·034	13	0·077	1·954	19	0·053	1·337
8·0	0· 80	20·320	12 ½	0·080	2·032	18	0·056	1·408
9·0	0· 90	22·860	12	0·083	2·117	17	0·059	1·494
10·0	1· 00	25·400	11	0·091	2·309	16	0·063	1·588
11·0	1· 12	28·448	10 ½	0·095	2·419	15	0·067	1·693
12·0	1· 25	31·750	10	0·100	2·540	14	0·071	1·814
14·0	1· 40	35·560	9 ½	0·105	2·674	13	0·077	1·954
16·0	1· 60	40·640	9	0·111	2·822	12 ½	0·080	2·032
18·0	1· 80	45·720	8 ½	0·118	2·988	12	0·083	2·117
20·0	2· 00	50·800	8	0·125	3·175	11	0·091	2·309
22·0	2· 24	56·896	7 ½	0·133	3·387	10 ½	0·095	2·419
25·0	2· 50	63·500	7	0·143	3·629	10	0·100	2·540
28·0	2· 80	71·120	7	0·143	3·629	9 ½	0·105	2·674
32·0	3· 15	80·010	6 ½	0·154	3·908	9	0·111	2·822
36·0	2· 55	90·170	6	0·167	4·233	8 ½	0·118	2·988
40·0	4· 00	101·600	5 ½	0·182	4·618	8	0·125	3·175
45·0	4· 50	114·300	5 ½	0·182	4·618	7 ½	0·133	3·387
50·0	5· 00	127·000	5	0·200	5·080	7	0·143	3·629
56·0	5· 60	142·240	4 ¾	0·210	5·347	7	0 143	3·629
63·0	6· 30	160·020	4 ½	0·222	5·644	6 ½	0·154	3·908
71·0	7· 10	180·340	4 ¼	0·235	5·976	6	0·167	4·233
80·0	8· 00	203·200	4	0·250	6·350	5 ½	0·182	4·618
Ra 20	R20			R40			R40	

than we do normally, as no experienced designer would in such cases dare to use any of the three systems without at least small changes.

The Whitworth system with its rounded crest and root is superior to the two other systems for threads exposed to dynamic stresses. It has, however, like the Sellers' system the severe disadvantage of too great a pitch for the smaller and the larger diameteres. For the smaller diameteres the thread has insufficiant selfbarring, and for the larger diameteres the cutting or the rolling of the threads will require unproportional costs when made with modern machine tools.

As far as the pitches are concerned, the SI-system is better than the Sellers' and the Whitworth systems for the smaller diameters, while the SI-pitches are also too large, and therefore unsatisfactory, for the larger diameters.

While it should not, in countries which are otherwise using the metric system, be difficult to have bolts and nuts made with the ordinary inch pitches as most of their machine tools are built to be able to manufacture the same, it will be very difficult to have threads with metric pitches made in countries which normally use the inch system.

During the last war an American-British Canadian co-operation was taken up in order to create an "ABC" system so made that nuts made either to the old Sellers' or Whitworth system would suit a screw made to the new system and *vice versa*. This was to be done by using the 60° angle of the Sellers' (and the metric SI) spstem instead of 55° as

Table I.—(ctd.) *Theoretical Figures*

	Diameter d		Fine Thread B			Fine Thread C		
			Threads per. 1"	Pitch p		Threads per. 1"	Pitch p	
No.	inch	mm.	n	inch	mm.	n	inch	mm.
1·6	0· 16	4·064						
1·8	0· 18	4·572						
2·0	0· 20	5·080						
2·2	0·224	5·670						
2·5	0· 25	6·350						
2·8	0· 28	7·112						
3·2	0·315	8·001	40	0·025	0·635			
3·6	0·355	9·017	37 ½	0·027	0·677			
4·0	0· 40	10·160	35 ½	0·028	0·715			
4·5	0· 45	11·430	33 ½	0·030	0·758			
5·0	0· 50	12·700	31 ½	0·032	0·806			
5·5	0· 56	14·224	30	0·033	0·847			
6·0	0· 63	16·002	28	0·036	0·907	40	0·025	0·633
7·0	0· 71	18·034	26 ½	0·038	0·959	37 ½	0·027	0·677
8·0	0· 8	20·320	25	0·040	1·016	35 ½	0·028	0·715
9·0	0· 9	22·860	23 ½	0·043	1·081	33 ½	0·030	0·758
10·0	1· 0	25·400	22 ½	0·044	1·129	31 ½	0·032	0·806
11·0	1· 12	28·448	21	0·048	1·210	30	0·033	0·847
12·0	1· 25	31·750	20	0·050	1·270	28	0·036	0·907
14·0	1· 40	35·560	19	0·053	1·337	26 ½	0·038	0·959
16·0	1· 6	40·640	18	0·056	1·408	25	0·040	1·016
18·0	1· 8	45·720	17	0·059	1·494	23 ½	0·043	1·081
20·0	2· 0	50·800	16	0·063	1·588	22 ½	0·044	1·129
22·0	2· 24	56·896	15	0·067	1·693	21	0·048	1·210
25·0	2· 50	63·500	14	0·071	1·814	20	0·050	1·270
28·0	2· 80	71·120	13	0·077	1·954	19	0·053	1·337
32·0	3· 15	80·010	12 ½	0·080	2·032	18	0·056	1·408
36·0	3· 55	90·170	12	0·083	2·117	17	0·059	1·494
40·0	4· 00	101·600	11	0·091	2·309	16	0·063	1·588
45·0	4· 5	114·300	10 ½	0·095	2·419	15	0·067	1·693
50·0	5· 0	127·000	10	0·100	2·540	14	0·071	1·814
56·0	5· 6	142·240	9 ½	0·105	2·674	13	0·077	1·954
63·0	6· 3	160·020	9	0·111	2·822	12 ½	0·080	2·032
71·0	7· 1	180·340	8 ½	0·118	2·988	12	0·083	2·117
80·0	8· 0	203·200	8	0·125	3·175	11	0·091	2·309
Ra20	R20			R40			R40	

in the Whitworth system, by rounding off the root of the thread in the nuts as in the Whitworth system, and by making the crest of the thread flat as in the Sellers' and the SI systems. For the 1/2″ thread, for which the Whitworth and the Sellers' systems have different pitches, the smaller pitch (13 threads per inch) of the Sellers' system should be taken over. The profile of this ABC-is shown in Fig. 1.

We have no reason to doubt that the ABC system can be introduced in Canada, the United Kingdom and U.S.A. Its possibilities as a world system will, however, be very small, if any at all. This system will only solve some of our present difficulties, as many of the disadvantages of the Sellers' and the Whitworth system will be found in the new one. And it is not reasonable to request from the metric countries, which have hitherto exclusively used either the Whitworth or the SI system or have used these systems side by side, that they shall change over to a new system, and charge themselves with the heavy costs and inconveniences in connection therewith, *unless they will in return get a really up to-date system.*

It may be mentioned in this connection, that countries which are particularly interested in the SI system, have already co-operated on a modified SI system, which under maintenance of full interchangeability with the old SI system will correct one of the most severe disadvantages of this system, namely its flat root. A draft proposal for a revised SI system was in fact considered by national standard bodies just before the outbreak of World War II.

Table II.—*Practical Figures*

	Diameter d		Standard Threads			Fine Threads A		
			Threads per 1″	Pitch p		Threads per. 1″	Pitch p	
No.	inch	mm.	n	inch	mm.	n	inch	mm.
1.6	0. 16	4.064	28	0.036	0.907	40	0.025	0.635
1.8	0. 18	4.572	26	0.038	0.977	36	0.028	0.756
2.0	0. 20	5.080	26	0.038	0.977	36	0.028	0.756
2.2	0.224	5.670	24	0.042	1.058	32	0.031	0.794
2.5	0. 25	6.350	22	0.045	1.155	32	0.031	0.794
2.8	0. 28	7.112	20	0.050	1.270	28	0.036	0.907
3.2	0.315	8.001	20	0.050	1.270	28	0.036	0.907
3.6	0,355	9.017	18	0.056	1·408	26	0.038	0 977
4.0	0. 40	10.160	18	0.056	1.408	26	0.038	0.977
4.5	0. 45	11.430	16	0.063	1.588	24	0.042	1.058
5.0	0. 50	12.700	16	0.063	1.588	22	0.045	1.155
5.5	0. 56	14.224	15	0.067	1.693	20	0.050	1.270
6.0	0. 63	16.002	14	0.071	1.814	20	0.050	1.270
7.0	0. 71	18.034	13	0.077	1.954	18	0.056	1.408
8.0	0. 8	20.320	13	0.077	1.954	18	0.056	1.408
9.0	0. 9	22.860	12	0.083	2.117	16	0.063	1.588
10.0	1. 0	25.400	11	0.091	2.309	16	0.063	1.588
11.0	1. 12	28.448	10	0.100	2.540	15	0.067	1.693
12.0	1. 25	31.750	10	0.100	2.540	14	0.071	1.814
14.0	1. 40	35.560	9	0.111	2.822	13	0.077	1.954
16.0	1. 6	40.640	9	0.111	2.822	13	0.077	1.954
18.0	1. 8	45.720	8	0.125	3.175	12	0.083	2.117
20.0	2. 0	50.800	8	0.125	3.175	11	0.091	2.309
22.0	2. 24	56.896	7	0.143	3.629	10	0.100	2.540
25.0	2. 05	63.500	7	0.143	3.629	10	0.100	2.540
28.0	2. 80	71.120	7	0.143	3.629	9	0.111	2.822
32.0	3. 15	80.010	6	0.167	4.233	9	0.111	2.822
36.0	3. 55	90.170	6	0.167	4.233	8	0.125	3.175
40.0	4. 00	101.600	6	0.167	4·233	8	0.125	3.175
45.0	4. 5	114.300	5	0.200	5·080	7	0.143	3.629
50.0	5. 0	127.000	5	0.200	5·080	7	0.143	3.629
56.0	5. 6	142.240	5	0.200	5·080	7	0.143	3.629
63.0	6. 3	160.020	4½	0.220	5·644	6	0.167	4.233
71.0	7. 1	180.340	4	0.250	6·350	6	0.167	4.233
80.0	8. 0	203.200	4	0.250	6·350	6	0.167	4.233

The inch—diameters and the number of threads per. inch are to be considered as fundamental, while the corresponding metric figures are derived therefrom.

As the solution of the problem of a world standard does not lie either in adopting, without changes, any of the present systems or in the adoption of anyone of them with small changes, *we can only place our hopes in an entirely new system.*

We should very soon be able to agree upon the requirements which such a system will have to meet. These requirements will mainly be:

a) an angle of 60° as in the Sellers', the SI and the ABC, systems.

b) a profile which is well rounded in the root and in the crest, like the Whit-worth and the ABC profiles,

c) pitches corresponding to whole or half numbers of threads per inch; as in the Sellers' the Whitworth and the ABC systems,

d) nominal diameters which are equally well acceptable both in inch and metric countries, and which will correspond closely to the standards in adjacent fields.

A new international system will furthermore have to cover not only threads for ordinary bolts and nuts but also threads for mechanical engineering in general.

In the tables given here is shown a draft proposal for an international system of screw threads which should meet these requirements.

As for the *profile* of this system, it is proposed that the ABC profile be adopted, as this profile seems to meet all the above requirements as far as the profile is concerned and that it should therefore not be difficult to agree on its adoption.

Table II.—(ctd). *Practical Figures*

	Diameter d		Fine Thread B			Fine Thread C		
			Threads per 1"	Pitch p		Threads per. 1"	Pitch p	
No	inch	mm.	n	inch	mm.	n	inch	mm.
1.6	0. 16	4.064						
1.8	0. 18	4.572						
2.0	0. 20	5.080						
2 2	0.224	5,670						
2.5	0. 25	6.350						
2.8	0, 28	7.112						
3.2	0.315	8.001	40	0.025	0.635			
3.6	0.355	9.017	36	0.028	0 756			
4.0	0. 40	10,160	36	0 028	0.756			
4.5	0. 45	11,430	32	0.031	0.794			
5 0	0. 50	12.700	32	0.031	0.794			
5.5	0. 56	14.224	28	0.036	0 907			
6,0	0. 63	16.002	28	0.036	0.907	40	0.025	0.635
7.0	0. 71	18.034	26	0.038	0.977	36	0.028	0.756
8.0	0. 8	20.320	26	0.038	0.977	36	0.028	0.756
9.0	0. 9	22.860	24	0.042	1.058	32	0.031	0.794
10.0	1. 0	25.400	22	0.045	1.155	32	0.031	0.794
11.0	1. 12	28.448	20	0.050	1.270	28	0.036	0.907
12.0	1. 25	31.750	20	0.050	1.270	28	0.036	0.907
14.0	1. 40	35.560	18	0.056	1.408	26	0 038	0.977
16.0	1. 6	40.640	18	0.056	1.408	26	0.038	0.977
18.0	1. 8	45.720	16	0.063	1.588	24	0.042	1.058
20.0	2. 0	50.800	16	0.063	1.588	22	0.045	1.155
22.0	2. 24	56,896	15	0.067	1.693	20	0.050	1.270
25.0	2. 50	63.500	14	0.071	1.814	20	0.050	1.270
28.0	2. 80	71.120	13	0.077	1.954	18	0.056	1.408
32.0	3. 15	80.010	13	0.077	1.954	18	0.056	1.408
36.0	3. 55	90.170	12	0 083	2.117	16	0.063	1.588
40.0	4. 00	101.600	11	0.091	2.309	16	0.063	1.588
45.0	4. 5	114.300	10	0.100	2.540	15	0.067	1.693
50.0	5. 0	127.000	10	0.100	2.540	14	0.071	1.814
56.0	5. 6	142.240	9	0 111	2.822	13	0.077	1.954
63.0	6. 3	160.020	9	0.111	2.822	13	0.077	1.954
71.0	7. 1	180.340	8	0 125	3.175	12	0.083	2.117
80.0	8. 0	203.200	8	0.125	3.175	11	0.091	2.309

The inch-diameters and the number of threads per. inch are to be considered as fundamental, while the corresponding metric figures are derived therefrom.

With regard to the *diameters* the proposal takes into consideration the fact, that the same series of preferred numbers have already been standardized in a number of countries, and that these series will certainly play an ever increasing part both in national and international standardization.

If the screw diameters are standardized by means of preferred numbers we will therefore in metric countries automatically get a good correspondence between the standards for screw threads and the standards in adjacent fields,— even if the metric countries have choosen the rounded off values of the preferred numbers when they standardized diameters and linear dimensions in general.

As the inch countries are more and more switching over to decimal inches instead of fractions, it should be logical for the inch countries to standardize diameters in general upon the principles of preferred numbers and decimal inches, *and to use the same diameters for screw threads.* As the conversion factor 1″ = 25.4 mm. is approximately a preferred number, we should then get a very good correspondence between the standard diameters and the diameters of screw threads in the two groups of countries.

Supposing this is done, and we base a series of thread diameters on the R20 series of preferred numbers, we will get the following :

Standard nominal diameters for screw threads

in inches	*in metric*
1,00″ = 25.400 mm	25 mm.
1,12″ = 28.448 ,,	28 ,,
1,25″ = 31.750 ,,	31,5 ,,
1,40″ = 35.560 ,,	35,5 ,,
1,60″ = 40.640 ,,	40 ,,
1,80″ = 45.720 ,,	45 ,,
2,00″ = 50.800 ,,	50 ,,
etc.,	etc.

in other words: practically the same diameters (within 2 per cent.)

For an international system we will however, have to make a choice between the above two series. The most reasonable will then be to choose the inch series and base the entire screw thread system there upon, as the diameters of the inch-series, with one or two exceptions, are a trifle larger than the corresponding diameters of the metric series. This makes it possible in metric countries, to cut off a little of the crest of the bolt-thread, leaving the rest of the profile unchanged, in case one should insist upon screw diameters that under all circumstances are not greater than the nearest standard diameter in mm. according to the R20 series.

A close investigation of the question of screw diameters will show that diameters in inches according to the R20 series will give very adequate sizes, even if the steps may be relatively great in the upper part of the series. In case where we need smaller steps, we may, however, use the intermediate sizes of the R40 series.

The same diameters will of course have to be used both for ordinary standard threads and fine threads for bolts and nuts and for ordinary threads and fine threads for mechanical engineering in general.

As far as the *pitches* are concerned, it has already been stated that the pitches of a new international standard system will have to be somewhat smaller than the pitches of the present standard systems.

Mr. Hilding Törnebohm, director of the SKF, Gotenburg, who is president of the *Swedish Standards Association*, well known in the international standardization work, and who has also for some time taken a keen interest in a world standard for screw threads, has found that the pitch of a 0.25197″ (or 6.4 mm.) standard screw should be about 1/24″ (or 0.058 mm.) and thereupon increase gradually to $\frac{1''}{4.5}$ (or 5.644 mm.) for a 6.3″ (or 160 mm.) screw, corresponding approximately to the formulae :

$$p_{\text{inch}} = 0.09\sqrt{d_{\text{inch}}} \text{ or}$$

$$p_{\text{metr.}} = 0.45\sqrt{d_{\text{metr.}}}$$

As d_{inch} and $d_{\text{metr.}}$ are supposed to be expressed by preferred numbers, this will also be the case with $\sqrt{d_{\text{inch}}}$ and $\sqrt{d_{\text{metr.}}}$; and as the factors 0.09 and 0.45 are both preferred numbers, this will also be the case with p_{inch} and $p_{\text{metr.}}$ and the corresponding numbers of threads per inch, when we base the pitches on the above formulae. If the screw diameters d are taken from the R20 series, we will get pitches from the R40 series.

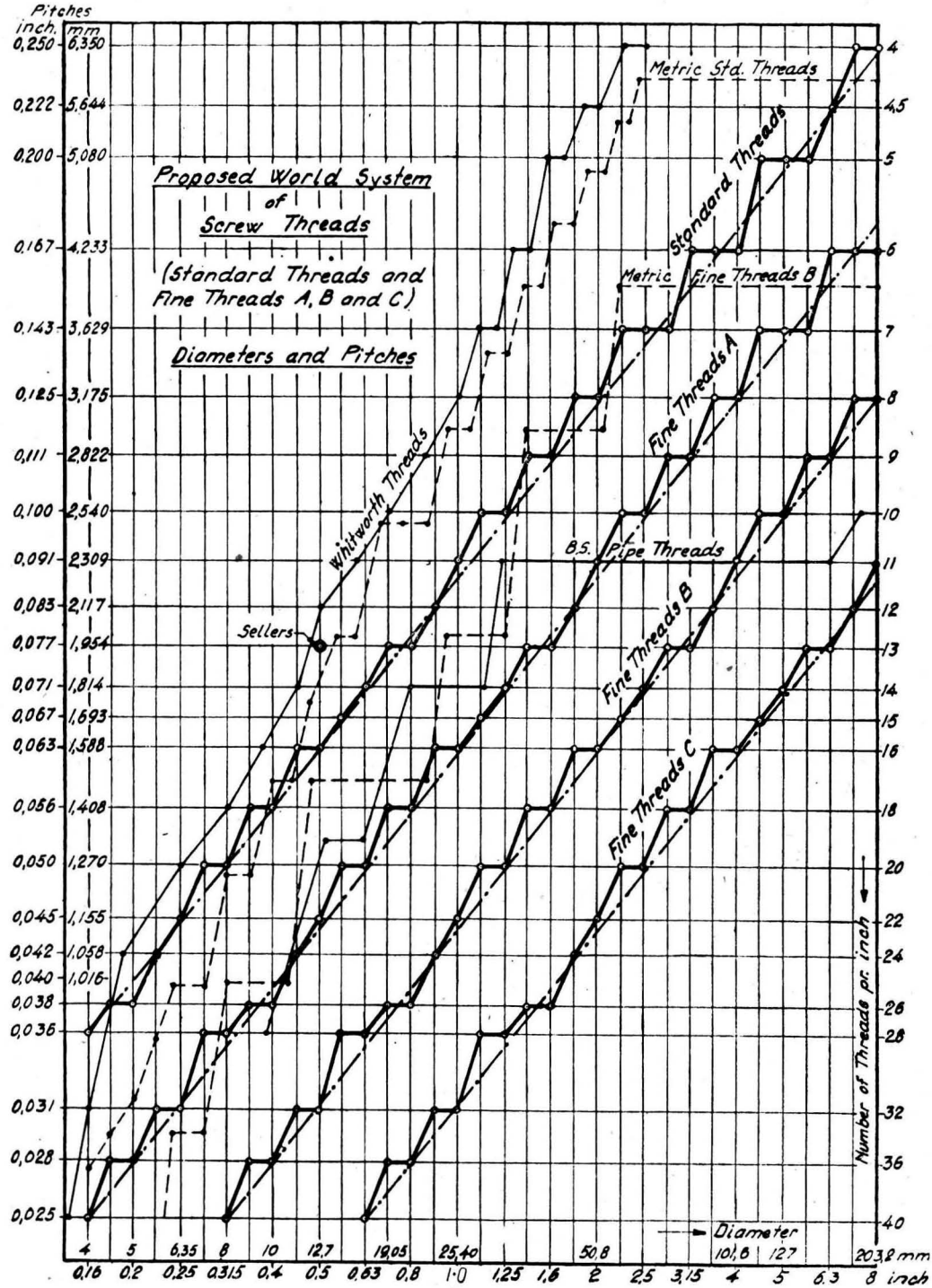

Pitches
inch. mm
0,250 6,350
0,222 5,644
0,200 5,080
0,167 4,233
0,143 3,629
0,125 3,175
0,111 2,822
0,100 2,540
0,091 2,309
0,083 2,117
0,077 1,954
0,071 1,814
0,067 1,693
0,063 1,588
0,056 1,408
0,050 1,270
0,045 1,155
0,042 1,058
0,040 1,016
0,038
0,036
0,031
0,028
0,025
Proposed World System of Screw Threads
(Standard Threads and Fine Threads A, B and C)
Diameters and Pitches
Metric Std. Threads
Standard Threads
Metric Fine Threads B
Fine Threads A
Whitworth Threads
B.S. Pipe Threads
Sellers
Fine Threads B
Fine Threads C
Number of Threads pr. inch
4 4,5 5 6 7 8 9 10 11 12 13 14 15 16 18 20 22 24 26 28 32 36 40
Diameter
4 5 6,35 8 10 12,7 19,05 25,40 50,8 101,6 127 203,2 mm
0,16 0,2 0,25 0,315 0,4 0,5 0,63 0,8 1·0 1,25 1,6 2 2,5 3,15 4 5 6,3 8 inch

Fig. 2

For fine threads, of which we,-for use in mechanical engineering in general,—,shall need various series, we will get appropriate pitches if we, for 3 fine thread series A, B and C, adopt the following :

Theoretical pitches for fine therads

in inches	in mm.
$p_{FA} = 0.063\ \sqrt{d}$	$p_{FA} = 0.315\ \sqrt{d}$
$p_{FB} = 0.045\ \sqrt{d}$	$p_{FB} = 0.224\ \sqrt{d}$
$p_{FC} = 0.0315\ \sqrt{d}$	$p_{FC} = 0.160\ \sqrt{d}$

In this way we will get a system of screw threads characterized by the following formulae :

Basic, theoretical inch-formulae	*Corresponding metric formulae*
$d = \text{R20 (0.16...8)}$	$d = \text{R20 (4...200)}$
$p = k\sqrt{d}$	$p = k\sqrt{d}$
$p_s = 0.09\sqrt{d}$ = R40 (0.0355...0.250)	$p_s = 0.45\sqrt{d}$ = R40 (0.9...6.3)
$p_{FA} = 0.063\sqrt{d}$ = R40 (0.025...0.180)	$p_{FA} = 0.315\sqrt{d}$ = R40 (0.63...0.45)
$p_{FB} = 0.045\sqrt{d}$ = R40 (0.018...0.125)	$p_{FB} = 0.224\sqrt{d}$ = R40 (0.45...0.315)
$p_{FC} = 0.0315\sqrt{d}$ = R40 (0.0125...0.090)	$p_{FC} = 0.16\sqrt{d}$ = R40 (0.315...0.224)

It is evident that the theoretical pitches of these series,—expressed as they are by preferred numbers—, will not be applicable, as we can only use pitches which are either a relatively even measure in mm. or which correspond to half or whole numbers of threads per inch.

As said above it should be most reasonable in a new international system to choose the latter alternative, whereby we will have to round off the pitches of the above fomulae, and preferably to pitches corresponding to numbers of threads per inch which can be regarded as more or less standardized, namely the following:

Standard numbers of threads per inch

40—36	—32—30—28	—26—24—22	
20—18	—16—15—14	—13—12—11	
10— 9	— 8—	7	— 6
5— 4½	— 4—	3½	— 3

From Table I will be seen the theoretical figures of the screw thread system based upon the above principles and formulae, and from Table II the corresponding practical figures. From these Tables and the accompanying bi-logarithmic Diagram in fig. 2 will be seen the systematic and plain structure of the system. For comparison with the Whitworth and the SI systems the pitches of these two systems have also been drawn in.

An international standard for screw threads will, however, not be complete unless we also standardize internationally the designations to be used for the various threads. It should be easy when standardizing such designations, to agree upon a designation consisting of a number, indicating the screw diameter, and a letter, indicating the pitch-series to which the thread in question belongs,—for instance by choosing the figures so that they will indicate approximately the screw diameters in 1/10″, and by choosing the letters S, A, B and C for standard threads and fine-threads A, B and C respectively,—for example:

S10, A20, B28, C40.

By dividing the figure of such designation by 10 we will get approximately the diameter of the screw in inches, and by multiplying by 2.5 approximately the diameter in mm.

It will be seen that the screw thread system described above is built on an entirely neutral base, and that it will—as far as possible—meet the requirements which to-day and probably for a considerable future, will have to be made to an international system of screw threads.

A paramount advantage of the system, which should make it easily adoptable in all countries, is the way in which it takes into consideration both the inch and the metric systems of measurement.

Sunspot Activity During the Current Cycle—*A Review*

By R. ANANTHAKRISHNAN, K. SETHUMADHAVAN and A. K. DAS
(Solar Physics Observatory, Kodaikanal)

A NEW cycle of sunspot activity commences with the appearance of small spots on the sun's surface at about latitude 30°. As the cycle advances the spots increase in size and frequency and at the same time show a progressive drift towards the solar equator until at the end of the cycle the average latitude of the spots is about ± 8°. Even before the end of a cycle, spots pertaining to the next cycle begin to appear at higher latitudes so that at the epoch of sunspot minimum there are four zones of activity upon the sun, two at about latitude 8° on either side of the equator and two between latitudes 25° and 35° in the two hemispheres. The duration of a cycle is the interval between two successive minima. The average value of this is 11.2 years, although individual cycles have been noticed with periods ranging from 9 to 13.6 years. The rise of activity from minimum to maximum is generally steeper than the fall from maximum to minimum.

Sunspot Activity During the Current Cycle.

The last sunspot minimum marking the commencement of the present cycle occurred about the middle of the first half of 1944. Since then the rise of activity has been steeper than usual. Table 1 which is based on the visual and photographic observations at Kodaikanal gives the number of days on which the sun's disc was free from spots, the number of new sunspot groups observed and the mean daily number of sunspot groups seen on the sun's disc during each month for the period Januray 1944 to May 1947.

During 1944 the sun's disc was absolutely free from spots on a little less than half the number of days in the year. In 1945 the number of such days was only 35, while since the beginning of 1946 there has not been a single spot-free day.

Fig. 1 gives a graphical representation of the growth of sunspot activity during the current cycle. The steep rise in activity since the last minimum is well brought out by the curve in the lower half of the diagram.

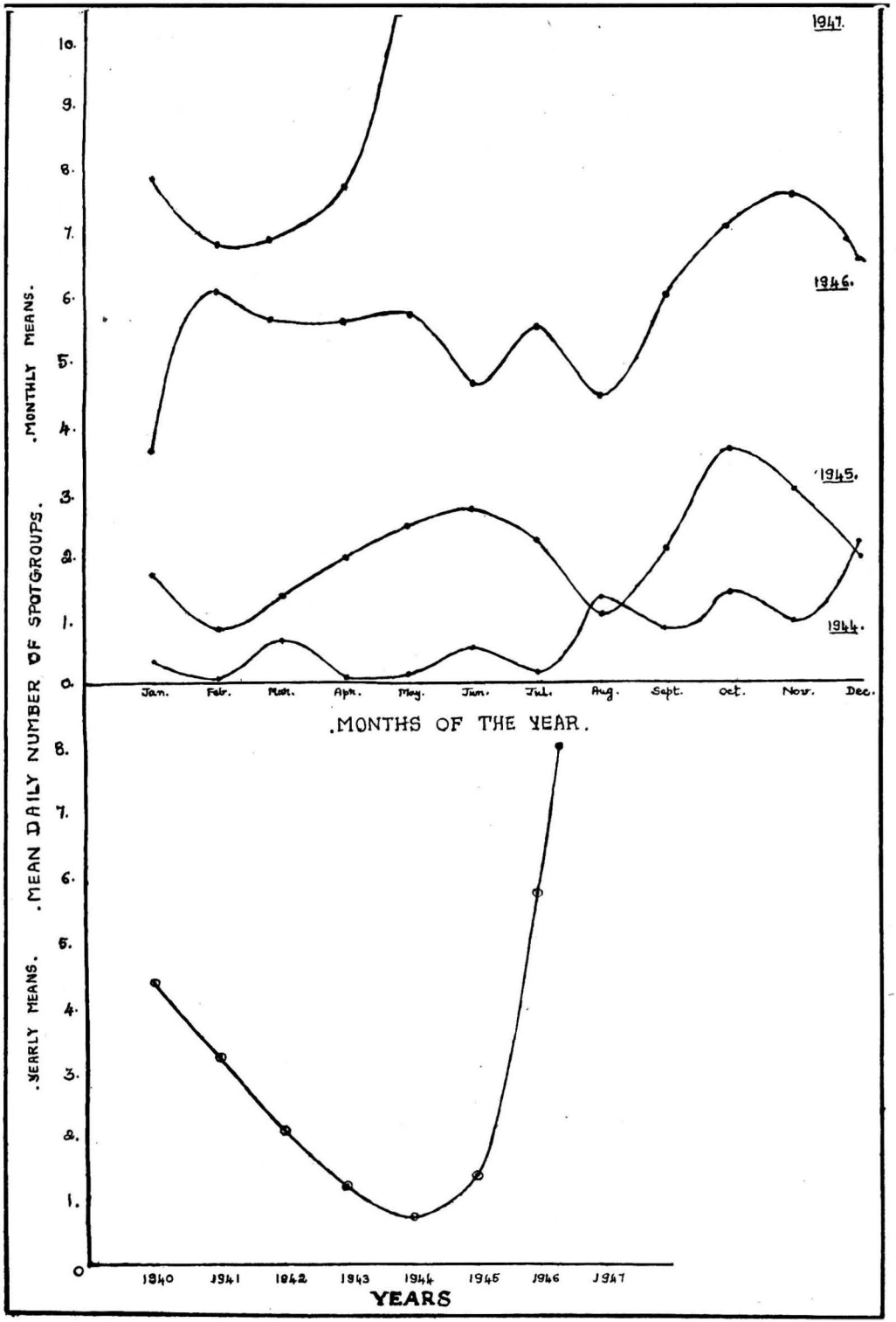
The Great Spot Groups of the Current Cycle.

A very significant feature of the current cycle has been the appearance of very large sunspot groups,-larger than any hitherto observed during nearly the last three quarters of a century. Two such groups appeared in 1946, one in February and the other in July.

(a) *Groups of 1946:-* The February group (Kodaikanal No. 8015) appeared at the east limb of the sun in the northern hemisphere on January 30th at a mean latitude of 27°. It crossed the central solar meridian on February 5th-6th and was last seen at the west limb of the sun on February 12th. This group consisted of two large spots, the following member being about twice the size of the leader. The group covered an area of approximately 4400- millionths of the sun's visible hemisphere as measured on the photoheliogram taken at Kodaikanal on the morning of February 5th. It stretched across the sun's disc over about 30° of longitude nearly in an east-west direction. This group reappeared a second time with greatly diminished

Table I.

Year.	No. of days on which sun was observed.	No. of days on which sun's disc was free from spots	No, of new sunspot groups observed.			Mean daily number of sunspot groups.												Annual Mean.
			N. Hemi-sphere.	S. Hemi-sphere.	Total.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
1944	290	156	13	30	43	0·33	0·04	0·69	0·03	0·10	0·54	0·17	1·33	0·84	1·36	0·92	2·17	0·71
1945	305	35	42	70	112	1·6	0·8	1·3	2·0	2·5	2·7	2·2	1·0	2·0	3·6	2·9	1·9	2·0
1946	292	0	136	156	292	3·6	6·1	5·6	5·6	5·7	4·6	5·5	4·4	5·9	7·1	7·5	6·5	5·7
1947																		
Jan.-May.	129	0	73	100	173	7·8	6·8	7·0	7·7	10·7	—	—	—	—	—	—	—	—


1941.
1946.
1945.
1944.
10.
9.
8.
7.
6.
5.
4.
3.
2.
1.
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Jan.
Febr.
Mart.
Apr.
May.
Jun.
Jul.
Aug.
Sept.
Oct.
Nov.
Dec.
.MONTHLY MEANS.
.MEAN DAILY NUMBER OF SPOTGROUPS.
.MONTHS OF THE YEAR.
8.
7.
6.
5.
4.
3.
2.
1.
0
1940
1941
1942
1943
1944
1945
1946
1947
YEARS
.YEARLY MEANS.

Fig. 1

area between February 27th to March 12th when the leader had broken up into a number of tiny spots while the following spot had been reduced to a third of its original size. The group was again seen during two more successive rotations of the sun between the periods March 29th to April 10th and April 26th to May 8th. At its last appearance, it was no more than a single spot comparable in size to many observed in daily photographs.

The second large sunspot group of 1946 (Kodaikanal No. 8146) traversed the solar disc from July 20th to August 2nd. This was also in the northern hemisphere at a mean latitude of 22° and crossed the central meridian on July 27th when it had an area of 3900-millionths of the sun's visible hemisphere. It was a complex group composed of a few well-defined major spots and several smaller ones. This group reappeared in the second half of August much diminished in area and resolved into five or six distinct spots

(b) *The group of* 1947:- In February 1947 a bipolar spot group (Kodaikanal No. 8327) appeared in the southern hemisphere of the sun between latitudes 17° and 26°. Although larger in size than the usually observed spot groups, it was, however, only less than half the size of the group of July 1946. This group was visible from February 5th to 18th crossing the central meridian on the 11th. It was noticed again during three successive rotations of the sun in March, April and May. During its second appearance (March 3rd to 17th; Fig. 2), it had grown to nearly 2½ times its previous size and extended from latitude 17° to 27°. On March 10th when the group was over the central meridian of the sun its area was only slightly smaller than that of the large spot group of February 1946. The group appeared for the third time at the east limb of the sun on March 31st and crossed the central meridian on April 7th when it extended from latitude 17° to 31°. Unfavourable weather conditions associated with a cyclonic storm in the Bay of Bengal prevented observations from 11th to 14th during which period the group disappeared at the west limb. As measured on the photoheliogram of April 6th, the group had a total area of 4900-millionths of the sun's visible hemisphere - *thus surpassing the record area of the spot group of February* 1946. This giant group of 1947 retained its bipolar character

Table II.

(All times in I.S.T. = G.M.T. + 05h. 30m.)

Year and month.	(a) Solar flares.	(b) Radio fade-outs.	(c) Magnetic storms.
1947 February.	7th - 08h. 2 m. - Slight intensity; SE quadrant. 13th - 08h. 33m. - Slight intensity; SW quadrant.		16th to 17th: Storm of great intensity preceded by quiet conditions commenced at 08h. 29m. of 16th.
1947 March	7th - 08h 17m. - Slight intensity; SE quadrant. 12th - 08h. 15m. - Slight intensity; SW quadrant. 14th - 08h. 50m. - Moderate intensity; SW quadrant. 15th - 08h. 10m. - Slight intensity SW quadrant.	3rd - 11h. 30m. to 13h. 30m. - Partial fade-out. 4th - 09h. 00m. to 16h. 30m. - Complete fade-out of all BBC frequencies. 5th - 06h. 30m. to 13h. 30m. - Partial fade-out at first and complete fade-out of all stations later. 6th - 07h. 30m. to 13h. 00m. - Partial fade-out of BBC frequencies. 10th - 09h. 00m. to 13h. 00m. - Partial fade-out. 16th - 13h. 00m. to 13h. 15m. - Dellinger type of fade-out. No trace of BBC, Australia and A.I.R. regional stations.	2nd to 4th : Storm of moderate intensity commenced at 09h. 29m. of 2nd and continued till 16h. 00m. of 4th. 8th to 9th: Moderate disturbance from 11h. 30m. of 8th to 03h. 30m. of 9th. 15th: Sudden disturbance from 14h. 12m. to 22h. 00m.

(a) Observed at Kodaikanal with the spectrohelioscope in Hα (b) Information kindly supplied by the Research Department of the A.I.R. (c) Recorded at the Magnetic Observatory, Alibag, Bombay.

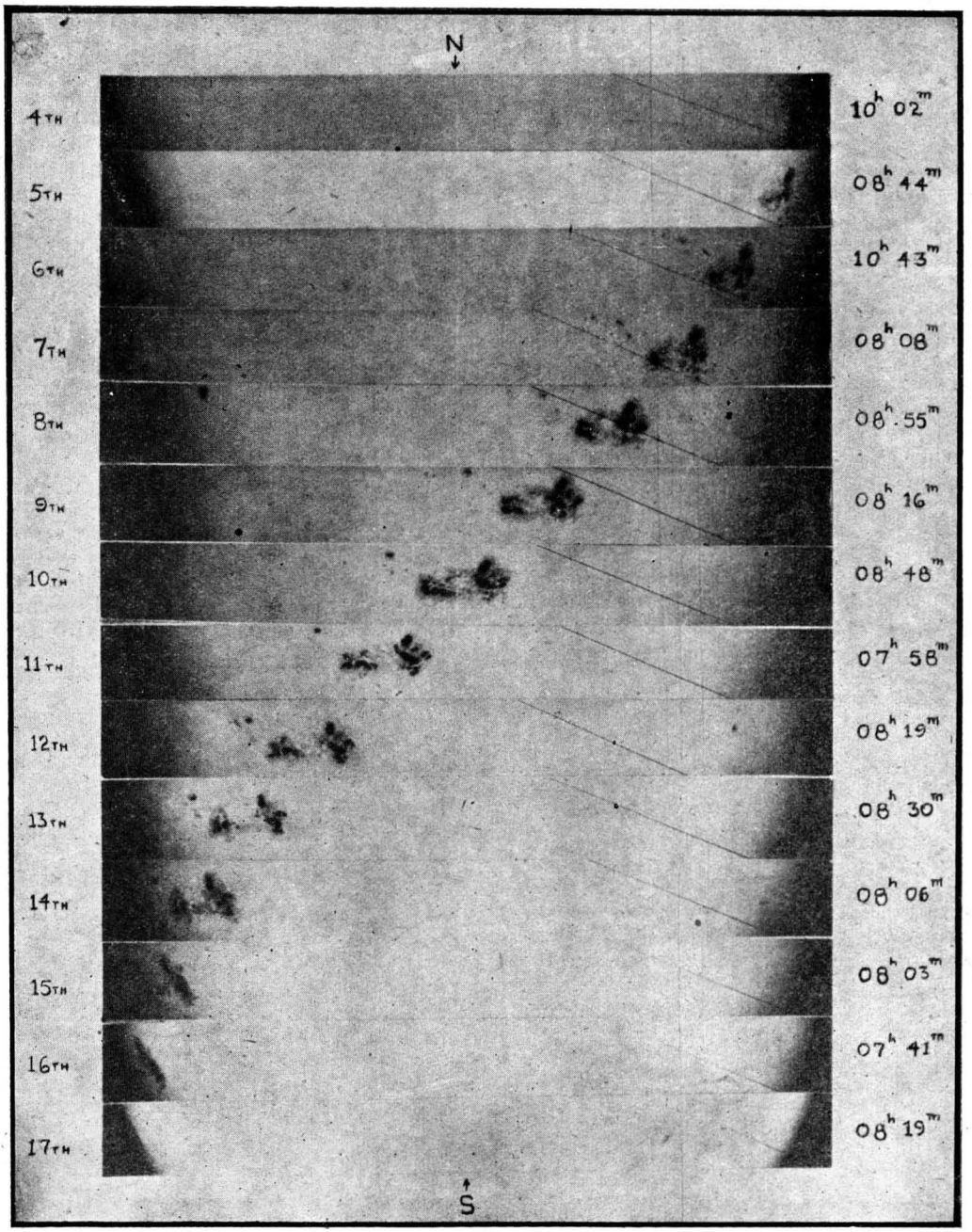

Fig. 2.—The Large Sunspot Group Of March 1947.

throughout its life history. During its first appearance in February, the leader was over twice as big as the follower. In March and April the following spot had grown enormously while the leader, though larger than in February was less marked in development. The following spot was about $2\frac{1}{2}$ times the size of the leading spot during the third appearance of the group in April. The group made its fourth and last reappearance between April 28th and May 11th, when it had very much dwindled in size and was no more conspicuous than the spots commonly observed on the sun.

(c) *Solar flares, terrestrial effects, etc., associated with the great spot group of* 1947:- Information relating to solar flares, short wave radio fade-outs and magnetic disturban-

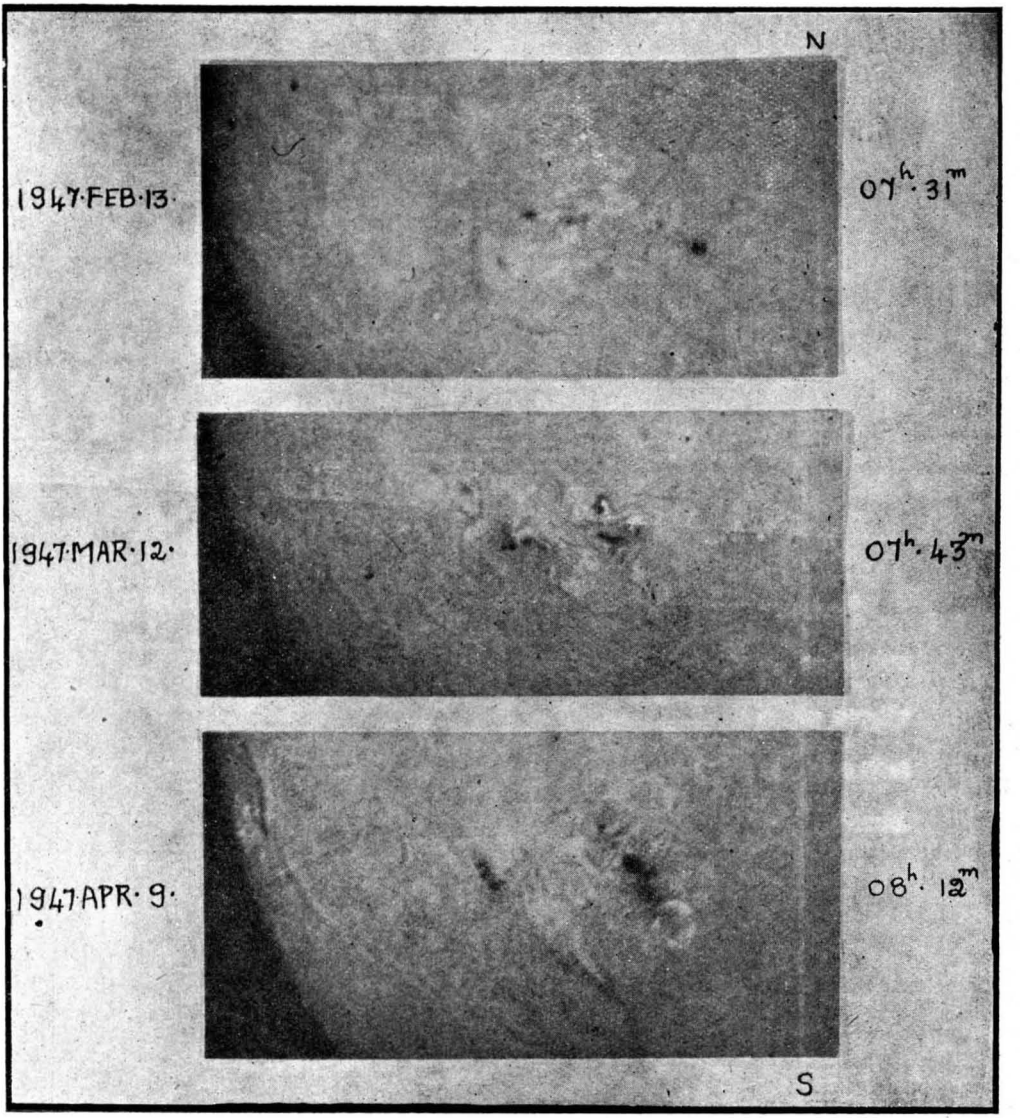

Fig. 3.—Spectroheliograms taken in the red (Hα) line of Hydrogen of the great sunspot group of February-March-April showing dark filaments and bright Hydrogen flocculi surrounding the sunspot group.

ces observed during the period of activity of the large spot group of 1947 are given in Table II. As compared with the group of February 1946, the group of March-April 1947 was markedly less active in these respects.

Typical spectroheliograms taken at Kodaikanal in the red ($H\alpha$) light of hydrogen which are reproduced in Fig. 3 bring out clearly the

Table III.

Kodaikanal No. of spot group.	Date of photo-heliogram on which area measured	Extent of spot group in latitude and mean latitude	Extent of spot group in longitude	Area.* (corrected for foreshortening.) Umbra.	Area.* (corrected for foreshortening.) Total.	Total area of group in terms of cross-sectional area of earth.	Total area/area of umbra.	Dimensions of follower.†	Dimensions of leader.†	Overall length of the group.†
8015	1946 Feb. 5.	20°-33°N (27°N)	30°	740	4400	104	5·9	74 X 52	65 X 30	189
8146	1946 July. 27.	17° 26°N (21°N)	21°	560	3900	92	6·9	—	—	135
8327	1947 Feb. 12.	17°-25°S (21°S)	22°	340	1700	40	5·0	33 X 27	54 X 35	166
	1947 Mar. 10.	17°-27°S (22°S)	24°	660	4200	96	6·2	61 X 49	57 X 38	122
	1947 Apr. 6.	17°-31°S (24°S)	27°	740	4900	116	6·6	89 X 51	31 X 28	189

* Expressed in millionths of the sun's visible hemisphere.
† In units of thousands of miles.

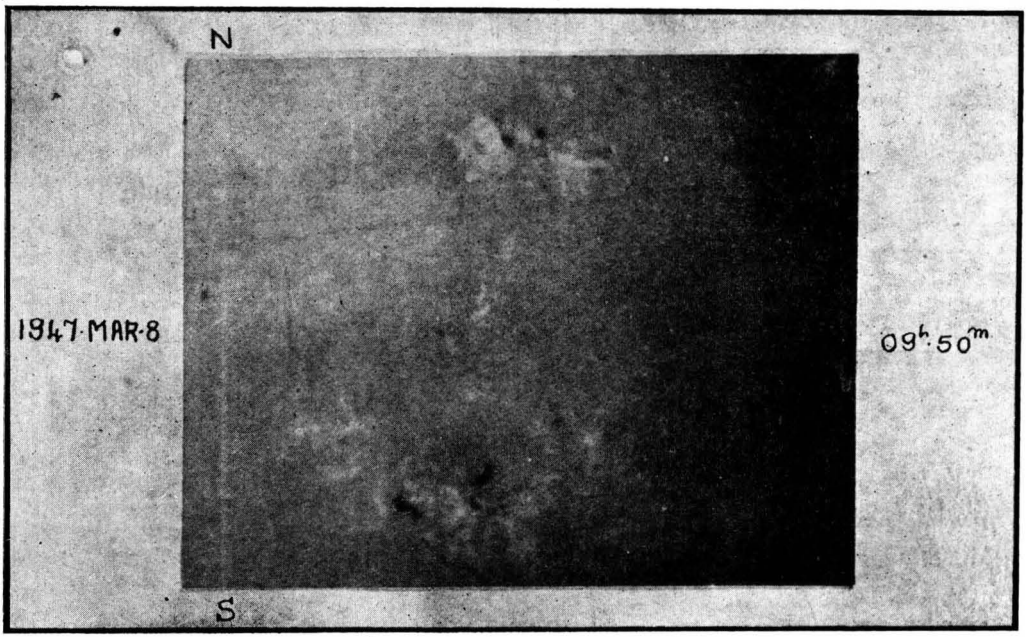

Fig. 4.—Spectroheliogram taken in the red ($H\alpha$) line of Hydrogen on 1947 March 8 showing a brilliant "Solar flare" in a sunspot group at the top of the photograph. The large sunspot group of March 1947 can be seen at the bottom of the photograph.

vortical structure of the hydrogen filaments in the neighbourhood of the spot group during its appearances in February, March and April.

The $H\alpha$ spectroheliogram taken at 09 h. 50 m. on 1947 March 8 revealed a brilliant solar flare in a sunspot group at heliographic latitude 13°N and longitude 30°E. This can be seen at the top of Fig. 4. At the bottom part of the picture can be seen the great spot group of March 1947 before its central meridian passage.

(d) *Comparative dimensions of the spot groups:-* Table III gives the comparative dimensions of the three large spot groups of the current cycle.

Fig. 5 shows the appearance of the spot groups at about the time of their central meridian passage.

Comparison of Areas of Spot Groups as Measured at Kodaikanal, Greenwich and Mount Wilson.

On comparing the area of the sunspot group of February 1946 as measured at Kodaikanal with the corresponding figures reported by Greenwich[1] and Mount Wilson[2], it was found that the Kodaikanal value (4400-millionths) is lower than the other two by 500 and 1000-millionths respectively. Even after allowing for the uncertainty in the measurement of areas it was felt that the discrepancy between the Kodaikanal and Mount Wilson measurements was too large. In this connection the areas of some of the large groups listed in Nicholson's pamphlet[2] were measured on the Kodaikanal plates and also compared with the areas given by Greenwich. A comparative statement of the values is given in Table IV:-

From the table it will be seen that there is generally closer agreement between Kodaikanal and Greenwich values than between Kodaikanal and Mount Wilson values. The reason for the very large discrepancy between Kodaikanal and Mount Wilson figures for the area of the spot group of February 1946 is not clear. In a recent publication Elizabeth Srernberg Mulders[3] has given the figure of 5478-millionths of the visible solar hemisphere for the area of this spot group as determined by the U. S. Naval Observatory. Repeated measurements of our photoheliogram of 1946 February 5 by at least three different persons have failed to give an area which is appreciably higher than the figures given in Tables III and IV.

Magnetic Field of the Spot Group of April 1947.

Systematic photographs of the spectrum of the large spot group of April 1947 were taken with the newly constructed 20-foot grating spectrograph of this Observatory in the fourth order during the period 3-4-1947 to 8-4-1947. The spectrogram in the red region obtained on April 7 is shown in Fig. 6 (a). The central strip (marked 1) in the top half of the Figure is the spectrum of the penguin-shaped umbra of the preceding spot (Fig. 7); the photospheric spectrum (marked 2) is given on either side of it for comparison. The lower half (Marked 3) is the spectrum of the umbra of the spot and of the surrounding penumbral and photospheric regions taken simultaneously with a long slit.

Table IV.

Date.	Mean latitude of spot group.	Area. millionths of the sun's visible hemisphere. Kodaikanal.	Greenwich.	Mt. Wilson.	Kodaikanal minus Greenwich	Kodaikanal minus Mt. Wilson.
1905 Oct. 20.	+ 14°	2900	2900	3000	0	− 100
1907 Feb. 12.	− 17°	1900	2200	2600	− 300	− 700
1907 June 20.	− 14°	1900	2200	2500	− 300	− 600
1925 Dec. 29.	+ 23°	2400	2800	2900	− 400	− 500
1926 Jan. 24,	+ 21°	3200	3400	3700	− 200	− 500
1928 Sept. 27.	− 15°	2500	2200	2600	+ 300	− 100
1937 Jan. 31.	− 10°	2100	2200	2500	− 100	− 400
1937 July 29.	+ 32°	3000	3000	2800	0	+ 200
1937 Oct. 5.	+ 9°	2800	>3000	2700	≈ −200	+ 100
1938 Jan. 18.	+ 17°	3100	3100	3100	0	0
1938 July 15.	− 11°	2300	2500	2500	− 200	− 200
1938 Oct. 12.	+ 17°	2900	≈2900	3000	0	− 100
1939 Sept. 10.	− 15°	2600	2400	2500	+ 200	+ 100
1946 Feb. 5.	+ 27°	4400	4900	5400	− 500	−1000
1946 July 27.	+ 22°	3900	≈4000	3700	≈ −100	+ 200

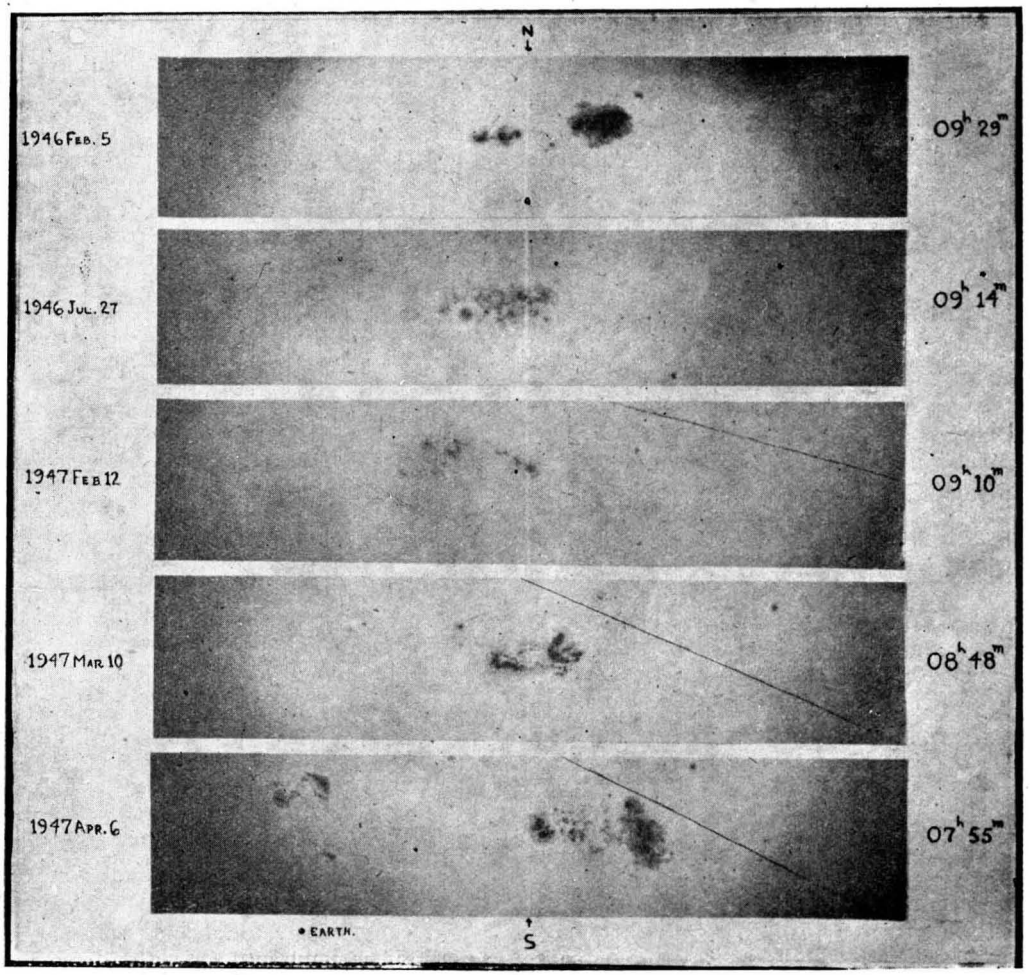

Fig. 5.—The Great Sunspot Groups Of 1946 and 1947.

As compared with the spectrum of the photosphere, the spectrum of the spot reveals many interesting features. Many photospheric lines appear considerably broadened inthe spot while some of the lines appear as doublets or triplets. In addition to this, the spot spectrum shows several new lines which are absent in the photospheric spectrum. On the original negative the iron line λ6173.348 appears as a clear triplet in the spectrum of the spot (Fig. 6b),while the iron line λ6213.443 appears as a doublet (Fig. 6c). The magnitude of the separation between the extreme components of the triplet and those of the doublet were measured with a view to estimating the intensity of the magnetic field in the spot which is responsible for the splitting of these two lines. Assuming the figures given by Hale and coworkers[4] for the magnetic splitting of these two lines in laboratory experiments the maximum value of the field strength at the centre of the umbra of the preceding spot of 1947 April 7 works out to be about 3300 gauss.

References

1. H.W. Newton, *The Observatory*, 1946, 66, 267.
2. Seth B. Nicholson, *Astronomical Society of the Pacific*, Leaflet No. 207-May 1946; Seth B. Nicholson and Joseph O. Hickok, *Publ. of the Astro. Soc. Pacific*, 1946, 58, 86.

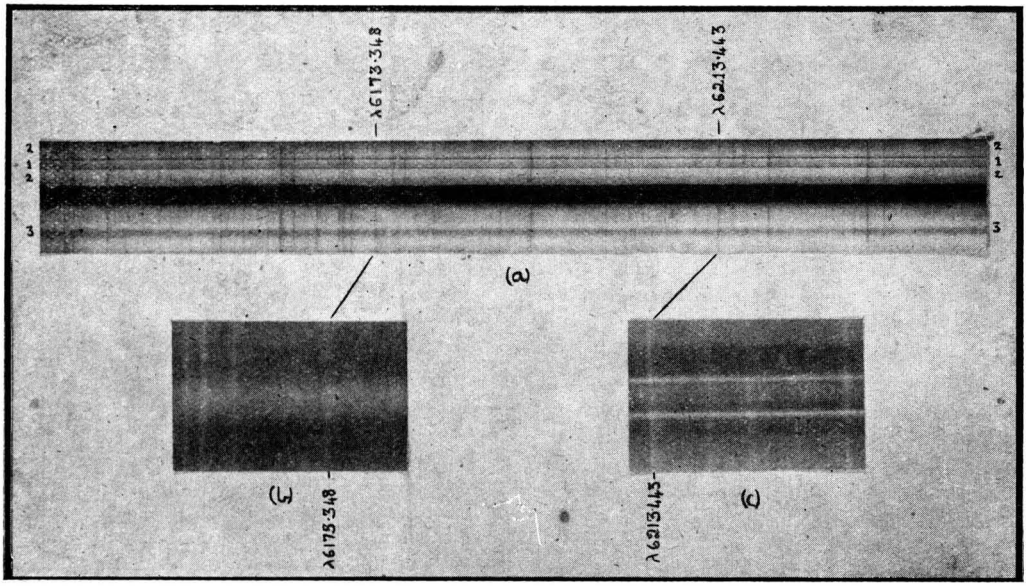

Fig. 6.—Spectrum of the giant sunspot group of 1947 April 7 taken with the newly constructed 20 feet grating spectograph, in the 4th order red region showing the magnetic splitting of the iron lines λ 6173.348 (triplet) and λ 6213.443 (doublet).

Fig. 7.—An enlarged photograph of the great spotgroup of April 1947—*the biggest sunspot observed during the last three quarters of a century*—just before its central meridian passage. The black disc at the bottom left corner represents the relative size of the earth.

3. Elizabeth S. Mulders, *Publ. of the Astro. Soc. Pacific.* 1947, 59, 12.

4. G.E. Hale, *Astro. Jour.*, 1908, 28, 326; G.E. Hale, F.H. Seares, A. Van Maanen, and F. Ellerman, *Hid*, 1918, 47, 235.

Board of Scientific and Industrial Research

NINETEENTH MEETING — NEW DELHI

THE nineteenth meeting of the Board of Scientific and Industrial Research was held in New Delhi on 24th August 1947 under the Chairmanship of the Hon'ble Dr. Syama Prasad Mookerjee, Minister for Industries and Supplies.

The Board recommended to the Governing Body for sanction the following 9 new research schemes:

1. Dr. S. K. Banerjee (*Calcutta*): Study of formation of vortices in solar atmosphere.
2. Prof. K. Banerjee (*Calcutta*): X-ray investigation of coal.
3. Dr. P. C. Guha (*Bangalore*): Preparation of new antimalarials.
4. Dr. S. K. K. Jatkar (*Bangalore*): Ultrasonic velocities in gases and vapours.
5. Sir J. C. Ghosh (*Bangalore*): Industrial catalysts.
6. G. C. Mitter (*Calcutta*): Investigations on the electrolytic oxidation of potassium manganate to permanganate.
7. Col. S. S. Bhatnagar (*Bombay*): Microbiological research in antibiotics.
8. Dr. U. P. Basu (*Calcutta*): Preparation of antimalarials.
9. Col. Sir R. N. Chopra (*Srinagar*): Survey of cultivation and improvement of medical plants.

The Board noted that in pursuance of their earlier recommendation a grant of Rs. 3 lakhs was made by the Governing Body of the Council of Scientific and Industrial Research for the Research Institute of the Indian Academy of Sciences, Bangalore, for physical and chemical investigation of the minerals of India, under the direction of Prof. C. V. Raman.

The Board accepted the recommendation of the Pharmaceutical and Drugs Committee for the establishment of a Central Drug Research Institute. The main functions of the Institute will be the promotion of drug research in all its aspects, including botanical, chemical, microbiological, pharmaceutical, pharmacological and clinical aspects; testing and standardisation of drugs; to offer facilities to industrial institutions in the solution of their problems; and provision of controlled clinical trials in hospitals and clinics. The establishment of the proposed Institute with its Chemical, Pharmacological, Biochemical, Bacteriological, and Clinical Divisions, will involve a capital expenditure of Rs. 36.32 lakhs, and a recurring expenditure of Rs. 6.74 lakhs for the first year.

The proposal sponsored by the Internal Combustion Engine Research Committee to establish an Internal Combustion Engine Development Board and a National Internal Combusion Engineering Laboratory was accepted by the Board. The Internal Combustion Research Committee will function, hereafter, as the Planning Committee for the N. I. C. E. Laboratory to work out the details of the proposal.

The Board recommended a capital grant of Rs. 2 lakhs, and a recurring grant of Rs. 25,000 to the Indian Institute of Science, Bangalore, for the training of personnel in internal combustion engine engineering and for long-range research in I. C. engines.

Plastics Industry Develops New Products

SALES of plastics products in the United States have grown from $ 20,000,000 in 1936 to an estimated $750,000,000 in 1946 and are expected to reach the $ 1,000,000,000 level within two or three years as shortages in the basic materials from which plastics are manufactured and in production equipment are eliminated.

This tremendous expansion in the American plastics industry has been made possible by the development of new raw materials and new uses for plastics; the improvement of established plastics; the development of new manufacturing processes; and the streamlining of production methods. Many of the new plastics were developed during the war under a cloak of secrecy which has been removed only recently. Other plastics are logical developments of previously known and available materials which have found applications in new fields.

Plastic materials, because of their usefulness and versatility, have become an important part of America's peacetime industrial programme. Manufacturers find plastics advantageous because of their light weight, high resistance to corrosion, acids and solvents, exceptional insulation properties, unlimited colour range, strength and dimensional stability. Plastics can be converted into finished goods without costly intermediate operations. Intricate shapes and fine tolerances are produced by moulding rather than by expensive handlabour processes. As colour is inherent in plastics, no painting or enameling is needed.

In synthetic fibres such as *nylon* and *saran*, finer and larger monofilaments with greater elasticity, tensile strength, resistance to mildew, acids and extremes of weather have been developed. Plastics have proved superior as coatings for fabrics, proofing materials against weather, fire, acids, shrinkage, creasing and loss of colour and glaze.

Thermoplastics used during the war to supplement rubber used for wire insulation and raincoats will continue in civilian use as they do not have rubber's limitation of colour, flamability or adverse reaction to weather extremes.

Plastic materials go back to 1830 when cellulose nitrate was discovered. In 1868 the first practical celluloid was used for men's collars. The second important plastic, casein, was produced in Germany in the 1890's. In 1909 the development of bakelite, a phenolformaldehyde resin, gave the American plastics industry its most important stimulus. Since that time some 30 basic plastics which lend themselves to hundreds of formulations have been developed.

The production of plastics is actually three separate industries. In one, such common molecules as phenol, formaldehyde, camphor, proteins, cellulose and urea are polymerized. The liquids, flakes or powders so produced are changed into consumer goods by moulding, extruding, casting, laminating or fabricating.

From the second or tributary industry come the plastic filaments, bristles, rubber and elastic substitues, bearings for rolling out steel, substitues for glass and bonding material for abrasives.

The third is the manufacture of useful articles from raw plastic materials. Plastic application is responsible for the luxurious decor in trains, automobiles, ocean liners, airplanes, restaurants and theatres. Plastics are used for machine parts; abrasive, electrical, mechanical and chemical equipment; protection coatings, mechanical housing; radio and television parts; automotive and refrigerator parts; switchgears, cams, handles and knobs. The householder finds window screens, fluorescent ornaments, high strength fish lines, phonograph records, nylon golf clubs, unbreakable tableware, raincoats, shoes, wallpaper, curtains and furniture upholstery, luggage and unbreakable tables and chairs among the new uses of plastics.

Developments in Equipment and Processes

New developments in equipment and processes have contributed to progress in the

manufacture of plastics. Larger and better injection-moulding machines were produced in quantity during the war. The method of high-speed transfer-moulding of thermosetting plastics was improved. Electronic sewing machines or heat sealers, effective in joining together two pieces of thermoplastic film were developed.

Among the newer plastics are the resins that are impregnated into paper, wood, cloth and other fillers which can be formed into large shapes and complicated forms by low-pressure moulding.

Industrial and architectural designers are finding new applications for the transparent acrylic plastics which were used during the war for cockpit enclosures, navigator domes and bomber noses. Civilian uses of this plastic include contact lenses, dentures and specialized surgical instruments. Corrugated sheets of this plastic are used in trains and buses for baggage racks.

New Uses

Polyethylene, which was developed and used in large quantities during the war for coaxial cables in radar and other high-frequency electronic applications, is expected to take over a substantial portion of the flexible, thin-sheeting field in civilian use. A potentially low-cast material, with high strength, relatively high softening point and resistance to moisture, the use of polyethylene will range from wire and cable insulations to shower curtains and tableware.

In the field of polyamides, grades of nylon sheeting with characteristics of leather have been manufactured. These can be embossed or moulded and are used in the manufacture of watch straps and wallets.

Hitherto unattainable strength in proportion to weight was developed by glass-reinforced low-pressure laminates. Plastics as structural materials are used in the production of streamlined chairs, lightweight luggage, prefabricated bathroom and kitchen units. A resorcinol resin solved many difficulties in assembly gluing of wood veneers or rasin-bonded playwood parts by curing rapidly under nearly neutral conditions. New resinous adhesives were found for bonding metals to themselves and to other materials.

Protective Packaging

In packaging, plastics have scarcely begun to scratch the surface. A recent test proved that fresh fish wrapped in packages lined with pliofilm will arrive at its destination 24 hours or more distant from the point of shipment, in excellent conditions without the use of ice or dry ice.

The United States Navy's method of moisture-proofing guns and other deck equipment on decommissioned warships by putting them in plastic cocoons has been adapted to peacetime industrial use. Several coats of liquid plastic can be applied within a few minutes, making a tough and flexible covering which will withstand exposure to wind, rain, snow, sun, oil, water or gasoline for months. An additional coating of a Gilsonite-base roofing material guarantees protection for 50 years. Silica gel placed inside the cocoon absorbs any minute moisture. The covering does not coat the metal and can be stripped off easily by cutting with a sharp knife. Products ranging from ball bearings to locomotives, precision instruments and gauges, machine tools and oil-field equipment are being protected while in storage or in transit by this method.

The use of plastics in upholstery is not new. For 30 years or more stimulated leather and rubber-coated fabrics have been used extensively, but the new vinyl upholstery has many advantages over the old forms. Because of its beauty, durability and ease of maintenance and handling, vinyl upholstery is used for domestic furniture, passenger-cars, taxi and truck paneling and seats, suitcases, golf bags, footballs, camera cases, and decorative surfaces in restaurants and theatres. These materials are stain and flame proof.—USIS

Airblast Improves Iron and Steel Output

AT a time when iron and steel are in short supply, when war-digging into the underground reserves of the nation has raised the question of future ore supply United States scientists have come up with as simple a technological innovation as could be found to increase both iron and steel output in quantity and quality.

Technically speaking, high pressure air blowing in blast furnaces has boosted pig iron output by 20 per cent. The steel improvement, in turn, concerns the use of oxygen which increased output by 25 per cent, accelerated production and often improved the quality of steel. Both methods have been in experimental use for about nine months. American and foreign plants already have plans for converting to the new processes as soon as practicable since they require relatively low capital investments.

The new iron production method of pressure blowing was worked out by Arthur D. Little, Inc., a chemical research organization in Cambridge, Massachusetts. In tests undertaken with two "guinea pig" furnaces of the *Republic Steel Corporation* in Cleveland and Youngstown, Ohio, blast furnaces were operated at pressures substantially above normal. Best results accrued from "blowing the furnace" at a rate of 110,000 cu. ft. per minute at a pressure of 30.5 lbs. per sq. inch, against a normal blowing rate of 75,000 cu. ft. per minute, at 20 to 25 lbs. per sq. inch.

With blowers capable of delivering 125.000 cu. ft. per minute at a pressure of 40 lbs. per inch, the increase in pig iron output might be raised beyond the 11 to 20 per cent. achieved in the tests. Installing the blowers costs between $70,000 and $5000,000, cheap compared to the $6,000,000 for a new blast furnace. The change, however, will be effected slowly, most probably when furnaces are down for repair, which happens but every few years

The change-over requires structural adjustments. One difficulty has always been that, if air is passed through the furnace too rapidly, it would blow fine iron ore out at the top along with carbon gases. Coke would not react as fully as possible with the ore. The structural adjustment gets around that problem by restricting the flow of escaping gases. Air and gases move through the furnace in greater volume but at much lower velocity. This cuts loss of fine iron ore and also coke consumption by about 12 per cent.

Besides raising the prospect of pig iron production by several million tons a year without need for new plants, pressure blowing will draw lower grade iron ores into the orbit of economic operations. The cost of iron production from high grade ores will be reduced.

The simultaneous discovery of both a new iron and steel method amounts to a neat piece of synchronization. More iron will be needed to feed the open hearth furnaces whose capacity of producing steel has been increased by the oxygen method, also successfully tested in American plants.

The method of using oxygen, developed by the *Air Reduction, Inc.*, of New York City, resembles the furnace pressure blowing. It introduces oxygen (rather than ordinary air) through a 1" diameter pipe below the surface of the metal in an open hearth. The oxygen feed speeds the removal or carbon and other elements, thus accelerating the process of refining by 1 to 3 hours per load. In the tests, the rate of oxygen supply to the "molten-bath" varied from 27 to 67 lbs. per minute. As a result tonnage increased by about 25 per cent. and the quality of the steel was equal or better than that produced by conventional methods.

The two processes mark the beginning of a technological evolution. Already, plans are being rushed to complete low-purity oxygen plants which will be needed when air and oxygen blowing will be used commercially, at the latest within two years. Oxygen use is also foreseen in the so-called Bessemer method of steel production. Moreover, chances are that the oxygen process might replace the new air pressure blowing in pig iron production with even greater economies than those achieved in the recent tests.

Economies accruing from the new production methods are expected to make steel

cheaper, ton by ton. Less fuel, less ore, and less limestone will be needed; loss of metal in the furnace will be reduced. The potential capacity of some open hearth furnaces is expected to rise by 15 to 30 per cent.

With the higher ingot capacity, the steel industry also will achieve a higher flexibility of production and will become adjustable to the shifting types of demand. The technological evolution which is barely beginning today promises within a few years cheaper steel, cheaper cars, railroads, machines and all the consumer goods which steel contributes to a better standard of living.— *USIS.*

The High Frequency Furnace in the Steel Foundry

By D. K. BARCLAY

THE first high-frequency induction furnace for melting ferrous metals on a commercial scale was installed at the works of *Edgar Allen and Co., Ltd.*, of Sheffield in 1926. The successful performance of this pioneer large-scale furnace was followed by rapid progress, and furnaces with melting capacities from eight ounces to six tons are now in operation. The smaller furnaces are extensively used for laboratory research in works and technical training institutes.

This type of furnace, with its low melting loss by oxidation, has made possible a very much higher recovery of valuable constituents in alloy scrap such as manganese, nickel, chromium, cobalt, molybdenum, tungsten and vanadium.

Construction Procedure:

The procedure adopted in the construction and operation of the furnace is essentially as follows. Metal in the form of selected scrap of known chemical analysis is charged into a rammed refractory lining of crucible shape. This lining is surrounded by a water-cooled coil of copper tubing, which serves as a conductor for the primary high-frequency current. The current generates an intense alternating magnetic field inside the coil, thereby inducing eddy currents in the charge sufficient to heat and melt it.

A typical steel foundry lay-out consists of two furnaces, one of 500 lb . and the other of 1,000 lbs. capacity, with power requirements in the region of 150-200 kW and 300-350 kW respectively. If the furnace is melting alloy steel scrap the current consumption will average 600-700 units per ton. There is an appreciable reduction in current consumption per ton as furnace capacity is increased. Cost of operation, however, is not the only factor of importance. A large proportion of high-grade carbon and alloy steel castings are of light or medium weight; and these can be cast best in the smaller furnaces, which are ready for pouring in from one to two and a half hours, ensure quick casting of moulds, and facilitate ready replacement by fresh moulds on the casting floor.

The furnace body is rectangular in shape and is equipped with lifting gear for pouring. Small furnaces have a framework of asbestos lumber strengthened with a non-ferrous material insulated at the joints. This type of construction, however, is inadequate for the larger furnaces, which are provided with steel framework shielded magnetically to prevent heating.

Safety Devices.

The charging and operation platform is of wood and the furnaces are constructed so that the top is on a level with the platform floor. Risk of oxidation or other contamination is reduced by providing easily removable domed covers for the furnace tops, whilst safety devices in the form of trip attachments, covering failure of water supply and metal leakage through lining walls, are fitted to all

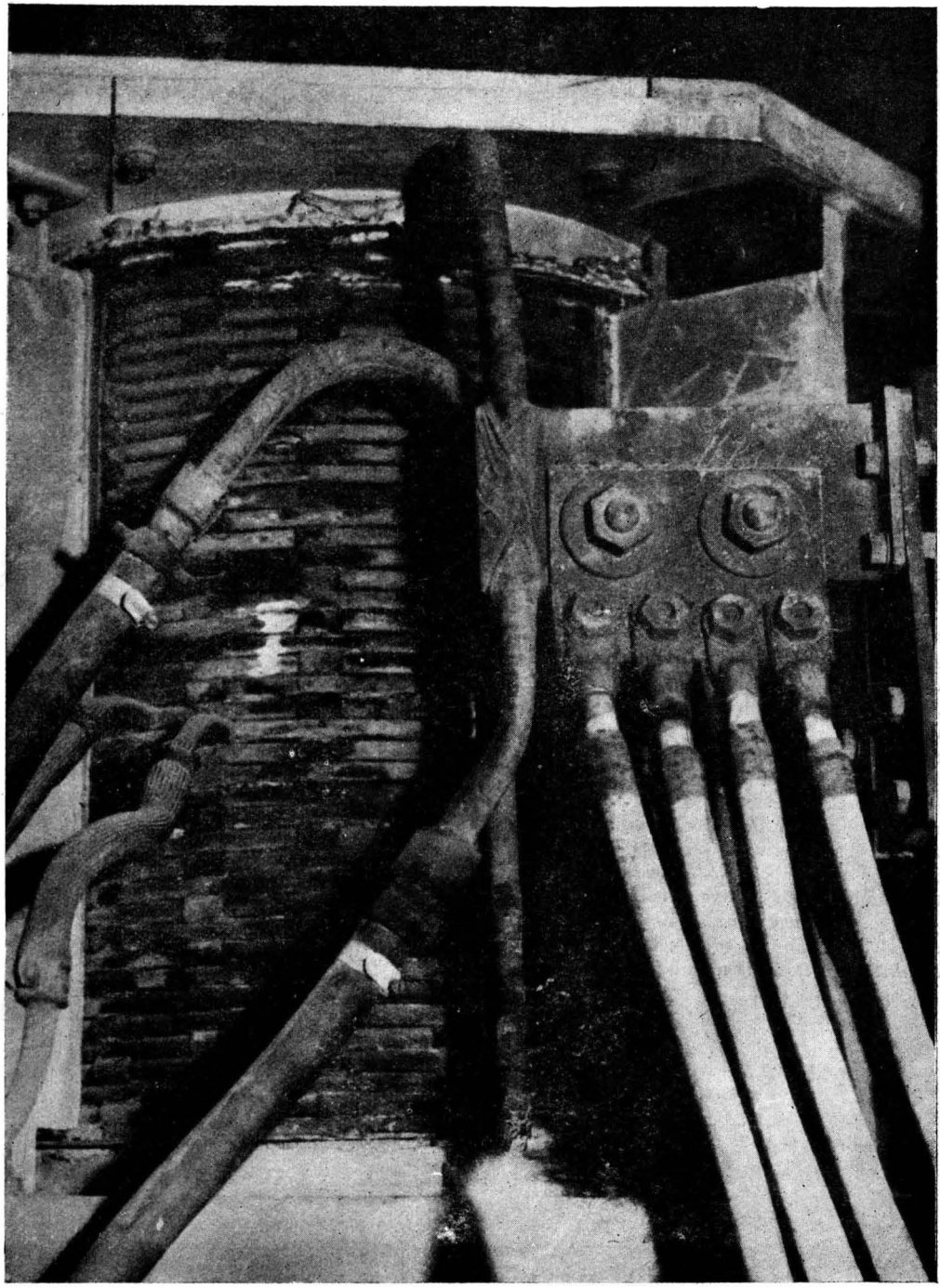

Fig. 1.—Water cooled copper tubing coil.

modern installations. The refractory lining of the furnace may be either of acid or basic material, depending on the type of steel it is desired to make. From an economic point of view it must be capable of giving a reasonable life, and be able to withstand the high pouring temperatures required in alloys steel casting production.

Acid linings find favour because they are less prone to crack. Their most useful field is in the production of carbon steels and steels of comparatively low alloy content. The material used is generally dry graded quartz with 1 to 5 per cent. borax as bond. On a 500 lb. furnace the lining is about $1\frac{3}{4}''$ in thickness, and $2\frac{1}{2}''$ on a 1,000 lb. furnace. Acid linings have a life of 60 heats and over. For the higher alloy content steels, however, such as austenitic manganese steel and the various stainless and heat-resisting steels, a basic lining is necessary, or at least advisable. In this case magnesite is used with fireclay or China clay as bond, giving a life of 50 or more heats.

When lining the furnace the coil is covered on the inside with layer $\frac{1}{8}''$ thick of cold-setting cement which is allowed to dry. A thin sheet of asbestos is placed next to the cement, after which the furnace bottom is made with well dried lining material firmly rammed to the required thickness. Once the bottoming is completed a steel former is placed in the desired position and wedged with temporary wood distance pieces. Lining material should then be poured between the asbestos and the outer side of the steel former to a depth of 2", and rammed with a pointed $\frac{1}{2}''$ steel rod until firm. This process is continued by adding more material and ramming it until the normal metal level is reached. Between that point and the top of the coil, lining material containing a proportion of China clay is used. The lining is finally completed with an admixture of lining material, China clay and sodium silicate. A steel ring shaped to facilitate pouring is placed on top.

The lining should be fritted in with a charge of small heavy pieces of selected carbon or low alloy content scrap placed inside the steel former, which becomes heated and is absorbed into the melt. Care should be taken, however, not to force the furnace on the first heat to ensure a good frit. As refining is seldom undertaken in the induction furnance the scrap should be low in sulphur and phosphorus, unless high sulphur is required for a specific purpose.

Bottom pouring ladles are probably the best means of metal distribution in the foundry, but sometimes it is necessary to pour small castings with hand shanks. The induction furnace is admirably suited to this method since the metal can be held in the furnace without detriment.

To summarise the advantages of the high-frequency furnace, there is neither carbon pick-up nor contamination from furnace atmosphere. The temperature is under constant control, high fluidity is ensured, and compositional accuracy easily maintained. The constant stirring motion provided by the eddy currents in the charge clarifies the steel of de-oxidation products and ensures homogeneity of product. Yet another advantage is the possibility of reproducing complex alloy steels with very small additions of alloy.—(Courtesy, *U. K. Publicity Services*, New Delhi.)

Petroleum*

By E. S. PINFOLD

(Continued from August issue)

Oil Transport

The most usual form of oil transport is by pipe-line. The Burmese fields are connected with the refineries south of Rangoon by a 10" diameter line over 300 miles in length; the oil from the Dhulian and Khaur fields in the Punjab is pumped over 50 miles through a 6" line to the refinery in Rawalpindi. One of the longest pipe-lines constructed in the pre-War period was that connecting the oil-fields of Iraq with the ports of Haifa and Tripoli on the Mediterranean. Many thousands of miles of pipe-lines transport gas, crude oil and refined products from one part to another of the North American continent. Great advances in pipe-line technique have resulted from the emergency demands of the war period.: The Big Inch line connecting producing and refining centres in Texas with New York comprises 1,253 miles of 24", 1,558 miles of 20" and 185 miles of subsidiary lines; the line fill of the 24" line alone is nearly four million barrels. Storage tanks constructed for this system have a capacity of 6,540,000 barrels. One of the most revolutionary achievements was the Pluto scheme in which 3" welded steel lines were laid across the English Channel, some of them over 70 miles in length. Lines were also constructed connecting Bengal ports with Upper Assam, Upper Burma and China. This system included a 6" line from Calcutta to Tinsukia, approximately 750 miles, and two 4" lines from Tinsukia to Kunming, approximately 1,000 miles. These lines, when completed, were capable of delivering 100,000 tons per month to China.

Products

In addition to the usual range of refined petroleum oils,-naphtha, petrol, kerosine gas oil or diesel fuel, lubricants, wax, greases, asphalt and fuel oil-, other useful products manufactured from mineral oil or natural gas are: special solvents used in the paint and varnish Industries, refrigerants, emulsifiers, wetting agents, detergents, medicinal oils, insecticides and fungicides, anti-freeze compounds, isopropyl alcohol, amyl alcohol, amyl acetate, ketones and toluene used as a solvent and a major source of explosives. Chlorinated products include refrigerants, anaesthetics and products used in fire-proofing. The gum-forming and resinous compounds present in cracked spirit are readily polymerised to resins; and butadiene, formed by a similar process, is the basic material used in the production of synthetic rubbers, Carbon black, prepared originally by burning natural gas with a controlled air feed, is now made by the direct decomposition of methane. This material is used in the manufacture of printers' inks, paints and as a filler for rubber used in tyres.

World Production

The rapid and almost continuous increase in the production of crude petroleum is show in Table II. (see Fig.1)

Table II.

World Production of crude petroleum (in millions of U. S. barrels).

1870	5.8
1900	149.1
1910	327.8
1920	688.9
1930	1,411.9
1940	2,150.0

The principal phases in the growth of the petroleum industry have been, briefly,: (i) 1870 to 1880,; The rapid replacement of fish and vegetable oils, previously used as illuminants and lubricants by mineral oils; (ii) 1880,; to 1900: The extension of markets and world-wide distribution; (iii) 1900 to 1914: The partial replacement of coal by oil-fuel, more especially for marine propulsion; the invention of the internal combustion engine and motor transport; (iv) 1914 to 1939: The rapid growth of air transport; (v) 1939 to 1945: The enor-

* Contribution to the *Dictionary of Economic Products and Resources of India.* Suggestions are invited by the Chief Editor, 20 pusa Road, New Delhi.

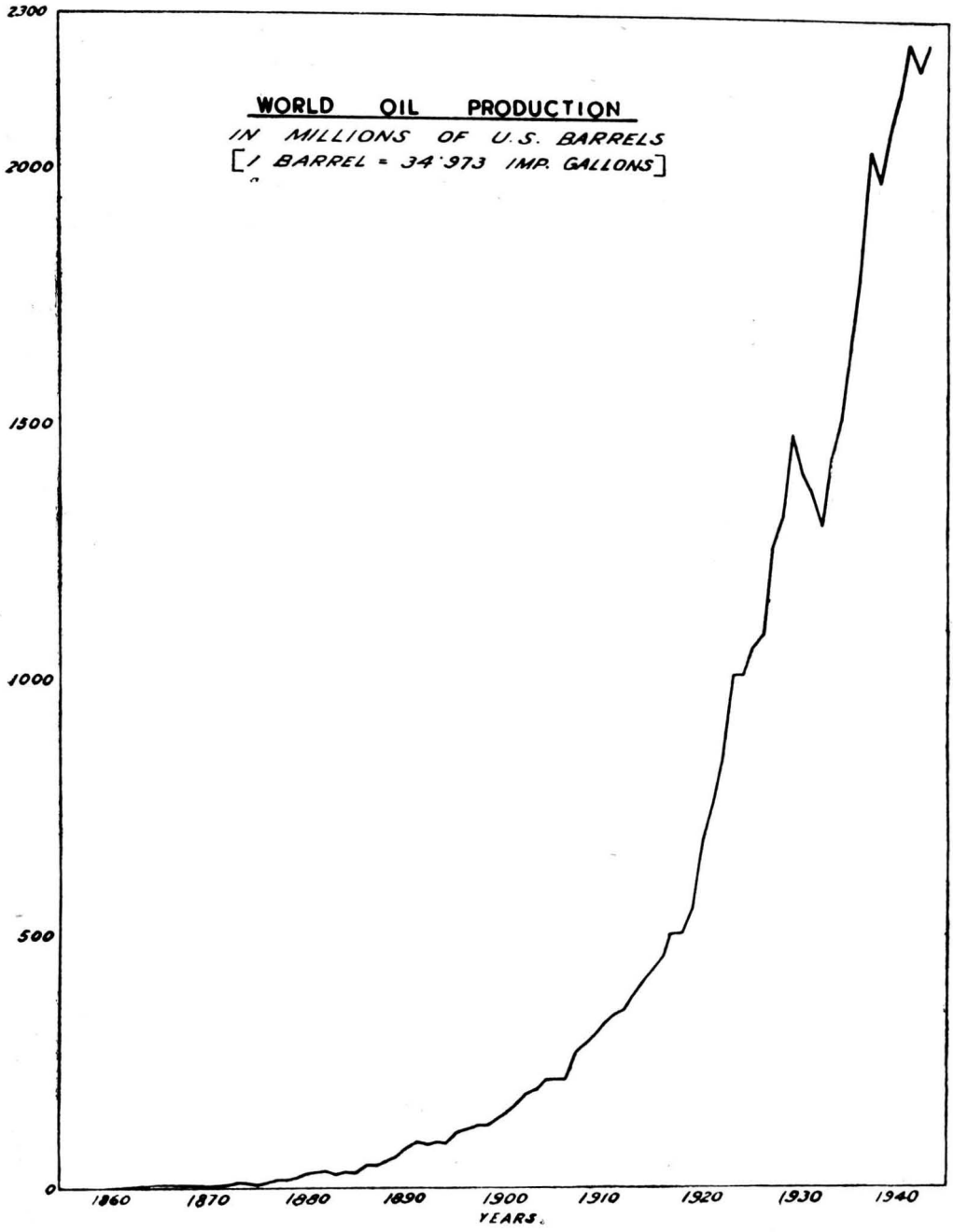
WORLD OIL PRODUCTION
IN MILLIONS OF U.S. BARRELS
[1 BARREL = 34·973 IMP. GALLONS]
2300
2000
1500
1000
500
0
1860
1870
1880
1890
1900
1910
1920
1930
1940
YEARS.

Fig. 1.

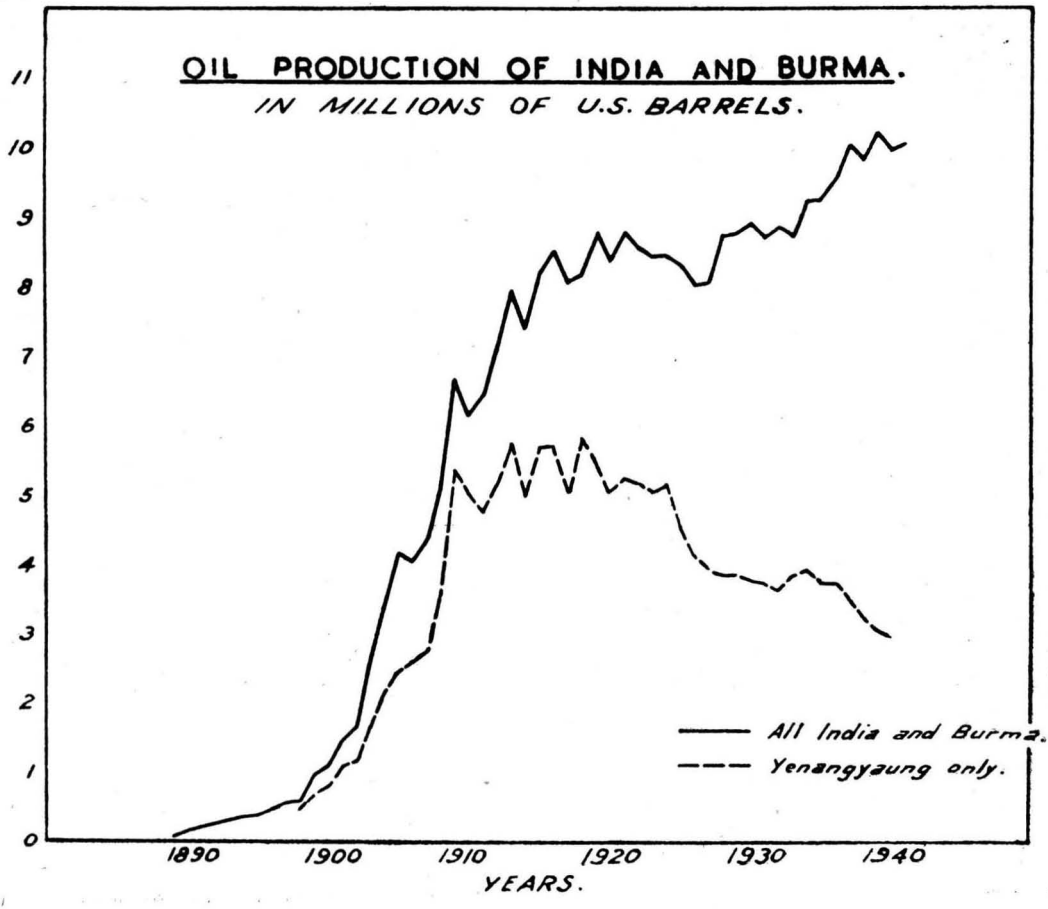

Fig. 2.

mous wartime demands for all petroleum products.

Factors which have enabled supply to keep up with, and indeed to exceed this remarkable increase in consumption have been: (i) The introduction of rotary drilling, about 1915 onwards; (ii) the discovery of prolific oilfields in Venezuela and in Iran, Iraq, and Arabia; (iii) the use of geophysical methods of prospecting, more especially in the Gulf Coast of North America and the Mid-Continent. The fall in production from 1930 to 1933 was due to the world depression in finance and industry in those years. Peak production, 2,598,009,000 barrels, has been reported for 1944.

Current annual production (in 1943) by countries is estimated to be as follows (in thousands of U.S. barrels) :–

U.S.A.	...	1,500,000
U.S.S.R.	...	240,000
Venezuela.	...	182,550
Iran.	...	78,000
Mexico.	...	37,000
Roumania.	...	36,500

Other countries producing over twenty million barrels annually are Iraq, Argentina and Trinidad.

From time to time the question of world oil reserves gives rise to discussion and some anxiety, but, to date, new discoveries in part by deeper drilling in established fields, have maintained the reserve position, notwithstand-

ing the enormous increase in consumption. North and South America still have many years' supply in known reserves. Last deposits, as yet almost untapped, have recently been proved in Iran, Iraq, on the Arabian shores of the Persian Gulf and in Russia.

Petroleum in India and Burma

Apart from early production from hand-dug wells of which no statistics are available, the total production of India and Burma up to the Japanese occupation of the Burma fields in April 1942, was approximately 315 million barrels; of this total, a single oilfield, Yenangyaung in Burma, contributed more than half. This field has recently taken second place to the near-by Singu field which, with its extensions Lanywa and Pyinma, had produced a further 25 per cent. of the all-India total. The remainder has been produced from the Digboi field in Upper Assam, the Khaur and Dhulian fields in the Punjab and the Minbu, Yenangyat and Indaw fields in Burma. So far as statistics are available, peak production in India and Burma was reached in 1939 with a total of 10,105,000 barrels.

The course of production is given in Table I and illustrated in Fig. 2. The latter shows the production of the Yenangyaung field separately:-

Table I Oil Production of India and Burma.
(in thousands of Imp. gallons)

Year.	*India.*	*Burma.*	*Total.*
1890	...	4,132	4,132
1900	753	36,986	37,739
1910	3,322	211,508	214,830
1920	13,410	279,707	293,117
1930	54,506	256,539	311,045
1935	71,326	251,339	322,665
1940	78,725	270,582	349,307

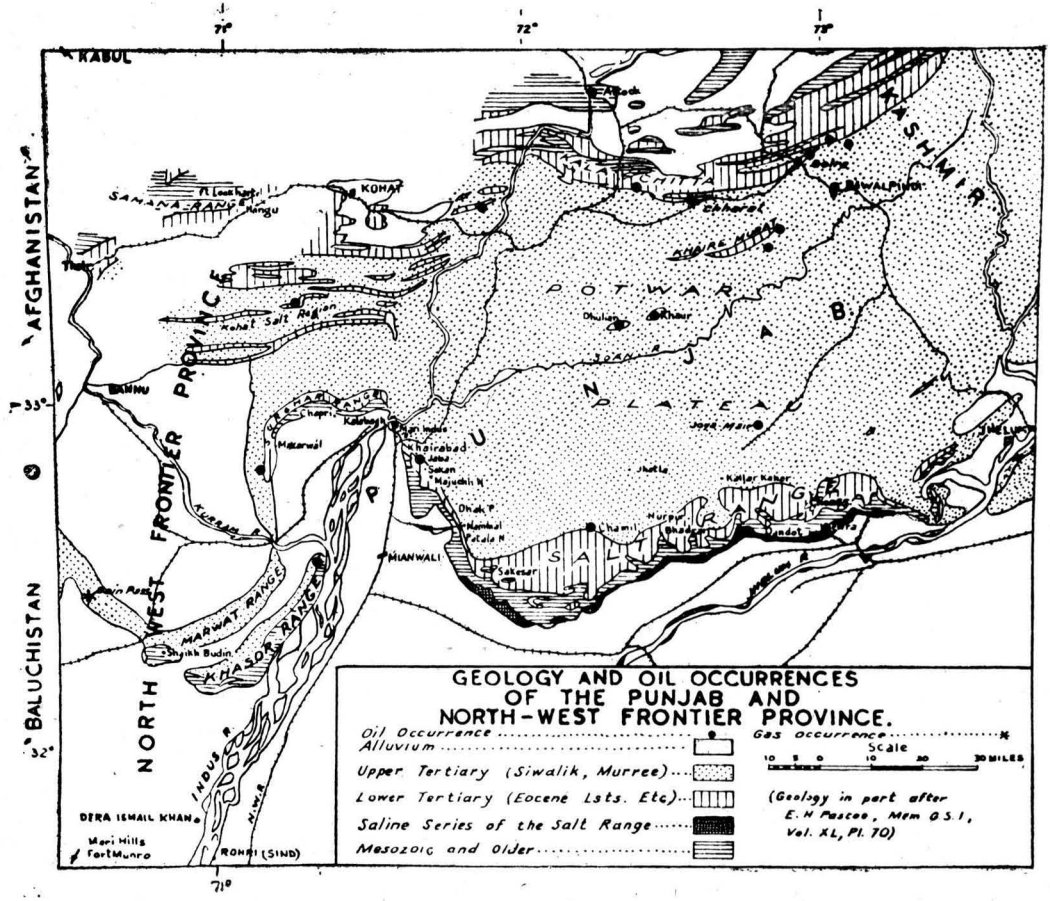

Fig. 3.

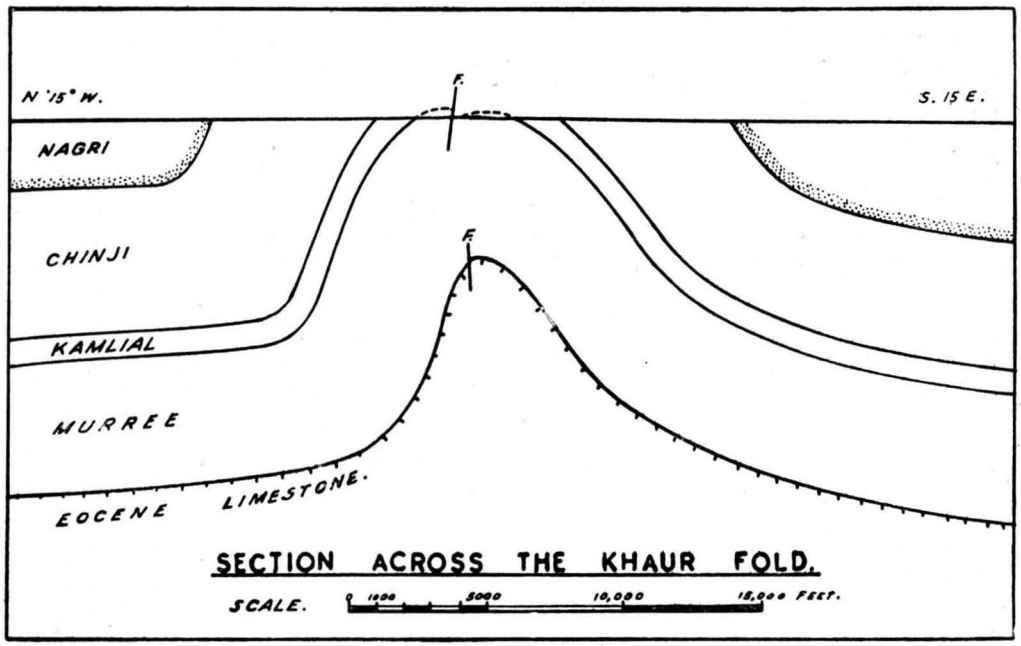

Fig. 4.

Early records of oil production in Burma are given by V. Ball. From these it appears that Burma had possibly the largest production in the world prior to the second half of the nineteenth century. The *Burmah Oil Company* was formed as a small syndicate about 1887 and the rapid rise in production from that date to 1907 was due to the introduction of drilling machinery. The Yenangyaung field reached its peak in 1918 and production since that date has been maintained by increasing withdrawls from Singu. Boring operations commenced in Assam as far back as 1866 and the *Assam Oil Company* was formed in 1899; a rapid increase in production took place from 1900 onwards, more especially after the *Burmah Oil Company* obtained control of the *Assam Oil Company* in 1922. Production from the Punjab fields commenced to be marketed in 1922.

India's total production prior to the loss of the Burma field to the Japanese in 1942 was about half of one per cent. of the total world production; India at that time ranked twelfth in the list of producing countries, and was, next to Trinidad, the second largest producer in the British Empire.

Geological and Geographical Distribution

The Indian oilbelt occupies the outer foothills of the Tertiary mountain range from Sind and Baluchistan to Burma. No oil occurs in peninsular India or Ceylon. All the known oil occurrences are in Tertiary rocks, except for small oil shows in the Saline Series of the Punjab Salt Range, which may be Cambrian or older.

The oil occurrences fall into six regional groups or oil provinces, according to location and geology: The Mekran Coast and Sind; Baluchistan and the Suleiman foot-hills; the Punjab and North West Frontier Province; Assam; the Arakan Coast; and Burma.

The Mekran Coast and Sind:—Only natural gas is yet known in this area; although a trace of oil was seen some years ago in a well at Drigh Road near Karachi, test wells since drilled in this locality failed to yield oil in quantity. The natural gas of the Mekran Coast and Las Bala gives rise to mud volcanoes, some of which near the mouth of the Hingol River, attain a height

of over 300′ (Chandragup). A well drilled here in 1916 gave out only gas.

Baluchistan and the Suleiman Foothills:— Oil seepages occur at Sanni in the Kelat State, the Bolan Pass, at Khattan on the western edge of the Murri Hills, and at Mogul Kot in the Dera Ismail Khan District. The source of the oil in this region appears to be the Dunghan (Bolan) Limestone near the local base of the Laki stage of the Eocene. The large seepage near Khattan led to the drilling of several wells by the Government aided *Townsend Syndicate*, about 1890, and a small production of heavy oil was obtained, though this proved short-lived. A deep test drilled in the Khairpur State, South of Rohri junction on the Indus, located on a low dome structure in Eocene rocks, drilled completely through the Eocene without obtaining oil in quantity.

The Punjab and North West Frontier Province:— Oil shows are abundant in this region, and wells were drilled near Fatehjang, Jaba and Kundal, by the *Townsend Syndicate* and others about 1890; a small yield was obtained which was utilised in the cantonment gasworks in Rawalpindi. The *Indolex Syndicate* drilled unsuccessful wells at Golra, ten miles north of Rawalpindi, in 1913-1915. The *Attock Oil Company* developed the Khaur and Dhulian fields in 1915 and 1937 respectively; these are the only fields in this part of India which have yet yielded oil in commercial quantities. Test wells at Joya Mair in the Jhelum District have recently (1944) obtained a considerable production of exceptionally heavy oil, and additional tests are being drilled in this area. The Joya Mair structure was first described as a possible oil-field by D. N. Wadia of the Geological Survey of India[2].

A detailed account of the geology and oil occurrences of this region is given by E. H. Pascoe,[3] and this includes a full bibliography to that date; additional references to later works are given at the end of this article.

The numerous oil shows of this province occur in the Kohat Salt Region, in the foot-hills of the Kala Chitta hills and their continuation across the Indus, along the northern dip-slope of the Salt Range, and at the eastern end of the Khaire Murat range. A good oil seepage occurred near the crest of the Khaur dome. Gas shows, originating probably in the Jajal Plant Series of the Jurassic, occur in the Bain Pass, on the borders of the Dera Ismail Khan and Bannu Districts, N.W.F.P., and at Gurguri Oba in North Waziristan. (Fig. 3).

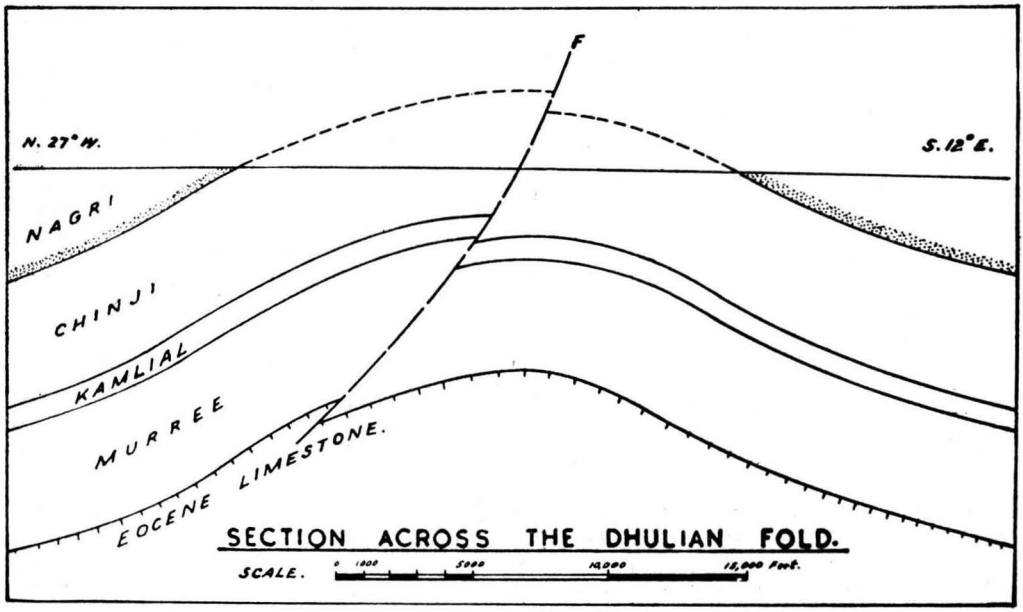

Fig. 5.

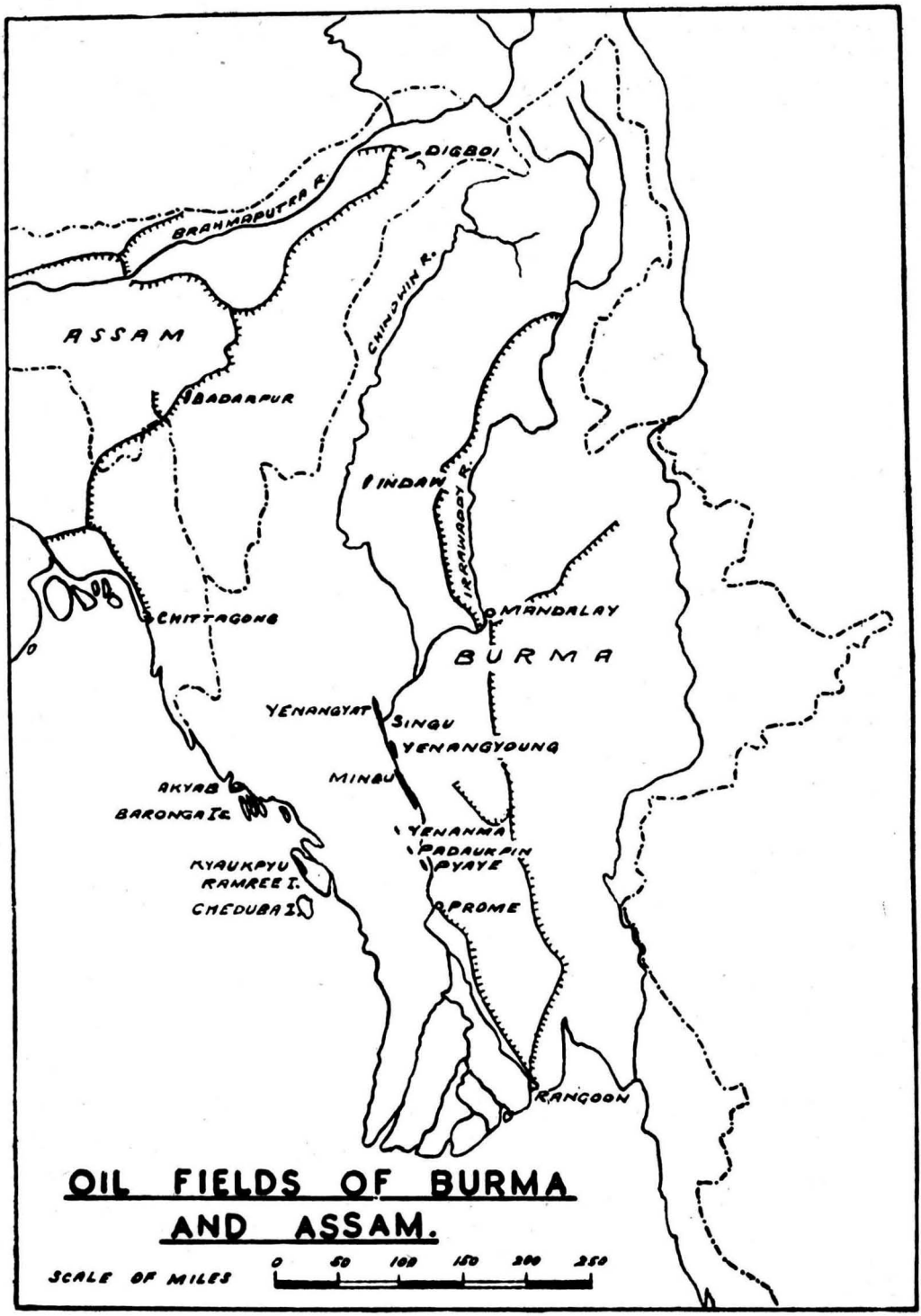
DIGBOI
BRAHMAPUTRA R.
CHINDWIN R.
ASSAM
BADARPUR
IRRAWADDY R.
MANDALAY
CHITTAGONG
BURMA
YENANGYAT
SINGU
YENANGYOUNG
MINBU
AKYAB
BARONGA I.
YENANMA
PADAUKPIN
PYAYE
KYAUKPYU
RAMREE I.
CHEDUBA I.
PROME
RANGOON
OIL FIELDS OF BURMA AND ASSAM.
SCALE OF MILES
0 50 100 150 200 250

Fig. 6.

The oil of north-west India has its source in Eocene limestones near the junction of the Laki and Kirthar stages. At this point in the succession there is a change from nummulitic limestone deposited under open sea conditions, to red marls with salt, gypsum and dolomites of inland sea origin, followed by thin fresh water deposits with *Planorbis* and vertebrate fossils. The oil appears to be genetically related with the change in conditions of deposition. A return to marine conditions occurred in the next later stage, but no oil has been observed in these marine beds. The Eocene is succeeded by a major unconformity, and the Oligocene and part of the Miocene is absent. The next higher beds are the sandstones and shales of the Upper Tertiary which attain a thickness of possibly 33,000'.

The Khaur and Dhulian oilfields lie about twenty miles south of the outer foot-hills of the Himalaya. They are located on open dome structures in the northern flank of the main syncline of the region, the Soan basin. The dome crests are in Upper Tertiary sandstones and shales, the limestone source rocks being at about 53,000' and 7,800' respectively in the two fields. Much of the production of the Khaur field has been obtained from the fresh-water deposits above the limestones and, oil has been produced from a number of separate sands from 150' downwards. These upper oilsands are believed to have obtained their oil by upward migration from the limestone mother-rock. Similar upper production, but of heavier oil, has been encountered in much smaller quantities at Dhulian; in this instance, post-Eocene seepage may have played a part. The cross sections of these fields are shown in Figs. 4 and 5.

The Khaur field reached its maximum production of 480,222 barrels in 1929 and has since declined rapidly; although approaching exhaustion, it appears probable that a small production may continue for several years. The Dhulian field reached peak production in 1941, and this field also is now declining rapidly. Except for the small quantity of upper 'black' oil, all the production from Dhulian has been obtained from a single horizon in the Eocene limestones. The limiting factor in the Punjab oil production has been the small thickness of the oil-source beds.

With the exception of the large gas show at Jawalamukhi, in the Kangra District, no oil or gas shows have been reported in the foothills of the central and eastern Himalayas. There is thus a gap in the Indian oil-belt of some 1,200 miles, due probably to the absence of Tertiary marine deposite and oil-source beds.

Assam and Eastern Bengal :— The geology of the Assam and Arakan oil occurrences has recently been described by H. M. Sale and P. Evans[4]. Reference may also be made to the memoir E. H. Pascoe[5]. The geographical position of the oilfields of Assam and Burma is shown in Fig. 6.

The most westerly oil seepages are along the southern edge of the Khasi and Jaintia Hills; the most prolific and numerous seepages are found along the western margins of the high ranges to the southeast of the Brahmaputra-Surma valleys. Gas shows only have been reported in the neighbourhood of Chittagong, and in the Teknaf Peninsula further south,

Along the southern edge of the Shillong plateau the strati-graphic succession is similar to that of the Punjab, thin marine limestones, sandstones and shales. The Jaintia Series is represented by many thousands of feet of sandstones and shales, mostly unfossiliferous. The Barails, which overlie the Jaintia or Disang Series throughout the region. are succeeded by a major unconformity representing a time intervol equivalent to the greater part of the Oligocene. The younger rocks, the Surma, Tipam and Dihing Series, include vast thicknesses of sandstones, shales and conglomerates, mostly of fresh-water origin, but including marine deposits of Miocene age at the southern edge of the Garo Hills. The total thickness of Tertiary rocks in the Surma Valley and Upper Assam is stated to be over 50,000'.

(To be continued)

References

1. Ball, V., *A Manual of Geology of India*, Part III, *Economic Geology*, 1881.
2. *Mem. Geol. Sur. Ind.*, 1929, **61** pt. 4.
3. *Mem. Geol. Sur. Ind.*, 1920, **40** pt. 3.
4. *Geol. Mag.*, 1940, **77**, 337
5. *Mem. Geol. Sur. Ind.*, 1914, **40**, pt. 2.

REVIEWS

The Intelligent use of the Microscope

by C. W. Olliver (Chapman and Hall, Ltd. London), 1947, Pp. 182, Price 12 Sh. 6 d.

While the design and manufacture of the microscope is the work of the physicist, it is used more often by workers in other branches of science, both pure and applied. This book will be of immense help to the users, both with regard to the understanding of the principles underlying the working of different parts of the instrument and the proper and intelligent use of these parts. In the first four chapters the author outlines the optical functions of the instrument in such a manner that this would be intelligible to the non-physicist. The fifth chapter is devoted to a discussion on the choice of the microscope and equipment for a given line of work. In the following chapters, the author gives a vivid account of the manner in which the microscope and its numerous accessories are to be adjusted during use, including focussing, illumination, choice of magnification for various objects, filters and photographic recording. A brief reference is made to specialised types of microscopes with binocular and stereoscopic vision, and research microscopes for metallurgy, petrology and bactereology.

The book serves as an admirable guide to the biginner in the use of the microscope either for routine work or for research. Descriptive and explanatory notes are well illustrated with clear diagrams and photographs. It will form an useful addition to libraries of educational institutions.

I. R. RAO.

The Microscope, its Theory and Applications, by J. H. Wredden (J. and A. Churchill Ltd., London), 1947. pages XXIV + 296, Price 21 S.

The book contains a lucid historical introduction of 16 pages (by W. E. Watson Baker F. R. M. S.) in which the story of the development of the microscope is well presented.

The book is divided into 12 chapters, each fully illustrated and giving a vivid and critical description of the points discussed. The reader is enabled to formulate ideas so necessary for handling microscopes with ease and confidence.

Chapter I deals with elementary optics. The laws of refraction, dispersion, achromatism, image production and magnification are explained in the conventional style with 31 illustrations. The second chapter deals with the compound microscope. A table giving the final magnification obtained by the use of watson's train of lenses is given; a similar table for Zeiss lenses would have been a useful complement. No mention is made of camera lucida either for determining the magnification or for drawing. The third chapter deals with the function, use, care and choice of eye pieces and discusses the drawbacks and advantages of different makes of eye pieces including Hommel (Zeiss). The next chapter describes the function of objectives, distinction between dry and immersion lenses, significance of N. A., resolving power and optical index. The various makes of objectives and their efficiencies are described and useful information on the use and care of objectives is provided.

The correct way of using the condenser, with and without artificial light, along with mirror and diaphragm is explained in Chapter V. Darkground illumination and the principles of ultramicroscope are also described in this chapter. Imperfect knowledge of illumination is a serious handicap in microscopy. This subject is dealt with in chapter VI and results of imperfect and perfect illuminations are lucidly brought out with the help of appropriate illustrations. Several modern types of microscopes are illustrated in the following chapter. The omission of the Zeiss model is rather conspicuous. Mechanical parts, stage and sub-stage are described. The accessories and uses of the polarising microscope are fully described in chapter VI.

Microtomy is the subject matter of chapter X. Eye piece micrometers, methods of calibration and the screw micrometer eye pieces are described. A table shows suitable magnifications for objects of verying sizes.

Fundamental principles underlying photomicrography, the use of filters and periods of exposure are dealt within the next chapter. The book closes with a chapter on the preparation of specimen slides, finishing, labelling, mounting and embedding.

The appendix contains useful conversion tables, refractive indices and formulae pertaining to microscopy.

Beginners would find in the book all the information required by them for handling a microscope. The book will be useful to trained workers also as it gives much valuable information on recent innovations in microscopy.

The book is a useful addition to the literature on microscopes and is warmly recommended to students and workers.

S. C. BISWAS.

Towards increased cloth Production by Shri Vadilal Lallubhai (The Padmaja Publication, Baroda) pp. 103: Price Rs. 3/-.

Shri Vadilal Lallubhai has presented in this book a collection of relevant documents on the subject of the textile industry, which is engaging the serious attention of the Government for sometime past, particularly since the institution of control over the industry. The main problem before the country is of increasing the production of cloth in order that the people of the country may have more cloth needed by them at the present time, due partly to an improvement in the economic condition brought about by the war, and partly to the considerable decrease in civil consumption during the war period as a result of the abnormal war demands and exports, leading to the pentup demand of cloth. The control authorities have been tackling the problem for sometime past, but they are by no means out of the wood yet. In spite of earnest efforts for the reorganisation of the industry, they have failed in achieving increased production due to a variety of reasons, e. g. labour troubles and shortage of raw materials, coal, transport, etc.

Shri Vadilal Lallubhai has done a great service by pointing out various methods in which the industry can effectively increase its production. The suggestions made by him, coming as they do from a practical industrialist, merit careful consideration of the Government of India. He has already implemented his scheme for increased cloth production in his own mills and suggests that with certain adjustments in regard to schedule of prices, it would be possible to increase production by at least another 10 per cent. He has also pleaded earnestly for a three-shift working of the mills, particularly in the spinning section, as that would also result in larger quantity of yarn being made available for the handlooms which in turn would lead to an increase in the total supply of cloth in the country.

With the installation of the National Government one can earnestly hope that they will take active steps to increase production of cloth by granting a small increase in price, if it is found necessary, particularly for the coarser varieties, in order to enable the mills to work profitably. The immediate need, it cannot be denied, is to increase production of cloth even at a little higher cost, and in this context the excellent suggestions made by Shri Vadilal Lallubhai would be extremely useful to the authorities in making their decisions.

Shri Vadilal Lallubhai has also pointed out correctly that the need of the hour is abundance of cloth supply and not of fineness. In doing so, however, fullest care should be taken to ensure that the quality of the cloth does not deteriorate, for if that happens, the life of the cloth will be shortened and even increased production of cloth, if it is of shorter durability, will mean no solution of the problem of cloth to the people of the country

The priced catalogue of B. D. H. Laboratory Chemicals and Testing outfits, 1946, pp. 241

The *British Drug Houses Ltd.*, have issued a fresh edition of their priced catalouge of B. D. H. laboratory chemicals and testing outfits dated September 1946. It comprises nearly 6,000 different products. Because of the necessity to use less paper, the usual separate "export" issue in which the prices include cost of containers, is not published. The prices quoted in the list are not firm but are intended as a guide to the value of BDH products at the time of issue.

NOTES and NEWS

Imperial Institute, London

The Annual Report of the Institute for the year 1946 show that the various departments were fully engaged throughout the year with work of a normal type, the inquiries of wartime character having ceased. A feature of the year was the resumption of the meetings of the Consultative Committees which had been suspended during the war.

The Committee on Insecticide materials of vegetable origin conducted investigations on *Milletia Pachycarpa* roots for use as a substitute for derris roots. Roots from Assam and North East India contain up to 3.5 per cent rotenone. The Committee was of the opinion that as the plant had low rotenone content it was of little value for export or for local use. The Committee on vegetable fibres has prepared useful reports of the development of fibre industries in various countries. Among these are reports on the development of the abaca industry in Central America, Phormium industry in St. Helena, sisal industry in East Africa and an account of the recent researches carried out by the Linen Industries Research Association.

The Institute carried out investigations on Lemongrass oil from Trindad and Tanganyika, cultivation of virginia tobacco in Cyprus, composition of black pepper from Sierra Leone, Cinnamon bark from Seychelles, tung fruit from Sudan, commercial utilisation of papyrus from Palestine and researches on the quality of hard and soft rubbers.

The Exhibition Galleries of the Institute are undergoing extensive changes and several new exhibits have been received and placed in appropriate courts. Of special interest to Indian readers is the work carried on in the Indian Court. The exhibit of 26 India's principle minerals is almost complete. A new and experimental type of display has been introduced in this section. A cubical wooden case in which an arrangement of mirrors in conjunction with a shutter revolving round a light, enables first one picture and then another to be seen through the glass front of the case. Each picture gradually dissolves into another, the device being particularly suitable for displays of the "before and after" type. Tobacco and cotton are two of the subjects to be so displayed. The Institute intends to erect a battery of four of these "dissolving pictures" in the Colonial Annexe to illustrate the progress which science has made possible in various parts of the Colonial Empire. The subjects chosen are Medical Science, Soil Erosion, Irrigation and Harbour Works.

The Government of India and several of the States have approved of the additions to be made to their respective courts. The Government of India propose to spend £ 966 on flourescent lighting, panels depicting life in India and mechanical models illustrating iron and steel and sports goods industries.

The Indian Association for the Cultivation of Science

According to the Annual Report of Association for the year 1946, the following investigations were carried out in the Association Laboratories:—X-ray studies on (1) Molecular derangement inside crystal lattice, (2) analysis of crystals, (3) Structure of metals and alloys, (4) Investigations of glass systems, (5) Indian Coal-other investigations include, (6) Electrical conductivity of molybdenite crystals and (7) Studies in fluorescence.

The Government of India have sanctioned a research grant of Rs. 4,32,000 towards capital expenditure, and Rs. 1,59,000 towards recurring expenditure for 1947-48. A recurring grant of Rs. 2,46,700 for 1948-49 and subsequent years, and an interest-free loan of Rs. 5,00,000 for building construction have also been made.

Dr. B. C. Law Gold Medal for 1945 has been awarded to Prof. R. Robinson.

A scheme of research on X-ray investigation of metal alloys to be carried out in the Association Laboratories has been scrutinised by the Council of Scientific and Industrial Research, and a sum of Rs. 4,050 was provided for this work during the year 1946.

Indian Research Fund Association

Notable advances in our knowledge of cholera, malaria, leprosy and plague, nutrition, indigenous drugs, manufacture of penicillin and of problems connected with industrial health and child welfare have been made as a result of research carried out under the auspices of the Indian Research Fund Association, according to the report of the Association for the year 1948.

Mr. P. Bruce White of the U.K. Medical Research Council was invited by the I.R.F.A. to conduct cholera research in India. In collaboration with Dr. Shrivastavas, a study of the closer relationships of the sub types of the *cholera vibris* is being undertaken. In field trials, sulphaguanadine has proved of value in the treatment and prevention of cholera.

The Malaria Institute continued its work on the preparation of DDT emulsion concentrates. An emulsion containing 35 per cent. DDT has been prepared using medium kerosine extract and turpentine as solvents. This emulsion concentrate, unlike the turpentine—toluene emulsion concentrate is not highly inflammable. Preliminary experiments have shown that DDT suspension in water, when applied as a residual spray against adult mosquito, is as effective as DDT emulsions or solutions. The sulphone druggs—promin and diasone, have proved effective in the treatment of leprosy but were highly toxic. The Haffkine Institute has prepared a new plague vaccine from casein hydrolysate medium,

which has better keeping qualities and higher potency than meat digest medium vaccine. The vaccine has the added advantage of retaining its potency for long periods at ordinary temperatures. Preliminary trials are being conducted at the King Institute, Guindy, Madras, for the manufacture of influenza vaccine.

The Nutrition Research Laboratories at Conoor have conducted investigations on Lathyrism, and Khesari dal (*cathyrus sativus*) has been shown to be the causative factor and not *vicia sativa,* whose seeds are frequently present as an adulterant. Studies on Phrynoderma (frogskin disease), has shown that the disease is due to lack of Vitamin 'B' complex in the diet and not due to Vitamin A deficiency as is generally supposed. Examination of a large number of cereals and pulses has demonstrated that the use of nitrogenous manures has a considerable influence on the vitamin content and nutritive value of the food grains.

The effect of different methods of drying and of the age of plantation on the pyrethrin content of pyrethrum flower heads was investigated at the Drug Research Laboratory, Jammu, Kashmir. The final pyrethrin content was highest in flowers dried for three successive days in the sun, the drying then being completed in shade. There is a gradual decrease in the pyrethrum content of the flower heads with increasing age of the plant. The decrease becomes appreciable after 3rd or 4th year of the life of the plant. Experiments to investigate the proper time of collection of belladona leaves from *Atropa accuminata* (*Via*) showed that the best time of harvesting is in early August when the plants start flowering.

An enquiry into methods of manufacture of penicillin and other problems connected with it was set up at the Haffkine Institute Bombay. A comparison of three different methods of extraction, viz., Claytons, *etal,* Bergers and Bests has been carried out and a modified method has been developed. Prior to the extraction by Borger's technique, a suitable quantity of ammonium sulphate is added to the culture fluid. This precipitates the inactive pigments ensuring a more complete extraction and effects a considerable saving in butanol which is insoluble in aqueous solutions containing ammonium sulphate. Penicillin contained in the butanol extract is chromatographed on a column of Brockmann's alumina. By this means, a highly purified and concentrated solution of penicillin in the form of its sodium salt has been obtained. The solution is reddish orange in colour, changing to light yellow on dilution. It has a bitter taste and a faint characteristic odour.

Work on essential oil bearing plants growing wild in Kashmir Valley was continued during the year and the following plants were studied:— *Acorus calamus,* widely used in indigenous medicine for treatment of asthma, dysentry, and as an emetic; *Cinnamon tamala* (Tejpat), used as a substitute for Cinnamonbark; *Hyssopus Officianalis,* the leaves of which are used as a stimulant, stomachic, expectorant and diaphoratic; *Angelica glanca* (Chora), used in treatment of dysentry, constipation and as a cordial tonic and *Eholtzia densa* (Pudina).

Cooperative Farming in Palestine

A delegation of officials and non-officials led by Dr. T. G. Shirname, Deputy Agricultural Marketing Adviser, Government of India, was sent last year by the Government of India to Palestine to study the methods of co-operative farming in that country. The report of the delegation recently released to the press, deals with the organisation and working of the co-operative farms developed by the Jews in Palestine . The report states, "It is obvious that collective and co-operative farming as developed in Palestine exhibits a new way of living and working, bringing together people who very largely share the same economic, political social and religious views. It is a unique experiment in the world in that it has been successfully executed on purely voluntary efforts."

Discussing the achievements of Co-operative farming, the Report states that the greatest difficulty in adopting mixed farming in Palestine, was the absence of irrigation water which was practically unavailable until 1930. Since then irrigation has progressively advanced, and underground water has been extensively tapped, reservoirs have been built and irrigation systems have been said to serve a number of settlements at a time. Electric power is available at a cheap rate all over Palestine and is freely used in the irrigation system on co-operative farms.

Among other improvements in agricultural practices are: (1) Soil fertility maintenance by a careful conservation and application of manure from the farm dairy and poultry. In addition, green manuring and growing of leguminous crops is followed; (2) Soil erosion control by contour cultivation, terracing and planting of trees; (3) Drainage of swampy lands by digging trenches, and reclamation of salty lands; (4) under the system of mixed farming followed by the Jews, the best lands are under fruits, vegetables and green fodder where irrigation is available, and food grains are grown on poorer grades of soil; (5) from the agricultural point of view, the greatest progress has been made in dairy farming, the average annual milk yield being amongst the highest in the world. Similar has been the progress in poultry keeping. In addition to sheep farming and pisciculture, a large number of subsidiary industries like packing cases, vegetable crates, water meters, fruit products, agricultural machinery, etc., contribute a major part of the income of a few settlements.

Among the important advantages which have accrued as a result of co-operative effort in Palestine are: (1) Optimum exploitation of land resources; (2) Larger output per unit of land, livestock and poultry; (3) Rationalisation in methods of production, sale and purchase; (4) Ability to cope with problems like plant pests and diseases, health and sanitation, education, etc; (5) Facility for large scale expansion of agricultural production with relatively unskilled or indifferent labour. 1

On the question of the adaptability of Palestine collective farming to Indian conditions the report states that social and political factors responsible for the development of Palestine are absent in rural India and it is difficult to create such conditions.

The soil, rainfall and climatic conditions are more favourable in many parts of India than in Palestine, but the financial resources at the disposal of the Jewish immigrants were ample and readily available. Building up an improved agricultural organization on lands newly acquired with labour always ready to imbibe new ideas and work hard was a comparatively easy matter. An average Indian farmer would never agree to live and work collectively but the problems of optimum exploitation of land, conservation of soil fertility, increasing output and the prevention of erosion of best men and women from villages, and building up a sound rural society, are of fundamental importance. It must be made worthwhile for the Indian farmer to continue to live in villages.

The report suggests that experiments on co-operative farming should be taken up on a wider and intensive scale in India. Small demonstration units should be set up in each province to make a start. Soldiers, who were stationed in Palestine, and who had the opportunities of studying and receiving instruction in co-operative farming methods should be utilised to man these demonstration farms. To make the Scheme practicable from the economic and organisational points of view the Report recommends a whole district as a good economic unit. The feasibility of settling landless labourers on State and other available cultivable land might be examined.

Emphasising the importance of the human factor, the Report states "apart from the farmer and his land and capital resources, the most important factor which would determine the extent of success or failure in co-operative farming and marketing would be the public or Government agency entrusted with this work. No amount of expenditure would assist if officiers and others in charge of this task act in a mercenary manner. Every one of them must make this as their life's mission to be performed for the good of the country with the greatest possible zeal and honest effort. The members of the public in general and the social and political leaders in particular must also adopt the same attitude and encourage at every possible opportunity the work of extending co-operation in every possible field of the social and economic activities of the Indian farmers."

Indian School of Mines and Applied Geology, Dhanbad

The Indian School of Mines, Dhanbad, which is to be called, hereafter, The Indian School of Mines and Applied Geology, will be shortly reorganised so as to keep pace with the rapid mineral developments in free India. The Government of India appointed a Committee with Mr. D. L. Mazumdar as *Chairman* to formulate proposals for the extension of the activities of the School, for an increase in the annual intake of students and generally for raising the School to a standard as near as possible to that of Royal School of Mines, London.

The report of the Committee has since been published. The committee recommends that the annual intake of the School be increased gradually from the present total of 24 to 60 (48 mining and 12 geology students). It is proposed to abolish the three year Certificate Course, and all entrants will be required to take the full four-year course. A technical Committee appointed by the Mazumdar Committee has made recommendations for the revision of the curricula of studies. Subjects like fuel technology, oil technology, refractory and ceramics, metallurgy and geophysical prospecting will be given greater attention. A scheme of post-graduate training has been propsed, to enable the graduates of the School to pass the competency examination prescribed under the regulations. This Scheme is estimated to cost Rs. 2.63 lakhs, a sum which it is urged, should be shared equally by Government and Industry.

The Indian Silk Industry

Consolidation rather than expansion is the immediate need of the silk industry in India according to the report of the Silk Panel appointed by the Government of India. A five year programme of Stabilisation and Consolidation of the industry preliminary to a phase of expansion during the next ten years has been suggested by the Panel. The industry witnessed considerable expansion during the war years, mainly through State assistance, as part of the war effort, and it is now left unsupported it may collapse. Incidentally, the Panel has made a separate recommendation that Japanese silk entering India by way of war reparations should not be allowed to undersell Indian Silk.

Consolidation and improvement of the industry can be secured through recourse to the following measures. Improvement of mulberry cultivation for which the five-year sericultural programme, successfully adopted by the Government of Madras should be extended to other silk producing regions viz., Kashmir, Mysore, Bengal, Bihar and Bombay; effective State Control to ensure adequate supply of disease-free seed for which the establishment of 300 fully equipped grainages, costing Rs. 20,000 each is recommended; Control of silk-worm disease, for which there should be in each silk producing region a special enactment as in Mysore; replacement of *charakas* by filature, a change on which the hope of the silk industry rests. The establishment of Co-operative Societies suited to local conditions is suggested; adoption of standards conforming to accepted international grading.

The Panel emphasizes co-operation among the various silk producing ones in the country and recommends the establishment of a Central Silk Board representing all silk interests.

The Panel does not foresee all India production to reach more than 4 million lbs. per annum at the end of 15 years. To enable this production mulberry cultivation should be expanded to cover 1,62,500 crores in the next 5 years, and 1,87,500 crores (excluding Kashmir) in the third quinquennium. The annual consumption at the end of 15 years is estimated at 15 million lbs.

Sugar cane Research

The Sub-committee of the Indian Central Sugar Committee it is learnt, has recommended a comprehensive scheme of fundamental research on sugarcane costing Rs. 15 lakhs in the first instance, with a recurring annual expenditure of Rs. 3.5 lakhs. The

Coimbatore station, will be greatly expanded, and a large number of specialists for research on Chemistry, botony, genetics, mycology and physiology will be oppointed. Technological studies of direct value to the sugar industry will be carried out at the Central Sugar Tecnhological Institute, Lucknow, and breeding work will be continued at the Shahjahanpur Sugarcane Breeding Station.

Temperature Indicators

An inexpensive and simple temperature indicator for use with pilot baloons, designed by the late Rai Bahadur G. Chatterji of the Agra Observatory, has been recently described (Sci. Notes, India, Met. Dpet., 1947, 9, No. 106). The instrument consists of a two pronged fork made of bimetallic strips which open outwards as the temperature falls. At the pre-desired or "set" temperature, this opening out releases a trigger held between the prongs which, in turn, burns a string holding the instrument to the baloon. The fall of the instrument is watched through a theodolite and the height of the fall thus determined easily. A knowledge of the surface temperature and the "Set" temperature and the "Set" temperature easily gives the lapse rate in the atmosphere between the surface and the height of fall.

A knowledge of the lapse rate of temperature, or rate of decrease of temperature with height in the lower layers of the atmospheres is of great value to meteorologists in the study of atmospheric instability, which is the cuase of such phenomena as thunderstroms and dust stroms. Lapse rates also help in the identification of air masses which is an important step in weather analysis.

Mechanical sterilization of flour

A Sydney flour milling firm has installed a machine which cleans flour by spinning weevils and other infesting insects in the flour to death. The machine called an "ENTOLETOR", operates on the centirfugal principle. The flour is fed by chutes into a cabinet housing a conical rotor in the centre of two steel discs joined at the outside by metal studs. Directed on to the remolving rotor, the flour is flung against the outer studs with such force that no insect, weevil, moth, egg or mite, is left alive. The rotor spins at 2,900 r.p.m. and a 1.5 h.p. machine handless 2,000 lbs. of flour an hour. A 7.5 h.p. model can handle 15,000 lbs. of flour per hour. Treated in this way, the flour remains sterile indefinitely and tests have shown that the machine improves the flour by giving it greater aerating qualities.

Monazite for Electrode Cores

Among the latest developments announced by the Australian Council for Scientific and Industrial Research is the use of monazite in the manufacture of carbon electrodes for searchlight. The positive carbons of a searchlight have a core consisting of a mixture of powdered carbon and fluorides of the cerium group of metals. It has been found that sands from the beaches of Northern New South Wales and Southern Queensland contain considerable quantities of monazite from which cerium fluoride can be prepared.

Cored carbons made from Australian materials have been tested in a searchlight arc lamp, and were found to be in no way inferior to those made from imported cerium fluoride.

Pyp Grass to cheak sand drift

A seed producing variety of pyp grass from South Africa introduced in Australia, has spread extensively and successfully checked soil drift by binding the soil.

Successful establishment depends largely upon early moisture conditions. The above-ground foliage should be cut to minimize water losses from roots and sufficient soil retained around roots to prevent excessive drying out before replanting. When soil and moisture conditions are adequate, plough furrows should be placed 8' to 10' apart, and the roots distributed at intervals not more than 10' in the furrows. It is preferable to plant the roots at a depth of about 9".

The Electronic Switch

To observe several phenomena recorded simultaneously on one screen with the help of an oscillograph, Philips Technical Laboratories have placed on the market an electronic switch type number GM 4580, which can be used with an oscillograph. The phenomena are visualized on the screen alternately, and this takes place so quickly that the intervals are invisible. The images are formed automatically and rapidly with the help of an adjustable switching frequency. There is no distortion of images and the images can be moved simultaneously over a certain distance in the vertical direction. It is possible to visualize three or more phenomena on the same screen, when two electronic switches are used.

The multivibrator frequency of the GM 4580 is adjustable between 2.5 and 40,000 C/S, offering a wide range from which to select the optimum switching frequency with respect to the frequency of the alternating voltage with which one is concerned. An electronic switch is the ideal instrument in all cases where a twin-ray oscillograph is unsuitable for certain measurements and for all single-ray oscillographs.

Germanium

The most important use for germanium is in the making of television viewing screens. It has been used also in photoelectric cells and in the treatment of anaemia. Alloys of the metal provide high grade thermoelectric couples for specific purposes. In its pure form germanium almost completely resists attack by hydroflouric acid. Small additions of the metal improve the strength and rolling properties of aluminium and magnesium alloys. It is incorporated in stainless steels and in the production of an alloy with gold which has a low melting point eutectic (356° C). The metal can be electrodeposited directly from a strong solution of the dioxide in potassium hydroxide (*Ind. Chem.*, 1947, *23*, 77).

The main sources of germanium are flue dusts from roasting chambers of zinc blende, cassiterite, tin-antimony-lead ores, certain silver sulphide ores and tantalite, condensed zinc oxides and ashes from certain coal deposits of Durham and Northumberland.

Portable Air Compressor

A new, light weight, air compressor of high efficiency has been placed on the market by *Hymatic Engineering Co. Ltd.*, of Reddith, Worcester, (*Iron and Steel*, 1946, Sept.). It is intended for the operation of medium-size pneumatic tools, paint spraying and similar purposes. The outfit is the result of intensive experience in the production of lightweight compressors for aircraft during the war years.

The compressor unit consists of a 125 cc. two-stroke, petrol engine and a single-stage compressor mounted in line on a common crankshaft. The crankcase is a single magnesium casting, partioned to provide separate chambers for the engine and compressor cranks, which are opposed at 180° for balancing purposes. The crankshaft is supported on five ball and one roller bearings and both con rods have roller bearing big ends.

The two-stroke engine is of the latest design with a flattopped piston. The gas enters by two angular transfer ports which give a loop swirl to the gases and so better blending and combustion. The use of a flat-top piston gives a long life between decokes and two hundred hours' running can elapse before decarbonization. Lubrication is by the petrol-oil system and a governor mounted on the crankshaft controls the engine speed for any required output.

The specially designed compressor uses special steel plate valves. The cylinder barrel is of aluminium with a cast-iron liner, and the cylinder head is fitted with an automatic regulator valve which adjusts the air intake to the required air flow at any given moment, so saving fuel. Cooling is by air drawn by an impeller fan mounted on the fly wheel magneto. The air is directed round the cylinders by a volute-shaped one-piece magnesium casting. The frame is all welded of tube and its weight is only 5 lb. An interesting feature of the design is the use of the frame as a cooler for the compressed air and also as a water and oil trap.

The overall dimensions of the set are 20.5" x 24.5" x 15" and the compressor gives a pressure of 80 lb. at 2,800 r.p.m.—Courtesy, *U.K. Publicity Offices, New Delhi.*

Guayule cultivation in U.S.S.R.

The rubber-processing factory recently built in Azerbiadizhan will be able to process 1,000 metric tons of guayule a year, indicating a yearly output of 100 metric tons of pure rubber, reports the Soviet press. During the late months of 1946, the plant was expected to process 300 metric tons of guayule. An increase in guayule acreage and the construction of an additional rubber-processing factory have been planned. The number of guayule bushes per acre averages between 4,000 and 6,000 each bush weighing 1 to 1.2 kgm (2.2 to 2.6 lbs). of the different varieties of guayule, *Pioner Karabakha* has been found the most productive.

Mechanical Engineering Research in the U.K.

A press release from the Department of Scientific and Industrial Research, London, announces the setting up, by Government, of a special organization to carry out scientific research in mechanical engineering. The main object of the new organization will be to carry out basic research in mechanical engineering science for the general benefit of industry throughout the country as a whole, and so assist British industry to maintain and extend its position in the forefront of industrial advance. The researches will provide a sound foundation of scientific knowledge on which specific industrial development projects of the future can be based, and be a store of knowledge and research experience from which many industries will be able to draw for their particular needs.

The purpose of the new establishment will be to provide a convenient centre for the experimental work; groups of research workers will be organised in each of the main branches and the necessary equipment, some of which will be on a fairly large scale, will be designed and installed. The research workers will be mainly engineer-scientists, but will also include physicists and mathematicians. It is intended that in due course much of the work in progress will be well ahead of the immediate requirements of industry, and that the reputation and standing of the new establishment will be such that other research groups and firms will naturally turn to it for the information and advice before starting on new projects. The man-power required for effective research in the various groups will vary because the research treatment of some of the subjects has still to be evolved and the scale of effort required will increase as they are developed. Close contact will be maintained with Industrial Research Associations, since these provide a most convenient way in which the results of fundamental and generic research can be made known and applied in industry. In the mechanical engineering industry there are a large number of firms which are too small to carry out much research for themselves and are not served by a particular research association; these firms should derive benefit from the results of the research to be carried out at the new establishment.

The evolution of a central establishment of this kind will take several years; in the interim period it is proposed to make the fullest possible use of existing facilities, particularly those at the National Physical Laboratory and in the mechanical engineering faculties of the Universities.

The subjects in which research is expected to be carried out are:

(a) Properties and strength of materials.

(b) Mechanics of solids, stress, stability and vibration of structures.

(c) Mechanics of fluids; aerodynamics, gas dynamics and hydraulics in their mechanical engineering applications.

(d) Lubrication, wear and mechanical engineering aspects of corrosion.

(e) Mechanisms, engineering metrology, and noise control.

(f) Mechanics of formation of materials; machine shaping of materials.

(g) Heat Transfer, heat exchange apparatus and applied thermodynamics.

Dr. G. A. Hankins, Superintendent of Engineering Division of the National Physical Laboratory, D.S.I.R., has been appointed Director of Mechanical Engineering Research. As with all other research organisations in the D.S.I.R., the Director will be advised by a Board, consisting of eminent scientists, technicians and industrialists, serving in their personal capacity and not as representatives of any organisation to which they may belong.

The location of the Research Station has not yet been decided. For the time being much of the work will be carried out at the National Physical Laboratory, while other work will be arranged for at Universities and other institutions. It is clear that the new station will have to work in the closest liaison with the N.P.L., which has a long tradition, in its Engineering Division, of engineering research of high quality and which will provide the nucleus, in due course, of the new organisation.

The NewZealand Department of Scientific and Industrial Research

A review of the war-time activities of the Department of Scientific and Industrial Research, New Zealand, have revealed a number of ways in which, new knowledge gained in the interest of defence during the war period has potential application for peacetime requirements of the country, particularly, in the field of manufacturing industries, according to the Annual Report of the Department for the year 1946. The Department has kept abreast of scientific developments in the world, and is exploring the peacetime possibilities of these developments in New Zealand. The use of radar to assist coastal navigation and of antibiotics in the control of plant and animal diseases are among those receiving close attention.

Progress in all branches dealing with problems of primary industry has been marked during the year under review. The problem of soil conservation, a very vital one for New Zealand, has received special attention. The Soil Bureau, Grasslands Division and the Botany Division have jointly investigated the areas where soil erosion is in progress or threatend and initiated investigations in the problem of soil fertility. To promote better and economic utilisation of pastures, the Grasslands Division has continued to breed, test and multiply improved strains of grasses and clovers. Grass-grab, the major insect pest affecting pastures, is being investigated by the Entomology Division. A wide range of diseases affecting crops have been studied in the Plant Diseases Division and noteworthy success has attended methods for overcoming a group of bacterial diseases with copper sprays. Ready means have been devised for controlling moulds which stain plaster walls and others which attack fabrics.

Wheat research has proved singularly valuable. When scarcity of wheat demanded 80 per cent. flour extraction, a machine was devised by the Wheat Research Institute which rendered this possible without loss in the nutritive value of the flour. A new high protein wheat has been bred by the Institute and tested in the field. The Woolen Mills Research Association has had a successful first year since incorporation, and good progress has been made in testing the anti-shrink process on a commercial scale. Molecular distillation of fish liver oils has been under close investigation in the Dominion Laboratory at Wellington and as a result of improved technique vitamin A concentrates equivalent to 1,000,000 I.U. per gm. from New Zealand fish liver oils has been produced.

Diploma Course in Electrical Engineering

With a view to attaining uniform standards in Engineering Education, the All India Board of Technical Studies in Engineering and Metallurgy have instituted, in the first instance, Diploma and Certificate Courses in Electrical Engineering. The All-India Diploma Course is a full-time three years' course in an affiliated institution followed by one year of practical training. The Diploma has been officially recognised by the Federal Public Service Commission for admission to examinations held by them for recruitment to posts under the Government of India. The Certificate Course is a part-time course of three years' duration. Persons employed in workshops and industry are eligible for this course.

ANNOUNCEMENTS

World Information Conference

The U.N. Economic and Social Council has decided to call on international conference on freedom of information and the press in Geneva, Switzerland, on March 23, 1948. It referred to a committee a suggestion that participation in the conference should be extended to all nations which attended last year's World Health Conference.—*American Newsfile*, July 29, 1947.

All-India Medical Institute

The Sir Lakshmanaswamy Mudaliar Committee has reported to Government on the location of the *All-India Medical Institute*. The Committee has selected Delhi for the location of the Institute. It has also made detailed recommendations for the equipment and staffing of the Institute which has raised the estimate from Rs. 2½ crores to Rs. 4 crores. The Report is now under the examination of the Government.

REPORTS FROM STATES & PROVINCES

BOMBAY

Palm-gur Industry

The Government of Bombay have approved the village Industries Committee's Scheme for the development of Gur Industry in the Province. Under this Scheme 40 families of agriculturists are to be trained in the manufacture of palm-gur for home consumption, five model centres,—three for date-palm gur one each in Gujarat, Maharashtra and Karnatak, and two for palmyra, one in Gujarat and one in Karnatak,—and one sago palm trial centre to train tappers in the manufacture of palm-gur as a whole time occupation, are to be established in the Province.

SIND

Trading Estates to aid industrial Development

As a part of their post-war industrial development programme, the Sind Government are establishing a number of planned industrial zones or trading estates at Karachi, Hyderabad and Sukkur. Each of these areas will be provided with rail and road facilities, power and water at competitive rates, and where possible a certain amount of labour accomodation. By providing land for industrial building purposes, the Government hope to relieve the manufacturer of the troubles of individual negotiation with public authorities and of heavy capital expenditure.

The planning for the first of these trading estates is now in hand, and the Karachi site has been selected. Development at Hyderabad and Sukkur will commence early in 1948. Sites in these industrial areas will not be thrown open for sale but will be rented or leased out. Tenants will not be allowed to sub-let their holdings.

Each estate will be planned in accordance with the latest principles of industrial layout. These include sufficient space for all factories to expand by 50 per cent., easy access to roads, and rail facilities for those who require it. An administrative building forms part of each estate, in which a post office, bank, police post, etc., will be provided.

To assist the early development of industries, the Government have decided to build a number of "Standard pattern" factories on the same lines as in the United Kingdom. The factories will be approximately 4000,8000, and 25,000 sq. ft. in area.

The Government hope that this measure will assist in rapidly developing the latent industrial enterprise in the province. Further information regarding the Trading Estates Scheme can be had from the Industrial Development Officer, Government of Sind, Karachi or the Director of Industries, Sind, Victoria Road, Karachi 4.

UNITED PROVINCES

Marl Deposits

With the intention of providing an impartial opinion on the possibility of establishing a Portland Cement works in the United Provinces dependent on marl, Sir Cyril S. Fox has prepared a report after visiting the sites of the deposits in the Lucknow and Unao districts, and a careful examination of the maps, plans and available literature on the subject. The work was carried out on behalf of the *National Cement, Mines and Industries Limited, Calcutta.* Marl is a calcareous clay or intimate mixture of clay and particles of calcite and dolomite, and fragments of shells. Sir Cyril Fox affirms that large quantities of marl occur in the subsoil of old river channels in many places in the Bara Banki, Lucknow, Rae Bareli and Unao Districts of the United Provinces and that only a fraction of these have been explored. The available information give good grounds for believing that a Portland Cement works could be erected with little difficulty and on a commercially satisfactory basis in the Ramnagar area of Bara Banki and in Goshainganj area of Lucknow, in the Dalmau area of Rae Bareli and in the Ajgain area of the Unao. As there are several new aspects in connection with this industry it is a matter which needs generous treatment by the Government of the United Provinces in the aquisition of surface rights and monopolistic grants. *Capital,* Aug.7, 1947,*P,* 266).

Nutrition Institute

A research institute with facilities for investigations on the nutritive values of foods and diets will be established by the Government of U.P. The instutute will have a division for the dissemination of information relating to nutrition to the public.

Housing plan

The Committee appointed by the Government last year to draw up a plan for urban, rural and industrial housing, has recommended a target of 10,000 unit houses in three years for big cities at an estimated cost of Rs. 13 crores. A unit house has been described by the Committee as one fetching a monthly rent of about Rs. 50."

HYDERABAD

Central Laboratories

The Government have sanctioned a non-recurring grant of Rs. 15,00,000 and a recurring annual grant of Rs. 2,76,000 for the Central Research Laboratories for Scientific and Industrial Research. Orders for the equipment required have been placed in the United States of America. The Central Laboratories, besides undertaking testing and research, also provide technical help and advice to industrialists and

to Government Departments. The Laboratories will be located on a spacious site of 56 acres near the Osmania University.

INDORE

Expansion of Industries

During the year 1946-47, the Government sanctioned the establishment of 32 large-scale and small-scale industries in the State. They include 18 oil expellers, 2 hosiery factories, a soap factory and a biscuit factory. Sanction has been accorded for the erection of a second factory for the manufacture of tin containers with a capacity of 1,000 tins per day. 4 metal pressing factories are to be started to roll circles and to turn out pressed utensils. A workshop for the manufacture of scientific instruments is to be started with a capital of 25 lakhs. The oil mills in the State have been permitted to set up additional plant for the manufacture of paints and varnishes. A factory for the manufacture of thymol will be established by the Government in the extensive *Ajwan* growing tracts of Mansa in the northern part of the State. Proposals for the establishment of paper, plastics, glass, sugar, rayon and razor blade factories are under consideration.

The Government have accorded sanction for the establishment of an Industrial Laboratory to conduct analytical and other work on minerals. The State has granted exemption from customs duty on imports as well as exports of all materials required for and produced by industrial concerns in the State with a view to promote industrial expansion.—(*Contributed*).

MYSORE

Radio Industry

A factory for the manufacture of radio receiving and television sets and component parts thereof has been set up under the patronage of the Government. *The Mysore Airmec Ltd.*, which is responsible for this new activity will be assisted by *Airmec, Ltd., London*. It is proposed to produce about 200,000 radio sets per annum. In the initial stages, the factory will assemble sets from imported component parts.

Trade Marks

The Government of Mysore have entered into reciprocal arrangements with British India whereby trade marks and certification of trade marks registered under the *Mysore Trade Marks Act* shall have protection in British India. Similar arrangements have been made with Baroda, Cochin, Travancore, Jaipur, Kapurthala and Kolhapur States.

Electrolitic alkali Industry

The Mysore Alkali and Chemicals, Ltd., Bangalore, have on hand a project for the manufacture of 2,500 tons of sodium hydroxide per annum. The factory will be located at Bhadravati, which offers many advantages notably power facilities, supply of wood fuel, transport and water facilities and skilled labour. It is proposed to manufacture also bleaching powder, hydrochloric acid, ferric chloride and other chlorinated products. All the products will be sold within the State of Mysore which offers the advantages of a closed market within an economic distance of the factory.

The initiative for the establishment of an alkali industry in the State was taken in 1927 by Mr. S. G. Sastry, then Director of Industries and Commerce. The question was recently examined by the Board of Scientific and Industrial Research in Mysore, and the feasibility of the project having been established, the Government granted an import licence to the Mysore Alkali and Chemicals, Ltd., for the import of necessary plant and machinery. The project has been planned by Mr. S. G. Sastry, who as Technical Adviser to the Company, will supervise the erection of the machinery and equipment.

Mysore has a well established heavy chemicals industry. Sulphuric acid, ammonia and fertilizers are being produced at Belagula. When the new factory comes into production, the State will have the necessary basic chemicals for the development of many secondary industries.

PATIALA

Hydro-Electric Project

Government have sanctioned a hydro-electric project for generating 16,000 kw. of firm power at a load factor of 70 per cent. The project comprises a dam near Simla across the river Ashni about 4 miles from Kandaghat, a concrete lined tunnel 8' diameter and 5½ miles long and a power house at Gauhra near the confluence of the Ashni Nadi and the Giri tributary of the river Jumna. The catchment area above the dam site is 62 sq. miles and the top of the dam above stream bed will be 440'. The project is expected to take 4 years to complete.

TRAVANCORE

Scientific Research

Laboratory experiments carried out at the Central Research Institute have revealed that a special grade of bitterns recovered from salt pans can be satisfactorily used in place of aluminium sulphate for the purification of water.

The Applied Chemistry Division of the Institute is engaged in the soil survey of the State. The Surveys indicate that Travancore soils are generally poor in lime, phosphoric acid and nitrogen.

Successful methods have been devised to combat the "bunchy top" disease of banana and "Thrips" of cardamom. A solution of nicotine sulphate is effective against thrips and 'Gammexane' has been successfully employed to kill the plantain *aphis* responsible for the bunchy top disease.

INDIAN PATENTS

[The following is a List of Patent Applications notified as accepted in the *Gazette of India*, Part II, section I, for May-June 1947.]

29338. IMPROVEMENTS RELATING TO THE PRODUCTION OF MOTOR OR AVIATION FUELS (14TH FEBRUARY 1941): *Normal paraffins are removed from the distillate of gasoline boiling range and subjected to catalytic reforming.*—Anglo-Iranian Oil Co., Ltd.

29339. PRODUCTION OF HIGH GRADE AVIATION FUELS FROM CRUDE PETROLEUM OILS: *Mineral oil distillate is subjected to superfractionation for the recovery of hydrocarbons of high octane and low octane number than to recovery of aromatic hydrocarbons from the distillate.*—Anglo-Iranian Oil Co., Ltd.

30107. ELECTRON DISCHARGE TUBES: *Arranged for beam of electrons to be produced, deflected or modulated to enable alternating energy to be taken off from output electrode system.*—Harries.

30723. COMPOSITE FABRIC: *Comprising a layer of metal filaments or wires inside by side relationship between textile; the whole being bonded by an adhesive.*—Dunlop Rubber Co. Ltd.

30893. ELECTRIC OSCILATORS: *An inhibiting bar placed parallel and symmetrically to the pair of parallel rods of the ocsillator.*—The G. E. Co. Ltd.

31834. CELLS FOR ELECTROLYSIS OF MAGNESIUM CHLORIDE: *Comprises an electrolysis chamber, a feed chamber and a superheating chamber connected by passages.*—The Mathieson Alkali Works.

32607 WRITING INSTRUMENTS: *Writing member comprising a ball is fed with ink from tube having internal diameter not exceeding 2.5 mm.* —Martin.

32768. PHOSPHORIC ACID CATALYSTS: *Mixture of compounds of phosphoric acid, calcium and copper.*—Anglo-Iranian Oil Co. Ltd.

32779. CARRIER TELEPHONE SYSTEMS AND THE LIKE: *Frequency modulated operation, two receivers, at the output local oscillator frequency added in such phase and magnitude that undesirable local signal is cancelled.*—The G. E. C. Ltd.

32812. CHLOROCRESOL DERIVATIVES: *Reacting a chlorocresol with and haloalkycarboxylic acid in the presence of an alkali metal hydroxide and adding an aqueous solution of an alkaline earth metal salt.*—I. C. I. Ltd.

32813. CHLOROCRESOL DERIVATIVES: *Chlorinating a cresol and subsequently reacting with ad-haloakylcarboxylic acid.*—I. C. I. Ltd.

32862. SEPARATION OF ONE OR MORE METALS FROM ALLOYS. (ADDITION TO NO. 32861): *Suitable salt mixtures used alone.*—The Indian Standard Metal Co. Ltd.

32869. PLASTIC COMPOSITIONS: *Incorporation of sulphur treated unsaturated hydro-carbon extract from mineral oil in polyvinyl halide and its polymers.*—Anglo-Iranian Oil Co. Ltd.

32918. CYCLOPENTANE FROM CYCLOPENTADIENE: *Hydrogenating cyclopentadiene in the presence of hydrogen and diluent.*—Anglo-Iranian Oil Co. Ltd.

32923. SLITTING TUBES OR STRIPS OF INSULATING MATERIAL AND APPARATUS FOR CARRYING IT OUT: *A line of weakening along a length is produced by subjecting material to a narrow concentrated high frequency alternating field and thereafter bearing along this line.*—British Insulated Cables Ltd.

32925. SATURANTS FOR POWER CABLES ELECTRICAL CONDENSERS AND THE LIKE: *Saturant cables and condesers obtained by treating a mixture of rosin and crude mineral lubricating oil with sulphuric acid.*—Dussek Bros. & Co. Ltd.

32939. PRESSURE-SENSITIVE ADHESIVES AND ADHESIVE TAPES AND METHODS OF MAKING SAME: *Adding a vulcanising agent to an elastomer, applying on a backing and vulcanising the coating.*—The Cofax Corp.

32941 METALLIC CONSTRUCTIONS: *Constituent elements are an elongated trough or an open box and are assembled in the same plane.*—Grisard.

32949. BUILDING TYRES: *Tyre building drum, expensible fabric folding ring and means for expanding, moving and releasing said ring.* —The General Tyre & Rubber Co.

32953. DIES FOR THE EXTRUSION OF METALS: *Metal working die in which the bearing has different height in different parts of the profile.*—Comptoir Industrial D'Etirage Et Profilage De Metaux.

32967. MULTIPLE PUMPS FOR USE IN LIQUID DISTRIBUTION SYSTEMS: *Pulsating fluid pressure generated in a common conduit operating the pumps, and the liquid to be dispensed being supplied through a separate common conduit.* —Tecalemit Ltd.

33001. ELECTRIC RADIATORS AND LIKE APPARATUS: *Reflecting surfaces, which are mirror images about a vertical plane form troughs with axes parallel to the plane and a pair of straight cylindrical radiators parallel to the plane.*—G. E. C. Co. Ltd.

33010. BRANCHED CHAIN ALKENES: *Producing branched chain alkenes by contacting normal alkenes at temperatures of 100°—600° C with an acid phosphate catalyst of a metal of group, I, II, III, IV, VI, VII, or VIII.*—

33040. WASHFOUNTAINS: *Wash basin having a hollow support and spray head clamped to the top of said support.*—Bradley Washfountain Co.

33082. PREVENTION AND DESTRUCTION OF WEEDS: *Comprising as active agent a compound of the formula Ar. Ar. X. CH_2 Y and a fertiliser and/or a solid soil conditioning agent or a solid inert diluent.*—I.C.I. Ltd.

33096. NEW COMPOSITIONS OF MATTER EFFECTIVE TO ENCOURAGE THE FORMATION OF CALCIFEROUS CONSTITUANTS OF THE BODY AND PARTICULARLY TO INHIBIT CARRIES OF ERUPTED DENTAL ENAMEL: *A composition of an alkali metal fluoride, ascorbic acid and vitamin D.*—Ayerst, McKenna & Harrison Ltd.

33111. BUFFERS FOR RAILWAY CARS: *Housing, friction shock observer including friction shoes, wedge block, springs and buffing head.*—W. B. Miner, Inc.

33264. BALL MILLS PARTICULARLY TUBE MILLS: *Partial seats for balls provided by cells in the lining centres of which are disposed along a square or triangular network.*—Henricot.

33319. WIDE BAND VALVE AMPLIFIERS: *Wherein a filter, comprising series inductances and shunt capacitors, is connected to output terminals of a valve.*—G.E.C. Co. Ltd.

33320. IMPROVEMENTS IN WIDE BAND VALVE AMPLIFIERS. (ADDITION TO NO. 33319): *Of the type wherein a filter comprising series inductances and shunt capacitors, is connected to output terminals of a valve.*—The G.E.C. Co. Ltd.

33321. WIDE BAND VALVE AMPLIFIERS (ADDITION TO NO. 33319): *Of the type wherein a filter comprising series inductances and shunt capacitors, is connected to output terminals of a valve.*—G.E.C. Co. Ltd.

33323. REFRIGERATION: *An auxiliary absorber in a refrigerating system to withdraw non-condensable gases from main absorber.*—Servel, Inc.

33372. REPLENISHING PLANT, PARTICULARLY FOR AIRCRAFT: *A hollow boom through which liquid is supplied mounted to rotate about horizontal and vertical axis.*—Zwicky Ltd.

33385. UNDER-JET COKE OVENS: *A plurality of air inlet and air voiding openings disposed longitudinally and transversely of the battery basement, located at the battery level beneath the level of combustion media distributing pipes.*—Koppers Co. Inc.

33392. MICROPHONES: *The movable electrode forms one wall of rigidly constructed granule chamber sealed against moisture.*—Standard Telephones and Cables Ltd.

33400. AUTOMATIC TONE CONTROLLING CIRCUIT ARRANGEMENT FOR RADIO OR LIKE SYSTEM: *Provides positive feed-back to the amplifier valve at lower frequencies in the audio frequency range.*—Marconi's Wireless Telegraph Co. Ltd.

33405. STRUCTURAL BEAMS: *Component plates are fastened in spaced relation by a projection on one extending through an opening in the other and clamped.*—Great Lakes Steel Corp.

33413. HEAT EXCHANGE RUDDERS: *Circuitors passage in rudder provided by horizontal plates with openings at alternate ends.*—Jutte.

33444. ORGANOMETALLIC COMPOUNDS CONTAINING 1, 3, 5-TRIAZINE RINGS: *Reacting a halogen or amino derivative of 1, 3, 5 triazine with an amino or halogen derivatives of a stibonic acid compound.*—Friedheim.

33445. ELECTRIC CONTROL SYSTEM FOR CONTROLLING THE OPERATION OF VALVES OF WATER-GAS PLANT: *Synchronous timber, controls circuits of electro-hydrolic thrustors operatively connected to valve gear.*—Burns and Gibson.

33447. CONCENTRATORS FOR USE IN THE CONCENTRATION OF MINERALS AND THE LIKE: *Comprising of a sloping table, a liquid supply, oscillating means for the table, an endless flexible belt, a fixed perforated screen, grooves in transverse relating to the belt, layer of cells with open tops and slotted walls.*—Bouwer and Dorfman.

33453. MANUFACTURING BLACK TEA: *Leaf is brought to a temperature neither below that of the due point of the air to be supplied not exceeding that at which the activity of the enzyme declines.*—Bake.

33456. B. —DIMETHYLAMINOETHYL ESTER OF BENZIL C ACID, AND THE PRODUCTS RESULTING THEREFROM: *Benzilic acid is reacted with a B— dimethylaminoethyl derivative.*—Eli Lilly and co.

33457. AMINO-ALKANES: *Introducing nitrogen into ketone, hydrogenating said nitrogen derivative to produce a 2-aminoalkane and subsequently incorporating the 2-aminoalkane with a liquid extending medium.*—Eli Lilly and Co.

33466. DOOR-OPERATING MECHANISMS FOR LIFT DOORS AND THE LIKE: *A member from lift door thrust mechanically into wedge like engagement with a block on a landing door.*—The Express Lift Co. Ltd.

33493. ELECTROLYTIC RECORDING SOLUTIONS: *Electrolytic recording solutions containing diazonium ions, an electrolyte, and a napthol sulphonic acid.*—Marconi's Wireless Telegraph Co. Ltd.

33500. HOLDERS FOR ARC-WELDING ELECTRODES: *One electrode gripping element of twin electrode holder adjustable lengthwise and pivottally mounted for rocking movements in the plane containing the electrodes.*—G.E.C. Ltd.

33503. POCKET CIGARETTE AND CIGAR CASES: *Cover part is bodily lifted from body portion but is not completely separated therefrom.*—Chia.

33519. SCREW AND NUT OPERATING MECHANISMS: *Longitudinal movement of the carriage with respect to a screw threaded shaft on rotation of the latter, the carriage being adapted to be coupled to the transmission mechanism.*—Arens Controls Ltd.

33520. ROOFING TILES AND ROOFS TILED THEREWITH: *The tile has a turned-down lip along the bottom edge and a turned-up lip along the top edge with an offset between the two edges.*—Turners Asbestos Cement Co. Ltd.

33525. PRINTING CINEMATOGRAPHIC FILMS: *Carrier with register teeth, means for moulding film of plastic materials on the carrier and means for peeling the film away from the carrier.*—Technicolor Motion Picture Corp.

33532. HEAT TREATMENT OF METAL WIRE, STRIP OR LIKE MATERIAL: *A plurality of quenching baths differing in character, a contact bath with shifting means.*—Trautman.

33533. REDUCING LIVELINESS OF TWISTED FILAMENTARY YARNS: *Subjecting filamentary materials to action of high frequency, electrical field.*—Industrial Rayon Corp.

33537. A FUEL CONSUMPTION METER FOR SELF PROPELLED VEHICLES: *Level of mercury, in a large U tube connected to a small U tube through which fuel flows, indicates amount of fuel flowing.*—Bose.

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Lac-Linseed Oil Varnishes

PART II.—LAC-LINSEED OIL-GLYCERINE

By Y. SANKARANARAYANAN

(Indian Lac Research Institute, Namkum)

MENTION has been made in an earlier paper about the desirability of incorporating lac in linseed oil or other drying oils with a view to combine the film forming property and plasticising action of the oils with the hardness and gloss of the lac[1]. Unfortunately lac is not compatible with any of the common drying oils under the usual conditions of varnish manufacture but may be made to dissolve in the presence of certain metallic oxides, glycerine, etc[2]., Bhattacharya[3] takes advantage of the compatibility of the lac with the fatty acids of the oils, particularly in the presence of glycerine, and has studied exhaustively the properties of the products of condensation of these three materials in various propertions in respect of drying time, hardness and water resistance of the films. Bhattacharya and Gidvani[4] have explained the reactions involved in the process as the initial formation of mono-and di-glycerides by the esterification of the fatty acids by glycerine and it is this mixture of the mono-and diglycerides that combines with lac. Bhattacharya has further shown that at least 25 per cent mono-glyceride must be present in the glyceride mixture to disperse the lac. If this explanations is accepted, it must be much easier to combine glycerine with the drying oils instead of the fatty acids for the preparation of the glyceride mixture.

The solubility of lac in linseed oil previously treated with glycerine has been described by Aldis[2]. But in his formula of 4 parts of glycerine to 10 parts of the oil, the former is in considerable excess over that required even for the cent. per cent. formation of mono-glyceride with the result that a large amount of unreacted glycerine must be left in the reaction mixture which must influence (rather adversely) the film properties of the composition. It was considered desirable, therefore, to re-examine the possibility of evolving suitable conditions for the preparation of a glyceride mixture which would be compatible with lac using linseed oil and the minimum amount of glycerine.

A reference to literature reveals that the earlier methods of preparing drying oil glycerides made use of the fatty acids[5-8]. Recent methods, however, make use of the (triglyceride) oils themselves and glycerine as the starting materials and the reaction is generally carried out in the presence of catalysts, like alkali metal glycerates, quicklime, preformed mono-glyceride, etc. etc. [9-14, 17, 18]. A direct method avoiding the use of catalysts has also been described by Mundy [15]. While most, if not all, of the above methods have been directed towards the production of either the mono- or the di-glyceride, no mixture suitable for this particular purpose

(of compatibility with lac) has so far been aimed at.

The simplest method to produce a lac-linseed oil-glycerine combination would obviously be to react the oil and the glycerine with lac *in situ* under suitable conditions. It was found that when lac is heated in a mixture of linseed oil * and glycerine in the proportion of 5:1, the lac invariably polymerises and separates out before any glyceride formation and consequent dissolution of lac takes place. Alternatively the glycerine and the oil were heated together for definite periods at various temperatures and the lac then added to the reaction mixture but the results were no better. When, however, the cooking of the oil-glycerine mixture was conducted in a closed system (with only a narrow long tubular outlet for the escape of fumes), a reaction mixture was obtained in which lac could be readily dissolved. To ascertain the optimum conditions, the oil and glycerine were heated under such a system at various temperatures and for different periods and the compatibility of lac determined at 185° - 190° C. by noting the time for obtaining (i) a homogeneous mixture, (ii) a clear melt and (iii) for gelling. The results are tabulated in Table I from which it is evident that cooking at 220°C. for 40 to 60 minutes** gives the most satisfactory mixture.

* Commercial doubleboiled linseed oil was used throughout this investigation.

** For larger batches one hour's cooking was found to be the optimum.

From the nature of the treatment, it may be expected that there is likely to be present in the reaction mixture at least a portion of the glycerine uncombined. The reaction mixture was therefore repeatedly washed with boiling water and as much as 40 per cent of the glycerine used was thus recovered. The washed oil was dried by heating in an open vessel to about 140°C. The oil thus produced was also compatible with lac under the same conditions.

Properties of the 'treated' oil. The product obtained was a thin brown oil when hot (slightly darker in colour than the linseed oil used) which solidified into a slimy semisolid mass on cooling and standing for some time. It was completely soluable in alcohol and insoluble in turpentine or white spirit. Table II shows the physical and chemical constants of the oil.

As the uncombined glycerine present in the reaction mixture is likely to interfere with the drying and film properties, only the oil washed free from glycerine and dried was used for further work.

Spirit-Soluble Varnish

Though the prepared glyceride and lac are soluble in spirit, a spirit solution of the two does not give a clear film on drying. For this purpose it is necessary to cook the glyceride and the lac at 185-190°C. for about 15 minutes (till a drop on a glass slide appears clear when viewed through transmitt-

TABLE I.

No.	Weight of linseed oil usen(gms).	Weight of Glycerine (gms.)	Temp. of cooking (%C).	Duration of cooking (mts).	*Compatibility of lac with the reaction mixture* Time in minutes at 85°— 190%C. to become* Homogeneous.	Clear.	Gelled.
1	250	50	260	40	5	27	42
2	250	50	240	40	0	17	53
3	250	50	220	40	0	17	60
4	250	50	200	40	Did not become clear		42
5	250	50	220	60	0	16	59
6	250	50	220	80	0	16	56
7	250	40	220	40	6	21	45
8	250	35	220	40	Did not become clear		42
9	250	50	220	30	8	22	43
10	250	50	220	20	0	40	53

* 150 gms. of the reaction mixture and 150 gms. fresh dewaxed lac were used for these tests.

TABLE II.

No.	Material	Soluble in	Hydroxyl	A.V.	S.V.	Iodine value
1	Linseed oil	Turpentine, white spirit	—	5.7	183.1	176.0
2	Treated oil	Alcohol	9.25	2.5	161.3	147.6
3	Treated oil after washing and drying		5.85	3.5	168.5	155.4

ed light) before dissolving in the spirit solvent. Any grade of lac may be used as the time for obtaining such a clear melt at this temperature appears to be independent of the grade or even the quantity of the lac used. 80 to 100 per cent. dewaxed lac on the weight of the oil gave the best films. A typical composition is as follows:

Washed and dried glyceride	- 150 gms.
Dewaxed lac	- 150 gms.
Methylated spirit	- 300 c.c.

As can only be expected, films from such a varnish do not air-dry satisfactorly but dry on baking at 90-95°C. in the course of about 1 to 2 hours. The following are some of the properties of the above varnish composition:

Drying time	- 2 hours at 95-100°C.
Viscosity	- 1.25 pois at 25°C.
Accelerated ageing-	- Passes (100 hours at 100-105°C.)
Electric strength (10 mil film on 1 mil tissue paper)	- At room temp. 1200-1340 volts/mil.
	- At 90° C. 645-663 volts/mil.
	- After conditioning at r.h. 95%, 340-370 volts/mil.

Chemical combination of linseed oil glyceride and lac.—The chemical combination between shellac and linseed oil mono-glyceride has been investigated by Bhattacharya and Mundy. The latter[16] has shown the possibility of etherification between the hydroxyl groups of lac and the glycerides in addition to the esterfication of the glyceride hydroxyl by the carboxyl of the lac molecules. It has further been shown that on this basis 10 parts of lac would require '10.5 parts of pure mono-glyceride, for complete reaction.

As the linseed oil glycerides prepared as described in this communication contain only about 60 per cent. of the hydroxyl content of pure mono - glyceride, it would be clear that only 6 parts of lac can react with 10.5 parts of this glyceride mixture. Therefore, 100 parts of the glyceride were treated with 60 parts of lac at varying temperatures and the acid valve (A.V.) of samples determined at suitable intervals, as the fall in acid value will be an indication of the extent to which the combination of the lac and glyceride has taken place.

Table III.—A V. of products obtained by cooking 100 parts linseed oil glycerides and 60 parts lac.

No.	Temp. of cooking	A. V. at the end of minites.			
	°c.	30	60	90	120
1	185 - 190	19.06	14.03	11.41	9.83
2	200	16.19	12.75	8.81	7.82
3	220	11.85	8.2	7.02	5.08
4	240	9.12	6.58	5.0	...
5	260	5.82	3.81		

It will be seen that the reaction is apparently complete in about an hour at 260°C. With the progress of the reaction, the solubility in alcohol is also lost and the product becomes completely insoluble in alcohol but soluble in hydrocarbon solvents like white spirit and turpentine when the A. V. falls to 5 to 6. It has been found desirable to incorporate a quantity of linseed oil (50 per cent. on the weight of the glyceride) after about half an hour's cooking of the components to avoid excessive thickening of the composition. The finsihed composition thus works out to about 40 per cent lac on the weight of oil. (Further oil, if desired, may be added after the cooking is complete, i. e. immediately before cooling and thinning.)

Drying:— The varnish thus produced behaves like any oil varnish and air-dries in the course of 2 to 3 days. 0.02 per cent. cobalt (particularly as the naphthenate) reduces this period to less than 18 hours.

The air-dried film is clear and bright, hard and glossy. Both dewaxed lac and ordinary shellac may be used, but compositions from dewaxed lac give better and brighter films. When ordinary shellac is used, a good portion of the wax gets precipitated in a fairly granular form and has to be carefully filtered off before the varnish can be used. Even then the film properties are not exactly comparable to the composition using dewaxed lac, particularly with respect to clarity, water resistance and hardness as will be clear from Table IV.

Table IV:—*Film properties of lac-oil varnishes (Films on glass slides allowed to age for a week)*

Lac used	Appearance of Film	Water-resistance,*	Scratch hardness
Dewaxed lac.	Clear and bright	No blush	300-350 gms.
Shellac	Minute specks of wax visible in an otherwise clear film.	Extremely faint blush.	Less than 100 gms.

* Immersion in cold distilled water for 24 hours.

Preparation of Lac-Oil Varnish

On the basis of the above observation a typical lac-oil varnish may be prepared as follows:

Linseeed oil (3,000 gms.) and glycerine (600 gms.) are heated together with efficient mechanical stirring in a closed kettle at 220°C. for hour. After cooling, the product is washed twice with boiling water and dried by heating in an open pan to about 140°C

3,000 gms. of this mixed glyceride is heated in an open kettle to 170°C. and 1,800 gms. dewaxed lac added in small lots. After the addition is complete, the temperature is quickly raised to 260°C. and maintained for half an hour. 1,500 gms. linseed oil (which has been in the meanwhile heated in another vessel to about 260°C.) is now added and the cooking continued for another half an hour. The product is then cooled to 180°C. and 12 gms. of cobalt naphthenate incorporated and then thinned with 6,000 cc. white spirit, cooled and filtered.

Such a varnish has been found to have the following properties:

Ash	... 0.04%
Appearance	... clear
Volatile content	... 42.5%
Acid value	... 2.8, to 3.0
Viscosity	... 1.7 pois at 30°C.
Density	... 0.890 gms. per c.c.
"Surface" Drying time	... Less than 6 hours
"Hard" Drying time	... Less than 18 hours.

Baking Varnish

The linseed oil glycerides and lac cooked for only half an hour at 260°C. and thinned with the usual varnish solvents like turpentine and white spirit may also find application as a clear baking insulating varnish. A typical composition had the following properties:

Drying time – Less than 2 hours at – 90 – 95°C.

Electric strength – At laboratory temparature – 1,300-1,400 volts /mil

– At 90°C. – 780-800 volts/mil

– After conditioning at saturated humidity for 24 hrs. – 500 volts /mil

Accelarated ageing – Passes.

The applicability of the air-drying composition combined with suitable pigments for use as shellac oil paints is being investigated and will be reported in due course.

Summary

(i) Linseed oil cooked with 20 per cent. of its weight of glycerine at 220°C. for 40–60 mts. in a fairly closed kettle gives a spirit soluble glyceride mixture which is compatible with lac.

(ii) This mixture contains about 40 per cent. of the glycerine used as uncombined which may be easily washed off with hot water.

(iii) Lac may be incorporated in the washed and dried glyceride mixture at 185°—190°C. when a clear melt is obtained in about 15 mts. the product thus obtained being completely soluble in spirit.

(iv) The washed and dried glyceride mixture may also be chemically combined with lac by cooking in the ratio of 100 : 60 at 260°C. for 1 hour when an oil-lac combination of low acid value (A.V., 3 to 5) is obtained, this product being insoluble in spirit but completely soluble in the usual varnish solvents like white spirit, turpentine, etc.,

(v) To avoid excessive thickening during the cooking, it is desirable to add about 50 per cent. of linseed oil when the cooking has proceeded for half an hour and then complete the remaining half an hour's cooking, followed by cooling and thinning.

(vi) The varnish thus produced air dries in about 72 hours but in the presence of 0.02 per cent. cobalt as naphthenate, this period is reduced to less than 18 hours.

(vii) The air dried films are hard, bright and glossy and are remarkably resistant to water.

(viii) A clear baking insulating varnish may also be obtained by combining the washed and dried glyceride mixture and 60 per cent. of lac at 260°C. for half an hour and thinning the product with white spirit or turpentine. No drier is necessary.

Acknowledgement.

In conclusion the author wished to express his grateful thanks to Dr. P. K. Bose for his keen interest and valuable suggestions in the progress of this work.

References.

1 Y. Sankaranarayanan, *J.Sci. Ind. Res., 1946, 5 B, 53.*

2 Aldis, *Paint Manufacture, 1933, No. 4, p 105.*

3 Bhattacharya, *Lond. Shellac Res. Bureau, Tech. Paper. No. 12, 1937.*

4 Bhattacharya and Gidvani, *J. S. C. I., 1938,* **57**, *285.*

5 Hilditch and Bhattacharya, *Proc. Roy. Soc., 1930,* **129**, *A, 468.*

6 Hilditch and Riggs, *J. Chem. Soc., 1935; U.S. Patent 2,073, 797 (1937).*

7 *Brit. Pat.*, 440,888.

8 Long, et. al., *Ind. Eng. Chem.*, 1921, **21**, *952.*

9 Armour and Co., *U. S. P., 2,002,493 (1935)*

10 Southern Cotton Co., *U.S.P., 2,015,606 Brit. Chem. Abs., 1936, 1107.*

11 Edeler and Richardson, *U. S. P., 340,803-05 (1934)*

12 Proctor and Gamble Co., *U. S. P., 2,065, 520 (1936)*

13 Blogonrovova, et. al., *J. App. Chem. U.S.S.R., 1941,* **14**, *192; C.A., 1942,***36**,*1590.*

14. Kawai *S. J. Soc. Chem. Ind. Japan, Suppl. binding, 1940, 43, 294*

15 Mundy, *J. Oil & Colour. Chem. Assoc., 1938,* **21**, *96.*

16 Mundy, *Oil & Colour Trades Journal, 1938, 1801.*

17 Kawai and Yamamato, *J. Soc. Chem. Ind. Japan, Suppl. bind., 1940,* **43**, *219.*

18 Fenge and Bailey, *Oil & Soap., 1946,* **23**, *259.*

Denaturation of Alcohol by Neem Cake Distillate

By N. N. GODBOLE AND G. D. PANDE.

(College of Technology, Benares Hindu University).

THE usual method for denaturing alcohol in India is to add pyridine and caoutchoucine or wood naptha to alcohol.

Since pyridine was not available in sufficient quantities in India during the war years, work was undertaken at the instance of the Council of Scientific and Industrial Research to find satisfactory substitute for alcohol denaturants, Neem oil and neem seed cake suggestd themselves for investigation.

After a few preliminary experiments, a procedure was worked out to obtain a product from neem seed cake which meets all the exacting requirements. The cake obtained after expressing the oil was subjected to destructive distillation. The liquid distillate obtained (40 per cent on the weight of the cake) separates into two layers on standing, a pale yellow liquid forming a third of the total volume and a dark brown viscous layer. The distillate, which head a strong repellant odour was used for denaturing alcohol.

A sample of the alcohol denatured by the addition of 3 per cent of the neem cake distillate was tested at the Central Revenues Control Laboratory New Delhi, and was reported to be satisfactory. The denatured alcohol was distilled under the following conditions :- (i) straight, (ii) after making it alkaline, (iii) after acidification with sulphuric acid, (iv) after treatment with alkaline and acid potassium permanganate solutions, (v) double distillation, (vi) extracted with brine

and petroleum ether and the brine extract distilled, and (vii) refluxed with sodium hydroxide for 2 hours and distilled. In all these cases, the spirit recovered had a repellant odour, gave turbidity with water, and was not potable. The denatured spirit is not toxic even to guinea pigs when administered in small doses. When burnt in a spirit lamp, it does not produce any unpleasant odour.

The gases produced during the destructive distillation of neem cake are absorbed by alcohol, and are effective as denaturants.

Neem seed is a waste product abundantly available all over India. Only a small quantity of the seed is used for pressing the oil. The seed cake should prove to be an economic source for the production of denaturants which can effectively replace pyridine and other imported products.

Tannic Acid, *B.P.* from Myrobalan.

By H. G. BISWAS.

(Sir Prafulla Chandra Research Laboratory, Bengal Chemical and Pharmaceutical Works Ltd., Calcutta.)

BESIDES being an important ingredient in the manufacture of writing inks of superior quality, tannic acid B.P. finds extensive application in pharmacy. It is obtained from gallnuts which are indigenous to Greece, Syria, Persia, Asia Minor and China. Though there is a great demand for this acid in India, its manufacture has not been developed in this country principally due to the lack of gallnuts. During the war years, the need for tannic acid became urgent and alternative sources for its preparation had to be explored. Among the indigenous sources of tannic acid, myrobalan *(Terminalia chebula)* is the best known. It is cheap and abundant and is being utilized for some years as a raw material for tannic acid of technical quality, A further examination of this material as a source of tannic acid B.P. was therefore undertaken.

Though there is considerable literature on the constitution of myrobalan tannin, there is no reference to any reliable and economic method for its preparation. The procedure developed by us is given below:

Preparation

100 gms. of myrobalan powder were extracted in a Soxhlet with a mixture of ether and absolute alcohol (3:1) for 12 hours on a waterbath. The reddish brown extract was distilled to recover the solvents. The residual mass was dried in vacuum on a waterbath, and dissolved in 300 cc. distilled water by warming. A brown flocculent precipitate appeared on cooling which was filtered off. A further quantity of the precipitate was thrown down on keeping the clear filtrate in a stoppered vessel for 6 days. This was separated by filtration, and the clear filtrate boiled with a small quantity of decolourising charcoal and filtered. The clear filtrate was concentrated on a waterbath, dissolved in the minimum quantity of absolute alcohol and dried in vacuum. The residue which had a shining appearance was light brown in colour and highly hygroscopic. It was immediately powdered and placed in an amber coloured stoppered bottle. Yield 12.5 gms.

A sample of the preparation was sent to the Biochemical Standardisation Laboratory, Calcutta, for testing. The relevent part of the report is reproduced below:

"*Characters:-* Light brown powder; odour characteristic; very hygroscopic; taste strongly astringent; soluble slowly in 1 part of water and in 1 part of alcohol giving a very dark solution; almost insoluble in ether and in chloroform; partly soluble in 1 part of glycerin; almost insoluble in benzene and in light petroleum (B. P., 50° to 60°C.); An acqueous solution produces precipitate in solutions of gelatin, albumen and some alkaloids.

Tests for identity:- Yields the characteristic B.P. tests for tannic acid; an aqueous solution is acid to litmus and is *dextrorotatory*.

Tests for purity:- (1) Limit of gums, dextrin, sugars and salt within B.P. limits.

(2) Losses when dried at 100° C. for 3 hours. 4.8% (B.P., 6 to 12%)

(3) Leaves on incineration, 0.207%, calculated on the substance received as such which is equivalent to 0.217% calculated on the substance dried at 100°C. (B.P. not more than 0.2%).

Conclusion:- The sample closely agrees to B.P.

Opinon:- The slight difference in the ash content from the B.P. limit is of a negligible order and is not likely to have any therapeutic significance. The opinion may, therefore, be expressed that this tannic acid (from myrobalan) has satisfied all B.P. requirements.

The Council of Scientific and Industrial Research, has made a generous grant for developing the process on a Commercial scale, and this work is in progress.

References.

1. Abderhalden, *Biochemisches Handlexicon*, Berlin, 1929, *11*, *P.* 472; *Ibid*, *6*, P. 23; *J.C.S.*, 1911, *99*, 1819; *Ber.*, *41*, 3015.; *Ibid*, *42*, 353; *Ibid*, *52*, 1239; *Ibid*, *53*, 1729.

Carborundum. - Preparation in an Experimental, High Temperature Resistance Furnace.

By V. V. DADAPE, G. P. KANE AND P. K. SATHE

(University Department of Chemical Technology Matunga, Bombay.)

AMONG the products of the electric furnace, silicon carbide or carborundum is of considerable importance as an abrasive, a refractory and an electrical resistor for heating. Silicon carbide (SiC), along with an oxycarbide (Si_2C_2O) termed siloxicon or firesand, are the principal products obtained when a mixture of silica sand and carbon is heated in a resistance furnace. According to Saunders[1] the temperature of formation of crystalline SiC is 1,840° ± 30°C., and that of its dissociation into graphite and silicon is 2,240 ± 5°C.

The operation of a commercial furnace for carborundum is described in some detail by Mantell[2]. Silica sand containing 98 to 99.5 per cent SiO_2 is mixed with 10 per cent. excess coke than that required by the equation $SiO_2 + 3C \longrightarrow SiC + 2CO$. Saw-dust and salt are added, the former to increase the porosity of the mixture and the latter to remove metallic impurities in the form of volatile chlorides. The charge is packed in the furnace round a central core of granular coke or graphite. Power is supplied to the core through graphite electrodes inserted at the ends of the furnace. The furnace resistance is high in the beginning, but it decreases as the core gets heated. Each run continues upto 36 hours, good yields being obtained when the bulk of the charge is maintained near the temperature of formation of SiC (1,840 ± 30°C). This is ensured by maintaining the core at a value somewhat higher than the decomposition temperature of SiC (i.e. at 2,350°C), during normal working.

Furnaces of such a size are obviously too expensive for experimental purposes and attempts have been made to design smaller units, in which the influence of different variables on the yield of carborundum can be studied. Furnaces run with 30 and 20 kw. have been described by Bancroft, Walker and Miller[3]. An inherent difficulty in the maintainance at high temperature of a small furnace is the great loss of heat by radiation. Another difficulty is that with the voltage necessary for operation the current is too low for heating with a graphite core.

Bancroft and co-workers used a granular carbon core to get over the latter difficulty.

An A. C. current was obtained from a motor-generator set and a step-down transformer, capable of any voltage from 25 to 200, in steps of about one volt. The charge consisted of nearly 200 lbs. of a mixture containing 53.5 per cent. sand, 40 per cent. coke, 5 per cent. saw dust and 1.5 per cent. salt. A part of the charge was placed in the firebrick furnace upto the level of the electrodes, the latter being inserted through holes at the centres of the end walls. A rectangular cavity was formed by placing two iron plates on both sides of the electrodes and this cavity was filled with 4 lbs. of crushed carbon to form the core. The iron plates were removed and the rest of the charge was poured in. The furnace was started with a potential difference of 160 volts. As it became hot, the current increased and the voltage dropped gradually to 50 volts in half an hour. At the end of six hour-run, it dropped further to 40 volts. The temperature of the core increased to 2,400°C. in one hour, and the maximum recorded value was 2,500°C. at the end of nearly 3 hours. The yield of carborundum and the percentage conversion were low in the 30 kw. furnace and still lower in the 20 kw. furnace (*cf.* Table IV).

The equipment for supplying current at low voltage and high amperage described by Bancroft and others, is still too expensive for laboratory experiments with carborundum and other products of the resistance furnace. An attempt was made in the course of our studies, to build a furnace that could be run with the help of a 40 volt, 125 amp. transformer that was available in the laboratory. The principal difficulty experienced was the formation of a core. The core formed according to the method of Bancroft and co-workers failed to start directly on 40 volts, because of its high initial resistance, while the use of a graphite core was precluded by the size of the transformer. Success was achieved after many trials with granular carbon cores by the simple expedient of a two stage arrangement, in which the furnace was started on 220 volts and switched over to 40 volts, after the core became sufficiently conducting. As data relating to small furnaces are not readily available in literature the construction and operation of a small, high temperature resistance furnace and a few results obtained with it in the preparation of carborundum are described in this paper.

Experimental

A ractangular furnace was built (Fig. 1 A) from firebricks without any bonding material. The walls were 4·5″ thick and the furnace was bound together in an angle-iron frame-work. The space available for the charge was 13″ x 9″ x 10″. Through holes in the centres of the opposite end walls, two square Acheson graphite electrodes, 1.25″ on the side and 7″ long, were introduced to a distance of 1″ from the inside wall, to make direct contact with a ¾ lb. core. The electrodes were clamped in between two parts of cast brass holders (Fig. 1B). The two parts of the holders were cast integrally with boxes in which water was allowed to boil, thus providing 12.5 sq. in. of cooling surface per electrode. The electrode-holders rested on an insulating flat surface near the outside furnace walls. They were also held together in a frame-work consisting of lengthwise iron rods with cross iron strips, the latter bearing on the electrodes through insulating bricks. By tightening the bolts of this frame, the electordes could be brought nearer to each other even during a run, to ensure contact with a sagging core.

The materials for the charge were: (1) Sand (Quartz sand supplied by *Messrs: Vijaya Glass Works, Bombay;* SiO_2,96.25%; residue after HF treatment, 3.02%; loss on ignition, 0.74%); (2) Coke (supplied by the *Bombay Gas Company, Bombay;* Ash, 20%; volatiles, 9%; fixed carbon, 71%); (3) common salt; and (4) teakwood saw-dust.

The materials were mixed in the following proportions as recommended by Tone[4] and charged into the furnace :

Sand, 54.4%, Coke, 35.1%, Saw dust, 7.0%; Salt, 3.5%

Power was supplied either directy from the A.C. mains (25 amps., 220 volts) or through a 40 volts, 125 amp. single phase transformer. The change over from 220 to 40 volts being made by means of a double pole two-way switch. A water rheostat, connected in series with the furnace, helped to control the current.

Many variations were tried to obtain a satisfactory core, including the use of a graphite pencil in the initial stages to increase the conductivity of the core. Ultimately a core prepared outside the furnace was found most satisfactory. The coke was powdered and

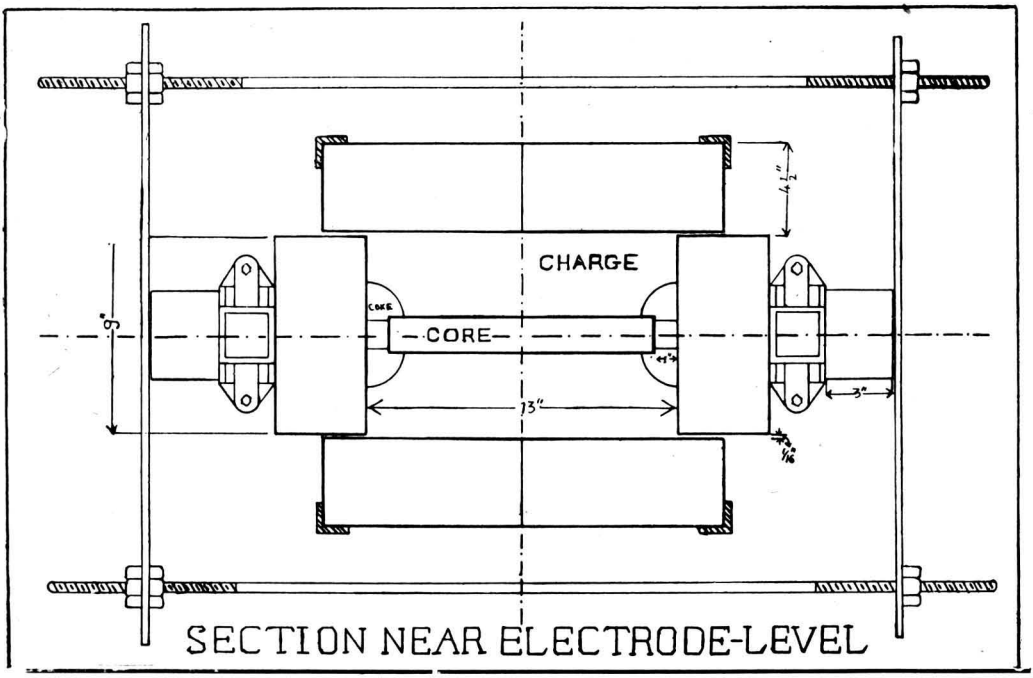

Fig. 1. Furnace plan

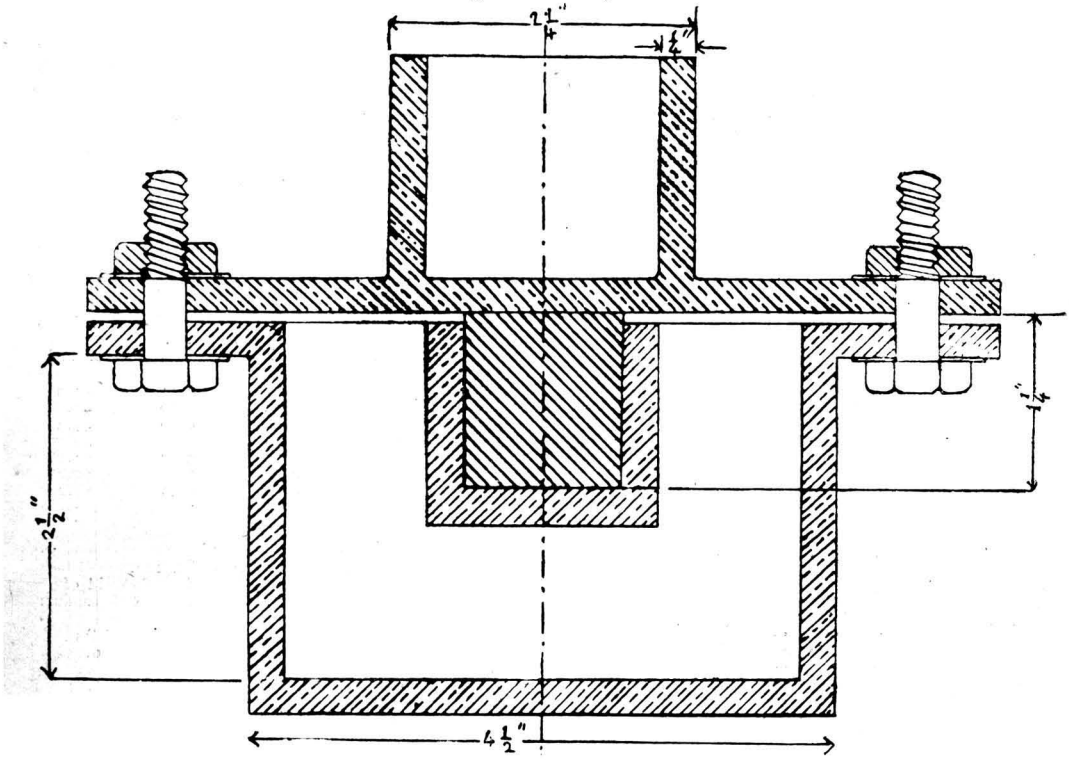

Fig. 2. Electrode—holder (section elevation)

separated into two grades according to size (Grade 1 : −10, +20 mesh; Grade 2 : −20, +40 mesh). These were mixed in the proportion of 1 : 3, and 2.5 per cent of pitch was added. The mixture was rammed into a wooden former, 1.25″ square, and 11″ long, with a blunt iron rod fitted into the holder of a vertical drilling machine. The former was prepared by binding together thin strips of wood with twine and it was held fast in metal clamps during ramming. This procedure avoided the introduction of iron into the charge. The rammed coke along with its former, was placed between the electrodes in the furnace, the space surrounding the points of contact being filled with more coke. Such a core gave very satisfactory results.

The furnace was started on the 220 volts line aud when the current increased to its full capacity of 25 amps., it was switched over to the 40 volts circuit. The change over was made usually within 2 minutes from the start The current increases continuously for about half an hour, and then maintains itself at a steady value of about 130 amps. The temperature of the core was not measured due to the unavailability of necessary equipment. The furnace runs could be reproduced satisfactorily any number of times.

The data obtained during a typical run is given in Table I.

TABLE I. — 3.5 kw.; 4 hours run.

Time Min.	Volts Secs.	Amps.	Kws. observed	Average kws. observed	Energy input in kw. hours
0	220	0	—	—	—
0-30	190	25	4.75		
1-00	130	25	3.25	4.00	0.0303
1-30	70	25	1.75	2.50	0.0208
2-00	34	30	1.02	1.38	0.0115
2-15	34	40	1.36	1.19	0.0049
3-00	34	50	1.70	1.53	0.0191
3-30	33	60	1.98	1.84	0.0153
4-00	33	70	2.31	2.14	0.0178
4-45	31.5	80	2.52	2.41	0.0305
6-00	31.5	100	3.15	2.83	0.0589
6-30	30.5	110	3.35	3.25	0.0270
7-00	30	120	3.60	3.47	0.0289
7-30	30	130	3.90	3.75	0.0312
10-00	30	140	4.20	4.05	0.1688
25-00	27	132	3.56	3.88	0.970
35-00	27.5	130	3.57	3.57	0.593
45-00	26	132	3.13	3.35	0.558
55-00	27	128	3.25	3.19	0.530
65.00	24.75	132	3.26	3.26	0.540
75-00	25.5	132	3.36	3.31	0.550
85-00	25.0	135	3.37	3.37	0.560
95-00	27	130	3.51	3.44	0.570
105-00	27.5	128	3.52	3.52	0.586
115-00	30	130	3.90	3.71	0.610
125-00	26	125	3.15	3.52	0.586
135-00	30	129	3.87	3.51	0.585
145-00	24	130	3.12	3.49	0.580
155-00	28	122	3.41	3.26	0.540
165-00	28.5	125	3.56	3.48	0.580
175-00	29	130	3.77	3.66	0.610
185-00	30	128	3.84	3.80	0.630
195-00	30	125	3.75	3.79	0.630
205-00	30	130	3.90	3.82	0.636
215-00	30	130	3.90	3.90	0.650
225-00	30	130	3.90	3.90	0.650
235-00	27	132	3.56	3.73	0.620
246-00	25	135	3.38	3.47	0.578
250-00	30	130	3.90	3.64	0.606

Total energy input during 4 hours, calculated, ... 14.54 Kw. hours
Yield of Carborundum, ... 175 gms. or 0.39 lb.
SiC Produced per kw. hour .. 12.03 gms.
Kw. hour per lb. of SiC 37.3

Core, 0.75 lbs;
Charge, 33 lbs. consisting of: Sand, 18 lbs. coke, 11.6 lbs.; saw dust, 2.3 lbs.; salt, 1.2 lbs.

Products :

Siloxicon, 2.25 lbs.; unchanged charge, 24 lbs.; carborundum (SiC), 0.39 lbs.; fused sand, 1.5 lbs.

Two sets of experiments were carried out for the production of carborundum. In one, the time of the run was varied from 2 to 14 hours, and in the other duration of the run was kept constant at 6 hours under the conditions determined above. At the end of each run the furnace was allowed to cool for 24 hours and then opened up. The different products are found arranged in concentric layers, the innermost being the core, succeeded consecutively by graphite, carborundum Siloxicon, unchanged charge, and a thin crust of fused sand. The lines of demarkation between the layers are distinct, particularly those surrounding carborundum, and the separation of the products and estimation of yields presents no difficulty. In our experiments, no graphite was produced due, probably, to the circumstance that the temperature required for graphitization (3,000°C.) was not attained in the furnace.

TABLE II.

Time of run hrs.	Core lb.	Charge in lbs.	Siloxicon (Si_2C_2O) lbs.	Carborundum lbs.	Kw. hours per lb. of SiC
2	0.75	33.5	0.75	0.11	63.5
4	,,	33	2.25	0.39	37.3
6	,,	33	3.0	0.49	43.3
8	,,	35	3.25	0.56	49.8
10	,,	32	3.75	0.67	52.08
12	,,	35	4.0	0.82	51.48
14	,,	35	4.75	0.83	59.28

TABLE III. — 3.5 Kw.; 6 Hrs. run.

Size range of sand (mesh)		Yield of Siloxicon lbs.	Yield of carborundum lbs
−10,	+20	2.0	0.15
−20,	+40	2.5	0.18
−40,	+60	3.0	0.12
−60,	+100	3.0	0.33
−40,	+100	3.25	0.36
−10,	+40	3.5	4.49

The variation in yields with the time of the run is shown in Table II. The energy consumption per lb. of carborundum was found to be lowest in the 4 hour run. The yield of carborundum increased rapidly upto 12 hours, but appeared to have reached a steady state after that period. The steady period was reached in the 20 and 30 Kw. furnaces of Bancroft *et al.*, in 10 and 6 hours, respectively.

The variation in yield with sand of different size ranges, for 6 hours runs, is shown in Table III.

It will be seen that the particle size of sand affects the yield to a marked extent and that better results are obtained with a material containing particles distributed over a wider size range. The best results were obtained with sand of size-10, + 40 which happens to be also the size range of the coke.

Representative results obtained in these and earlier experiments *(loc.cit)* are summarized in Table IV, from which it is clear that the results with a 3.5 kw. furnace fall in their logical sequence.

TABLE IV

Operative details	Mantell	Bancroft and coworkers		Present work.
Furnace capacities, Kw.	1,495	30	20	3.5
Length of the furnace, inches	360	27	27	13
Wt. of charge, lbs.	Probably in excess of 10 tons*	193	200	33
Wt. of core, lbs.	*	4	4	0.75
Final voltage,	75	40	*	25
Final current, amperes	20,000	740	*	135
Length of run, hours	36	4	3.5	4
% conversion to carborundum	70-80	9.52	3.55	2.14
Energy consumption, kw. hr. per lb. of SiC	3.25-3.85	12	18.1	37.7

* Not given in the literature.

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References.

1. *Trans. Amer. Electrochem. Soc.*, 1912, **21** 425.

2. "*Industrial Electrochemistry*" by Mantell, 2nd Ed., 1940, p 526.

3. *Trans. Amer. Electrochem. Soc.*, 1912, **22**, 73.

4. "*The Principles of Applied Electro Chemistry*" by Allmand, 2nd Ed. 1924, p. 656

Letters to the Editor

Effect of Pectin Solutions on the clotting time of Blood

OTTO Reiser [1] observed that when pectin was given intravenously, subcutaneously or perorally to rabits, it decreased the clotting time of blood to a about half its original value in 30 to 45 minutes. This was not corroborated by *in vitro* experiments; either there was no effect, or there was an ncrease in clotting time in such exp eriments. using two samples of human blood. Typicad results obtained are shown in Table 1.

The results, which have been repeatedly confirmed, clearly show that, irrespective of the source, pectin brings about a fall in the clotting time of blood, and in this respect it behaves analogously to thromboplastin and snake venom. In haemorrhagic diathesis, pectin acts as a foreign colloid and helps in increasing the coagulability of blood.

TABLE I.
CLOTTING TIME

% Concen. of pectin in solution.	Lemon peel pectin			Onion Pectin			Guava Pectin		
	Blank without pectin Secs.	with pectin Secs.	% lowering	Blank without pectin Secs.	with pectin Secs.	% lowering	Blank without pectin Secs.	with pectin Secs.	% lowering
0.75	80.0	70.0	12.5	126.5	104.4	17.3	126.5	108.4	14.3
1.00	80.0	67.0	16.25	126.5	90.0	28.8	126.5	94.0	21.7
1.25	80.0	64.0	20.0	126.5	80.0	36.7	126.5	85.0	32.8

To ascertain the effect of pectin solutions on the clotting time of human blood, *in vitro* experiments were carried out using solutions of pectin prepared and purified as described in an earlier communication [2]. The method of Iyenger, Sehra and Mukerji [3] for clotting time determination was employed with suitable modifications. Solutions of pectin from 3 different sources were prepared in 3 concentrations each, and the clotting time determined,

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Lahore, June 5,1947

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References

1 Otto Reiser, *Klin. Wochenchr*, 1933, 14,958.

2 Trehan Y. N. and Ahmad B., J. *Sci. Ind. Res.*, 1947, 6, 16.

3 Iyenger, N. K., Sehra, K. B. and Mukerji, B., *Ind. J. Med. Res.*, 1942, 30, 339.

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