

a soap bubble, by blowing a hydrogen bubble in hydrogen and noting the decrease in diameter as time went on, due to the slight excess pressure inside the bubble. What he measured was the excess of the rate of gas diffusion outward over the rate inward through the film, and he found that as the soap bubble became thinner the gas transference became greater. In the present experiment the endeavour was to determine the actual rate of gas flow per square centimetre through the film, keeping the film as nearly constant in composition and thickness as possible.

V. *Description of Apparatus.*

A small cylindrical brass chamber (see fig. 1) was made for the film in two sections with a ground brass joint, which, when covered with soft wax and pressed together, made the vessel air-tight. Each section was 1.1 cm. in diameter and 7.0 cm. in height, having inlet and outlet tubes as shown in the diagram. The top section A, fig. 1, was closed by a window of plate glass, G, put on with hard wax, so that when a source of light was held directly over the chamber, its image in the film could be distinctly seen and in this way the character of the surface of the film—whether concave, convex, or plane—was known at once by the character of the image produced. Knowing the curvature of the film one could adjust the pressures of hydrogen and air on either side very accurately and so as to keep the film plane and therefore eliminate the diffusion due to excess pressure on either side. The brass ring C, fig. 1, supporting the film was 4.95 cm. in diameter, and ground down to a sharp edge. An annular channel, D, was made in the outer part of the supporting ring, and the whole soldered in the lower section of the film chamber, leaving about 0.6 cm. of the brass ring projecting above the wax surface. In this way the soft wax used in making the joint air-tight was prevented from contaminating the film and destroying its surface tension.

To overcome the difficulty of evaporation and drainage from the film, that is to keep its composition and thickness constant, the air and hydrogen used were both saturated with water vapour before entering the chamber, and, in addition, a means of adding solution to the film was provided in the following way. A bent tube, T, was inserted in the upper chamber as indicated in the diagram, having a thistle tube connected to the outer end by rubber tubing. A small amount of the same soap solution used in making the film was poured into the thistle tube and a drop of this was