Liquid Flow.	*Magnetic Induction.*
(*a*) Pressure gradient.	(α) Magnetic intensity or force.
(*b*) Rate of flow per unit width of liquid layer.	(β) Magnetic induction.
(*c*) Ratio of (*b*) to (*a*).	(γ) Permeability = ratio of (β) to (α).

From this it is evident that the permeability corresponding to a given ratio of thicknesses of the liquid layer is given by the ratio of the rates of flow, per unit width of layer, for the two thicknesses, assuming the same pressure gradient for both. The connection between the rate of flow and the thickness for a given gradient of pressure was carefully investigated in a series of preliminary experiments, and it was found that the rate of flow varied as the *cube* of the thickness—a result which was afterwards confirmed by a theoretical investigation. The permeability in the magnetic problem is thus given by the ratio of the *cubes* of the two thicknesses.

A stream-line diagram corresponding to the theoretical diagram given above was next obtained, and on superposing the two it was found that their lines were practically coincident.

The soundness of the method as applied to two-dimensional problems in magnetic induction having been thus established, the authors proceeded to apply it to a number of special cases, many of which could not be successfully attacked by any other method. The paper is accompanied by a large number of photographs, showing the results obtained. Some of these are of importance from an electrical-engineering standpoint.

The method described is the only one hitherto known which enables us to determine the lines of induction in the substance of a solid magnetic body. It is equally applicable to two-dimensional problems in magnetic induction, electrical flow, and heat conduction.

"The Distribution of Molecular Energy." By J. H. Jeans, B.A., Scholar of Trinity College, and Isaac Newton Student in the University of Cambridge. Communicated by Professor J. J. Thomson, F.R.S. Received June 14,—Read June 21, 1900.

(Abstract.)

This paper attempts to examine the well-known difficulties in connection with the partition of energy in the molecules of a gas. A definite dynamical system is first considered, an ideal gas in which the molecules are loaded spheres, that is, spheres of radius a, of which the centre of mass is at a small distance, r, from the geometrical centre. It

is shown by direct methods that the energy will, after an infinite time, distribute itself equally between the five degrees of freedom, but when a wave of sound is passed through the gas, the energy will never have sufficient time to attain to its equilibrium distribution. It is shown that sounds of different period will be propagated with appreciably different velocities, except in the extreme case in which the ratio of r to a is almost, but not necessarily quite, zero. In this case, the ratio of the two specific heats, as determined from indirect experiments on the velocity of sound, would be $1\frac{2}{3}$, while direct experiments might give any value from $1\frac{2}{3}$ to $1\frac{2}{5}$, the value varying with the duration of the experiment.

It is suggested that an escape from this dilemma is made possible by regarding the molecules as forming an incomplete dynamical system, of which the ether is the remaining part. For purposes of illustration, it is imagined that the interaction between the two parts of this complete system consists of a frictional force which retards the rotation of the molecules. A steady state is now impossible, but it is shown that when the energy (*i.e.*, temperature) of the gas is sufficiently low, the gas tends to assume an approximately steady state, in which the energy of rotation vanishes in comparison with that of translation.

It is then shown that these conclusions may be generalised, so as to apply to a more complex system of molecules, these molecules possessing an indefinite number of degrees of freedom, and internal potential energy as well as kinetic. The molecules exert forces on one another at any distance, and the radiation is of a more general type than before.

In Part III some of the physical consequences of the view here put forward are examined. The final conclusions are briefly as follows :—

The degrees of freedom must be weighted, not counted. The weight of a degree of freedom may be anything between unity and zero, and may vary with the temperature. A degree of freedom which does not radiate energy will always be of weight unity; for a non-luminous gas, one which does radiate energy when the gas is heated is of weight zero.

As the gas is heated, the radiation and internal energies will increase much more rapidly than the temperature, until finally, at infinite temperature, the energy is distributed equally between all degrees of freedom.

Finally, it is pointed out that this view is in accordance with ordinary thermodynamics for a non-luminous gas, but that the ordinary thermodynamics must be supposed to break down above the temperature of incandescence, a view which has already been put forward, in a modified form, by Wiedemann.