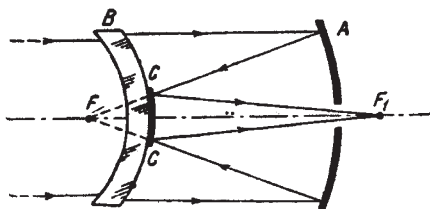


meniscus and the mirror; but one is positive and the other is negative. It is this fact which is the basis upon which the theory and the design of the meniscus telescope have been built. Maksutov has succeeded in proving that by suitable selection of the radii of curvature of the meniscus and mirror, the thickness of the meniscus and the quality of the glass used, it is possible to arrange that the spherical aberration of the mirror is compensated for by the spherical aberration of the meniscus lens. In addition, the design permits the almost complete removal of chromatism. By these means, sharpness of image in the centre of the field of view is readily attainable; but Maksutov has also shown that it is only necessary to introduce into the calculation the distance between the meniscus and the mirror to establish the conditions for a field of view which will be well defined over an area sufficiently great for all practical purposes.

The principle may be used in various types of more complex telescopes. The accompanying figure illustrates one such type. Here the meniscus and mirror are placed closer together than is usual in the simplest type, and the centre portion of the meniscus is silvered so that the reflected rays from the concave mirror fall on the meniscus, are reflected by the small convex mirror, pass through an opening in the concave mirror and form the image.



A meniscus telescope combines most of the good qualities of both refractors and reflectors and eliminates most of the unsatisfactory features. It is extremely compact and powerful; it is generally of closed construction, like a refractor, and it is achromatic, like a reflector. Moreover, it is of great significance, from the point of view of simplicity and cheapness of manufacture, that all the optical elements are parts of spherical surfaces.

The superiority of the meniscus type over the other two main types of telescopes used for astronomical purposes may be illustrated by taking as examples, the Yerkes refractor, the Simeiz reflector and one of the meniscus telescopes now planned for construction in the U.S.S.R. These examples are comparable since the aperture in each case is 1 m. approximately. The Yerkes refractor has a tube-length of 20 m., and the object-glass consists of two lenses of optical glass (crown and flint), but in spite of the great length, the quality of the image obtained is very poor on account of chromatic aberration. The Simeiz reflector (now destroyed) had a parabolic mirror of 1 m. diameter and its tube-length was about 5 m. The image quality at the centre of the field of view was faultless, but it deteriorated rapidly towards the edges. The meniscus telescope referred to will have a tube-length of a little less than 3 m. The image is expected to be sharp over a fairly wide field, while the power will be considerably greater than that of a reflector of similar diameter. It will require only one lens in optical glass. Crown glass or flint glass or, indeed, almost any type of glass, could

be used; but crown glass has naturally been chosen since it is more transparent to violet and ultra-violet light.

Because of the reduction in size the cost of building observatory domes, etc., will be much less with meniscus telescopes than with other types. It is estimated that the Simeiz type and the Yerkes type would cost four times and seventy times, respectively, the amount which will be expended on a 1 m. diameter meniscus telescope.

Many observatories, together with their equipment and instruments, have been destroyed during the War, but Soviet astronomers are determined on the speedy restoration of these and the construction of new observatories where instruments, embodying all the refinements of recent research, will rival the best available elsewhere. They are planning, also, an increase in the number and size of university observatories, and they are proposing to establish smaller telescopes in both town and country schools. The meniscus type of telescope offers the best means of achieving these aims with the minimum of delay and the minimum of expense.

G. STANLEY SMITH.

<sup>1</sup> Maksutov, D. D., *Nauka i Zhizn (Science and Life)*, No. 9, p. 1 (1944). The theory is described in detail and dimensional particulars are given under the reference: Maksutov, D. D., *J. Opt. Soc. Amer.*, **34**, 270 (1944).

## RECENT WORK ON RHENIUM

IN the two decades since rhenium (Mendeléeff's dwi-manganese) was discovered, hundreds of its compounds have been reported. Among the latest are some stable complexes in which the element is present as the cation. Lebedinský and Ivanov-Emin (*J. Gen. Chem., U.S.S.R.*, **13**, 253; 1943) have described the complexes derived from saturated solutions of the double chlorides,  $K_3ReCl_6$  and  $K_2ReCl_6$ , by using a large excess of ethylene diamine. This is apparently the only suitable base, since ammonia and pyridine do not react in the same way. During the reaction, rhenium oxidizes to the pentavalent state and  $ReO_2(C_2H_4N_2H_4)_2Cl$  separates. It gives no precipitates in aqueous solution except with cobaltinitrites and platinum chlorides.

A corresponding iodide, only slightly soluble in water, was obtained by metathesis with potassium iodide. When treated with hydrochloric acid the substances yield  $ReO(OH)(C_2H_4N_2H_4)_2Cl_2$ , which is isolated from its saturated solutions by precipitation with alcohol. A curious compound,  $ReO(OH)(C_2H_4N_2H_4)_2PtCl_6$ , results when the chloride is mixed with sodium platinum chloride solution. A corresponding iodide is also known. Both are only slightly soluble in water, but the solutions contain rhenium ions.

When rhenium salts were first obtained there was some controversy over the efficacy of hydrogen sulphide as a reagent for precipitating rhenium as sulphide. Geilmann and Lange (*Z. anal. Chem.*, **126**, 321; 1944) now state that the heptasulphide is completely precipitated from slightly acid solutions by hydrogen sulphide under pressure, especially if the mixture is heated for half an hour before filtering. For estimating rhenium the washed precipitate is converted into sodium per-rhenate with sodium hydroxide and perhydrol and then re-precipitated as nitron per-rhenate. Rhenium compounds fused with sodium carbonate and sulphur yield an insoluble alkali complex.

Another selective reagent, toluene-3:4-dithiol, is found to give a green complex with rhenium (and also with molybdenum) and a blue one with tungsten (Miller, *Analyst*, 69, 112; 1944). The *K*-absorption limit for rhenium is reported to be 172.66 by Manescu (*C.R. Acad. Sci.*, 216, 732; 1943) who examined its salts between 'Cellophane' sheets using a potential of 100–125 kV.

According to Naray-Szabo, rhenium trioxide crystals are cubic (*Naturw.*, 31, 466; 1943).

## FORTHCOMING EVENTS

Saturday, June 30

ASSOCIATION FOR SCIENTIFIC PHOTOGRAPHY (at the Alliance Hall, Westminster, London, S.W.1), at 2.30 p.m.—Mr. H. White: "Make the Photograph tell a Story".

Friday, July 6

PHYSICAL SOCIETY (at the Royal Institution, Albemarle Street, London, W.1), at 5 p.m.—Prof. Arturo Dupperier: "The Geophysical Aspect of Cosmic Rays" (29th Guthrie Lecture) (Fellows of the Royal Astronomical Society and members of the Royal Meteorological Society are also invited to attend).

Saturday, July 7

SOUTH-EASTERN UNION OF SCIENTIFIC SOCIETIES (at the Rothamsted Experimental Station, Harpenden), at 9.30 a.m.—Fiftieth Annual Congress. Prof. W. G. Ogg: "Some Aspects of the Work at Rothamsted".

INSTITUTE OF PHYSICS (LONDON AND HOME COUNTIES' BRANCH) (in the Physics Department, Imperial College of Science and Technology, South Kensington, London, S.W.7), at 2 p.m.—Discussion on "The Corrosion of Metals".

## APPOINTMENTS VACANT

APPLICATIONS are invited for the following appointments on or before the dates mentioned:

CIVIL ENGINEER by the British Overseas Airway Corporation, for control and supervision of civil engineering and building work in the India and Burma Region—The Ministry of Labour and National Service, Central (T. and S.) Register, Room 5/17, Sardinia Street, Kingsway, London, W.C.2, quoting E.1659.XA (July 6).

LECTURER (full-time) IN ELECTRICAL ENGINEERING—The Principal, Handsworth Technical College, Golds Hill Road, Birmingham, 21 (July 7).

LECTURER-IN-CHARGE OF THE CHEMISTRY DEPARTMENT EVENING CLASSES in the East Ham Technical College, to be responsible for organization and development of part-time courses up to Higher National Certificate standard and courses in both Pure and Applied Chemistry—The Chief Education Officer, Education Office, Town Hall Annex, Barking Road, East Ham, London, E.6 (July 7).

ASSISTANT LECTURERS IN BOTANY, GEOGRAPHY (climatology and cartography), and ZOOLOGY—The Registrar, University College, Exeter (July 9).

BOROUGH ELECTRICAL ENGINEER AND MANAGER—The Town Clerk, Town Hall, Leigh, Lancashire (endorsed 'Borough Electrical Engineer and Manager') (July 10).

WATER ENGINEER AND MANAGER—The Town Clerk, Council Offices, North Street, Chichester, Sussex (endorsed 'Appointment of Water Engineer') (July 11).

DIRECTOR OF WORKS by a Governmental Office (candidates must be Corporate Members of the Institution of Civil Engineers and must have had experience in carrying out constructional work abroad)—The Ministry of Labour and National Service, Appointments Department A.9, Room 5/17, Sardinia Street, Kingsway, London, W.C.2, quoting E.1700.A (July 13).

ASSISTANT ADVISER IN PLANT PATHOLOGY—Prof. R. G. White, School of Agriculture, University College of North Wales, Bangor (July 14).

DEMONSTRATOR IN THE PHYSICS DEPARTMENT, for general teaching duties—The Dean, Guy's Hospital Medical School, London Bridge, London, S.E.1 (July 14).

LECTURER IN PHYSICS—The Principal, Royal Holloway College, Englefield Green, Surrey (July 14).

GARDENING INSTRUCTRESS for a County Technical School for Girls with a demonstration garden at Chislehurst—The County Education Officer, Springfield, Maidstone (July 14).

ASSISTANT LECTURER IN CHEMISTRY, and an ASSISTANT LECTURER IN CLOTH MANUFACTURE, at the Bradford Technical College—The Director of Education, Town Hall, Bradford (July 14).

ASSISTANT LIBRARIAN in the University Library, and a SUB-LIBRARIAN in the Faculty of Engineering—The Registrar, The University, Liverpool (July 15).

PROFESSOR OF CHEMICAL TECHNOLOGY at the University of Madras—The Registrar, University of Madras, Chepauk, Triplicane, Madras (by Air, July 15; copy to the High Commissioner for India, General Department, India House, Aldwych, London, W.C.2).

LIBRARIAN—The Secretary, The University, 38 North Bailey, Durham (July 16).

ASSISTANT LECTURER IN HORTICULTURE with special qualifications in Horticultural Machinery—The Registrar, The University, Reading (July 16).

RESEARCH OFFICER FOR SPECTROSCOPIC INVESTIGATIONS, Division of Industrial Chemistry, Council for Scientific and Industrial Research, Melbourne—The Secretary, Australian Scientific Research Liaison Office, Australia House, Strand, London, W.C.2 (July 16).

LECTURER IN GEOGRAPHY (with special qualifications in Cartography)—The Registrar, The University, Reading (July 16).

LECTURER (or ASSISTANT LECTURER, according to qualifications) IN THE DEPARTMENT OF BOTANY—The Secretary, King's College, Strand, London, W.C.2 (July 20).

SECOND ASSISTANT PETROLEUM TECHNOLOGIST in Trinidad—The Ministry of Labour and National Service, Appointments Department A.9, Room 5/17, Sardinia Street, Kingsway, London, W.C.2, quoting F.4411.A (July 21).

SCIENTIFIC ASSISTANT—The Deputy Director, Imperial Bureau of Dairy Science, Shinfield, Reading, Berks (July 21).

UNIVERSITY LECTURER IN GEOLOGY—The Secretary of the Appointments Committee of the Faculty of Geography and Geology, Department of Mineralogy and Petrology, Cambridge (July 30).

SECRETARY TO THE UNIVERSITY COUNCIL—The Secretary, University Registry, Cathays Park, Cardiff (July 31).

LECTURESHIP IN CHEMISTRY—The Registrar, Trinity College, Dublin (August 20).

WARDEN OF CREWE HALL (The University Hall of Residence for Men) who must be a graduate and will be required to take some part in University teaching—The Registrar, The University, Sheffield (August 31).

CHAIR OF MEDICINE in the University—The Registrar, The University, Sheffield (October 31).

CHAIR OF SURGERY tenable at the British Postgraduate Medical School—The Academic Registrar, University of London, Richmond College, Richmond, Surrey (January 1).

LECTURER IN CHEMISTRY, with qualifications in Organic Chemistry—The Registrar, University College, Exeter.

LABORATORY ASSISTANT (man or woman) FOR THE BIOLOGY DEPARTMENT—The Warden and Secretary, London (Royal Free Hospital) School of Medicine for Women, 8 Hunter Street, London, W.C.1.

LABORATORY APPRENTICES (boys or girls) IN THE DEPARTMENTS OF BOTANY, PHYSICS, PHYSIOLOGY AND ZOOLOGY—The Secretary, Bedford College for Women, Regent's Park, London, N.W.1.

RESEARCH MANAGER, a CHIEF CHEMIST, CHEMISTS and PHYSICISTS (2 or 3) with some years research experience, and several JUNIOR CHEMISTS and PHYSICISTS—The Director, Paint Research Station, Waldegrave Road, Teddington, Middx.

TEACHER IN ENGINEERING SUBJECTS up to Higher National Certificate standard in day, part-time, and evening classes—The Principal, Erith Technical College, Belvedere, Kent.

TEACHER (well qualified) OF SCIENCE—The Principal, Technical Institute, Tunbridge Wells.

LECTURER (full-time) IN THE PHYSICS DEPARTMENT—The Secretary, Northampton Polytechnic, St. John Street, London, E.C.1.

HEAD OF THE ENGINEERING DEPARTMENT—The Registrar, Municipal College, Portsmouth.

TEACHER (full-time, day and evening) OF ENGINEERING SUBJECTS in the Harrogate Technical Institute—W. E. C. Jalland, Municipal Offices, Harrogate.

TEACHER OF ENGINEERING SUBJECTS, including Workshop Practice and Drawing, and a TEACHER OF ELECTRICAL ENGINEERING SUBJECTS in Day and Evening Classes, in the Mexborough Schofield Technical College—E. B. Stockdale, Education Office, Mexborough, Yorks.

ASSISTANT LECTURER IN AGRICULTURE, and an ASSISTANT LECTURER IN AGRICULTURAL BOTANY—The Registrar, University College of Wales, Aberystwyth.

LECTURERS (full-time) IN GENERAL ENGINEERING SUBJECTS to Higher National Certificate standard, ELECTRICAL SUBJECTS to University Degree standard, and PHILOSOPHY (candidates should possess a good Degree in Philosophy or Psychology and be able to take a class in Elementary Logic)—The Clerk to the Governors, South-West Essex Technical College and School of Art, Forest Road, Walthamstow, London, E.17.

TEACHER (well qualified) OF MECHANICAL ENGINEERING, and a TEACHER (well qualified) OF ELECTRICAL ENGINEERING—The Principal, Technical Institute, Darnley Road, Gravesend.

## REPORTS and other PUBLICATIONS

(not included in the monthly Books Supplement)

### Great Britain and Ireland

Association for Planning and Regional Reconstruction. Review No. 5 (A.5): Resources of the Sea. Pp. 41. (London: Association for Planning and Regional Reconstruction, 1945.) [26]

Imperial Bureau of Pastures and Forage Crops. Bulletin No. 53: Ley Farming in Sweden; a Field Day at Svalöf. Pp. 44. (Aberystwyth: Imperial Agricultural Bureaux, 1945.) 3s. [26]

Proceedings of the Science (Research) Society. No. 3: Report of the Biological Panel. Pp. 22. (Richmond: Science (Research) Society, 1945.) 1s. [26]

National Institute for Research in Dairying. Report for the Three Years 1941, 1942 and 1943. Pp. x+68. (Shinfield: National Institute for Research in Dairying, 1945.) [26]

U.S. Office of War Information. Symposium on Recent Advances in Medicine. Pp. vi+260. Symposium on Recent Advances in Surgery. Pp. vi+229. (Reprints from the Medical Clinics of North America for 1944.) (London: U.S. Office of War Information, 1944.) [26]

### Catalogue

Brochure of Mass Miniature Radiography. Pp. 34. (London: Watson and Sons (Electro-Medical), Ltd., 1945.)