

RADIO TECHNIQUE IN SURGERY

ALTERNATING currents of radio frequency, while used very largely for radio communication, broadcasting and navigation, also find extensive application nowadays in the hands of the physician and surgeon. Diathermy treatment by means of high-frequency currents has long been practised by the medical profession, but, more recently, other applications of radio technique have been developed. Two of these applications are referred to in considerable detail in the September issue of the *Wireless World*.

The first is described in an illustrated article by A. W. Lay entitled "Electrosurgery", and deals with the use of a high-frequency arc for surgical operations. In such an operation the high-frequency current passes between a specially shaped electrode held by the surgeon, and the patient, who is efficiently earthed by means of an electrode of large area applied in close contact to a smooth part of the body. The cutting effect depends upon the intense concentration of heat in a minute arc, which is struck and maintained at a point of the operating electrode during the course of the cutting stroke, which is controlled by the surgeon. An important feature of the use of this method is that raising the temperature of the blood to about 40° C. accelerates its coagulation and so checks bleeding. A high degree of skill is necessary on the part of the surgeon, as the active electrode must not be allowed to dwell at any point in the course of the cut; otherwise the resultant clotting is too deep, the tissue becomes charred and healing will not follow or will be seriously delayed. Should the electrode unavoidably sever a large blood-vessel, this may be closed by a pair of special forceps, through which a more intense current may then be passed to stop the bleeding.

The high-frequency energy required for cutting

operations in general surgery varies from about 30 to 80 watts, and the critical cutting voltage is in the range 220–230 volts R.M.S. At voltages above 250 the arc is too fierce and then there is a tendency for the divided tissue to become charred, which, as already mentioned, must be avoided. Further research is needed to determine the exact process by which the heat disintegrates the molecular structure of the tissue; but if current of suitable value and character is applied, a very clean cut is obtained and the healing compares very well with the effects following the use of the surgeon's knife.

The second reference in the journal mentioned above, is a note referring to a communication in the *Lancet*, describing a radio-frequency probe for locating metallic particles, such as bullets and shell-splinters, in the human body, an instrument of obviously great utility at the present time. A low-power radio frequency oscillator has a tuning coil fitted into a sterilizable porcelain probe, 10 cm. long and 1 cm. diameter. If this coil approaches a metallic substance, such as a splinter, in the area of application, the inductance of the coil, and so the frequency of the oscillator, will change. This frequency change is detected audibly by means of a second reference oscillator, and a detector, amplifier and loud-speaker combination. The apparatus is in general equally sensitive to all metals, and can detect quite small particles, but naturally all metal instruments within a certain radius must be removed while the probe is in use.

The same application of radio frequency currents has been used previously for detecting nails in timber and for other similar purposes, where the location of metallic particles embedded in insulating material is required.

POSTGLACIAL UPLIFT AND THE MOBILITY OF THE EARTH'S INTERIOR

B. GUTENBERG of the Pasadena Seismological Observatory, California, has recently completed a study of the above problem ("Changes in Sea Level, Postglacial Uplift, and Mobility of the Earth's Interior", by Beno Gutenberg, *Bull. Geol. Soc. Amer.*, 52, 721–72; May 1, 1941). The author has examined carefully the records of tide gauges throughout the world, and finds that these indicate that sea-level generally is rising at an average rate of about 10 cm. a century. In particular, maps have been constructed to show the rate of uplift in Fennoscandia and North America. A discussion of the new material and historic evidence appears to indicate that the uplift is a consequence of isostatic readjustment of the equilibrium disturbed by the postglacial melting of the ice. The remaining uplift is about 200 m. in Fennoscandia and possibly more in North America, where the present rate of uplift has its maximum of about 2 m. per century in the region of Hudson Bay. Simultaneously with the glaciation in Fennoscandia, the British Isles were covered by ice with a centre in the Hebrides where the postglacial uplift exceeded 30 m., decreasing towards Scotland; the zero isobase for the recent millennia intersects northern Ireland

and northern England. There is some indication that the zero isobase at present lies south and west of Great Britain. Originally, the time needed to reduce the defect in mass to one half under the regions of uplift was less than 10,000 years, but it has been increasing with time and now exceeds 20,000 years.

Theoretical investigations on the plastic flow in the interior of the earth connected with the uplift have been critically discussed and extended by the author. According to Gutenberg, the movements affect the whole interior of the earth below the regions of uplift; their amplitudes decreasing slowly in the upper 1,000 km. If one assumes a strong lithosphere with a thickness of about 70 km., and below that the asthenosphere with a viscosity of the order of 10^{22} poises, and but little or no strength to prohibit plastic flow, there is no disagreement with observations related to isostasy or deep-focus earthquakes. Tectonic processes connected with isostatic anomalies larger than those in the regions of postglacial uplift are judged to be connected with plastic flow at least down to the core. Gutenberg suggests that defects of mass producing only relatively small gravity

anomalies are able to produce plastic flow if sufficient time is available. The lower limit, below which the processes stop, is important. The *Polfluchtkraft* probably produces stresses of the order of one hundredth of the stresses in Scandinavia stated to be large enough to maintain plastic flow. If the *Polfluchtkraft* is large enough to maintain plastic flow, then we should not be surprised to see continents being shifted by subcrustal flow during the history of the earth under the action of such small but persistent forces.

RESEARCH IN GEOPHYSICS

THE annual report of the director of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, published in December 1940, is an important record of achievement carried out under difficulties caused by war. It describes the initiation of several fresh experimental projects, the continuance of the previous programme of field observations, the reduction of existing data, the organization of and participation in several important congresses, and the publication of a large number of scientific papers.

With the aid of a cascade high-pressure bomb, hydrostatic pressures in excess of 200,000 atmospheres were attained at the Geophysical Laboratory. This apparatus renders possible the investigation of the magnetic properties of materials at pressures comparable with those actually existing in the earth's interior. For a specimen of cadmium-magnesium-iron-spinel under a pressure of 10,000 atmospheres, a shift in the Curie temperature of as much as 5° C. was observed. These measurements necessitated the development of an alternating-current bridge capable of responding to changes in inductance as small as $1/10^{10}$ henry.

One of the outstanding problems in atmospheric electricity arises in connexion with the 'supply current', which in an undetermined manner supplies negative electricity to the earth at a rate of about 1,800 amperes, and so maintains a negative charge on the surface in fair-weather areas. The actual current flowing from air to earth in such areas depends to some extent upon meteorological and other more or less local factors, which have to be taken into account in arriving at a measure of the supply current.

In connexion with the volcanological investigations planned by the Institution, a series of earth resistivity measurements were carried out with the view of determining the thickness of the extensive deposits of volcanic ash occurring in Guatemala. Depths extending to 600 miles were recorded.

Laboratory work in nuclear physics centred around the high-voltage electrostatic generator, which was induced to yield tensions up to 3-6 million volts, and the installation of a 60-in. cyclotron. Measurements were made on the scattering of slow and fast neutrons by collisions with protons, on the resonance scattering of protons by helium nuclei, and on the splitting of the deuterium nucleus into a proton and a neutron by high-energy gamma radiation.

It is proposed to employ the cyclotron, when completed, in connexion with work of a biological and chemical character, utilizing the radioactive isotopes of ordinary elements as tracers for following various reactions. A scheme for the adequate shielding of those operating the cyclotron from the powerful radiations generated by it has been worked out.

FORTHCOMING EVENTS

(Meeting marked with an asterisk is open to the public.)

FRIDAY, SEPTEMBER 26

BRITISH SOCIETY FOR INTERNATIONAL BIBLIOGRAPHY (at the Institution of Electrical Engineers, Savoy Place, London, W.C.2), at 2 p.m.—Joint Discussion with the Library Association and the Association of Special Libraries and Information Bureaux on "The Preparation of Indexes to Volumes of Periodicals" (Opener: Dr. S. C. Bradford), and "Listing Titles of Periodical Publications" (Opener: Mr. E. Lancaster-Jones).

FRIDAY-SUNDAY, SEPTEMBER 26-28

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE (at the Royal Institution, Albemarle Street, London, W.1).—Discussion on "Science and World Order".*

FRIDAY, SEPTEMBER 26

Morning Session: "Science in Government" (Chairman: Sir Richard Gregory, Bart., F.R.S.). Afternoon Session: "Science and Human Needs" (Chairman: Hon. J. G. Winant).

SATURDAY, SEPTEMBER 27

Morning Session: "Science and World Planning" (Chairman: Mr. I. M. Maisky). Afternoon Session: "Science and Technological Advance" (Chairman: Dr. E. Benes).

SUNDAY, SEPTEMBER 28

Morning Session: "Science and Post-War Relief" (Chairman: Dr. Wellington Koo). Afternoon Session: "Science and the World Mind" (Chairman: Mr. H. G. Wells).

APPOINTMENTS VACANT

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

LECTURER IN PHARMACEUTICAL SUBJECTS, and a DEMONSTRATOR IN PHARMACEUTICS—The Principal, College of Technology and Commerce, Leicester (September 27).

ASSISTANT LECTURER IN PHARMACEUTICAL CHEMISTRY—The Registrar, University College, Nottingham (September 29).

LECTURER IN ELECTRICAL ENGINEERING AND ALLIED SUBJECTS—The Principal, County Technical College, Worksop, Notts. (September 30).

SENIOR LECTURER (MALE) IN EDUCATION—The Principal, Training College for Teachers, Collegiate Crescent, Sheffield (September 30).

CHIEF INSTRUCTOR with experience as Head of Engineering Branch of Technical Education, a SPECIALIST IN PHYSICS, and TWO SENIOR and TWO JUNIOR LECTURERS who should be Physicists or Specialists in Mechanical Engineering, for the training of Ordnance Mechanical Engineers in India—The Secretary, Military Department, India Office, London, S.W.1 (October 1).

HEADMASTER of Stockport Grammar School—The Clerk to the Governors, Stockport Grammar School, Mile End, Stockport (October 15).

LECTURER IN ENGINEERING SUBJECTS in the Rotherham College of Technology and Art—The Director of Education, Education Offices, Rotherham.

REPORTS AND OTHER PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Department of Scientific and Industrial Research: Road Research Laboratory. Wartime Road Note No. 1: Recommendations for Tar Carpets and Surface Dressings. Pp. 12. 6d. net. Wartime Road Note No. 2: Sources of Naturally-coloured Chippings in Great Britain. Pp. 14. 6d. net. (London: H.M. Stationery Office.) [99]

Other Countries

Universidad Nacional de La Plata. Publicaciones de la Facultad de Ciencias Fisicomatematicas. No. 137: Cuarta Reunion Anual de Caminos, Vol. 1. Pp. 350. No. 138: Cuarta Reunion Anual de Caminos, Vol. 2. Pp. 300. (La Plata: Universidad Nacional de La Plata.) [278]

National Research Council of Canada. Review of Activities for the Year ended March 1940. (N.R.C. No. 976.) Pp. 155. (Ottawa: National Research Council of Canada.) 75 cents. [278]

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