

ANALYSES

The composition of any sample of methane-nitrogen was determined by estimating the methane by combustion and the nitrogen by difference. The apparatus used was of the Burrell Gas analysis type. A sketch is here attached, Fig. 1, showing the combustion chamber, KOH absorption pipette and the measuring burette. This latter could be read to hundredths of a cc.

GENERAL DESCRIPTION OF APPARATUS

Fig. 2 shows in diagram the essential features. The mixtures of methane and nitrogen were liquefied in a tube surrounded by a bath of liquid oxygen. This part of the apparatus is shown in the centre of the diagram and may be referred to as the cryostat. The mixtures were admitted to it after passing through drying tubes of calcium chloride and phosphorus pentoxide. Samples of the liquid and vapour phases were drawn off over mercury in burettes shown on each side of the diagram and collected in small sample tubes for analysis. In place of glass taps it was found convenient at some points in the apparatus to insert short lengths of rubber compression tubing which could be closed by screw clips. These are shown at L, M, N, P, R, S.

THE CRYOSTAT

This is shown in detail in Fig. 3. The liquefying tube (*a*) was closed by a rubber stopper through which four small tubes passed, (*b*) used as exhaust tube as well as for the admission or withdrawal of gas samples, (*c*) a capillary tube used to withdraw samples of the liquid phase (this device was used by Baly, *Phil. Mag.* 49, 517, 1900), (*d*) a tube for the thermocouple wires—one wire running down inside it, the other outside—(*e*) a tube closed outside by a short length of rubber tubing and containing a glass stirring rod, which could be moved by hand through the rubber.

The vacuum flask holding the bath of liquid oxygen had part of the silvering removed so that the progress of liquefaction could be seen.

The flask was closed by a rubber stopper and connected by the tube (*g*) to an exhaust pump. By reducing the pressure to 5 cms. of mercury a temperature of -200°C . or lower could easily be reached. The pressures in the liquefying tube and in the vacuum flask were observed on simple mercury manometer columns.

MANIPULATION

In carrying out an experiment with any mixture the following order of proceeding was adopted. The liquefying tube was first exhausted through (*b*), the vacuum flask being removed. The storage