ments. Pain and Smy[8], using very high-temperature gases (around 10,000° C.) in a shock tube, discuss boundary layer breakdown at very high currents with cold metal electrodes. Brogan *et al.*[2] report electrode voltage drops of 50–80 V. with hot carbon electrodes. They abandoned extended electrodes in favour of ¼-in. diameter carbon rods to obtain current densities high enough for the generator to manifest the ohmic behaviour of the hot gas. Way *et al.*[3] with hot electrodes do not have very large electrode drops (only 3 V.) while in our own experiments with both carbon and water-cooled copper electrodes the voltage-current characteristics go sensibly through the origin. Furthermore, these characteristics were all linear, contrasting with the Langmuir type saturation observed in similar experiments at those laboratories using water-cooled copper electrodes in the carbon free plasma from an arc-heated argon plasma jet.

As a result of our experiments it appears that it may be possible to have stable electrodes of indefinite life by using cooled metal surfaces on which a thin layer of carbon is deposited from the gas stream. As this layer is ablated away more carbon may be deposited to maintain an equilibrium thickness, so that the electrode surface is continuously replaced. The carbon surface in contact with the ionized gas will be hot enough to emit freely so that there should be no drop in voltage at the electrodes, and the heat transfer should be considerably less than that to a bare cold metal surface.

Experiments are continuing to investigate the proposed electrode system more fully.

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A Development of the Use of the Electrolytic Tank for Field Studies

A TECHNIQUE for the establishment of a field which satisfies Poisson's equation in a conducting sheet analogue is that suggested by Peierls[1] and involves supplying current to the sheet so that current and voltage in the analogue represent respectively the potential and stream functions of the original field. If the current supply is to be distributed it is necessary to make an approximation by subdividing the region into a number of finite areas each fed with a current concentrated at the centre, and refinements of this method have included an examination of optimum electrode size for these currents when the complete solution may be built up of a number of particular solutions[2].

An alternative analogue which I am investigating is derived from the generation of eddy currents within an electrolyte. Electric field E, magnetic induction B, electrolyte resistivity ρ and eddy current density J are related by:

$$\text{Curl } E = -\dot{B}$$

and

$$E = \rho J$$

Thus, for current flow in two dimensions:

$$\frac{\partial}{\partial x}\left(\rho\frac{\partial\psi}{\partial x}\right) + \frac{\partial}{\partial y}\left(\rho\frac{\partial\psi}{\partial y}\right) = \dot{B}_z$$

where ψ is the current (or stream) function, and B_z is the induction of the transverse magnetic field. This reduces to Poisson's equation as the dependence of $\dot{B}$ on ψ is diminished.

For the measurement of local eddy current density and direction, I have used a probe composed of a rectangular wafer of insulating material arranged to pivot vertically about a central axis. Flat electrodes cemented to the two vertical edges of the wafer are connected to a coaxial cable concentric with the pivot by leads running along the top of the wafer, and the far end of the cable is connected to a remotely placed resistor the value of which is made equal to the resistance between corresponding faces of the bulk of electrolyte displaced by the probe when the latter is dipped into the electrolyte; the current density is measured in terms of the potential difference across the external resistor. An essential requirement for accuracy of measurement is that the probe dimensions should be small relative to the radius of curvature of the local current path, and, provided this is satisfied, tests on models of simple geometry with the electrolyte energized by an alternating magnetic field of frequency 1,000 c./s. have justified the method as regards both orientation of the probe for maximum current in the resistor and the value of current density obtained.

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Irradiation Effects in Strain-aged Pressure Vessel Steel

BOTH neutron irradiation and normal ageing phenomena may separately cause deterioration in the properties of mild steels by increasing the brittle-ductile transition temperature. In the case of reactor pressure vessels, the effects of neutron irradiation alone may increase this transition temperature to values well above room temperature. For purposes of reactor design, as well as for estimating the permissible service-life of a reactor pressure vessel, it is therefore essential to have reliable data regarding this effect, and considerable effort has been, and is being, devoted to this end. So far as we are aware, published data for mild steels are limited to steels in the normalized condition. In the absence of irradiation, ordinary ageing phenomena occurring during the life-time of a pressure vessel may alone cause a significant ($\sim$ 30 – 40° C.) increase in the brittle–ductile transition temperature, and the question arises whether the effects of neutron irradiation and ageing are additive or whether the increase due to