II. *Preliminary Experiments.*

In order to test the apparatus and to acquire a working familiarity with the instruments, a preliminary study of the diffusion of hydrogen through the fabrics used by Elworthy and Murray was made. The apparatus used and the method of assembling it was the same as described in their paper. The fabrics used by them were inserted as a separating diaphragm in an air-tight drum-like vessel. Two gases were brought into this drum, one on either side of the fabric, and their transfusion was determined by tests on the gases by means of the instruments mentioned above. For a full description of the Shakespear apparatus the reader is referred to the paper by Elworthy and Murray. It will suffice here to say that this apparatus was made by the Cambridge Scientific Instrument Co., and that its principle is based on the variation in resistance of a heated platinum coil, constituting one branch of a Wheatstone Bridge circuit, when the gas mixture surrounding the cell has its thermal conductivity varied by changes in its component parts. The two methods adopted were (1) to pass a continuous stream of pure air and one of pure hydrogen on opposite sides of the fabric as a dividing diaphragm, and (2) to enclose a known quantity of pure air on one side and to pass a continuous stream of pure hydrogen past the other side of the fabric.

In the present experiments both methods were followed, but gas tests were made with the katharometer only. It was found that 20° C. was a more suitable temperature for working at than 15°·5 C. as previously used by Elworthy and Murray. The measurements obtained were made by keeping the permeameter and connexions in a thermostat at 20°·0 C., the variation in temperature being not more than 0°·2 C.

III. *Calibration.*

The katharometer used to detect small percentages of hydrogen or of helium in air had already been calibrated for both gases; but this calibration was checked by noting the galvanometer deflexions for a given sample of gas, deducing the percentage of helium or hydrogen present from the calibration curve and then checking the result by actually weighing a known volume of the sample studied. It was found that the values obtained by the latter method fitted in very closely with the calibration curve of Elworthy and Murray. It may be stated here that in their work it had