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