particular solution with which each was to make contact, and they were then placed in position. In practically all cases the observed potential difference increased with some rapidity during an initial period of considerable duration, during which several observations were made. If this were due to salts diffusing from the bridges, it would be necessary to make the exceedingly improbable assumption that more than ten times as much salt diffused into the more concentrated solution (0.1 *N*) bathing the membrane as into the less concentrated solution (0.01 *N*). Somewhat similar considerations apply to the succeeding period of constant potential difference.

After a time the potential difference ordinarily fell off. Pumphrey's explanation applies better here. However, we noted that in general the shorter the period between the readings, the closer was the correspondence between successive readings; the potential varied with the time rather than with the number of insertions of the bridges. When the interval between observations was long and, therefore, the KCl bridges were not being inserted, the potential fell, nevertheless. For example, in one experiment, using 0.1 *M* NaCl on one side of the membrane and 0.01 *M* NaCl on the other, the potential fell from 28 mv. to 3 mv. during an interval of twenty hours during which no observations were made.

It must be recognised that an appropriate combination of convective streaming and diffusion might be imagined, such as would account for the inconstancy of the potential difference in our experiments. Certain other differences between our experimental procedure and that of Pumphrey might be used as a basis for speculation, did it seem worth while. We regard it as preferable to seek an opportunity to repeat our experiments in such a way as to shed further light on the probable causes of the differences between Pumphrey's results and our own.

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¹ Pumphrey, R. J., *Proc. Roy. Soc.*, B, 109, 434; 1932.

² Brooks, S. C., A. C. Giese, and R. I. Giese, *J. Exp. Biol.*, 8, 124; 1931.

Photomicrographic Method for Magnification and Recording in High Speed Pressure Indicators

PRESSURE gauges for recording rapidly changing pressures, such as occur in discharge of firearms or explosions in closed vessels, usually consist of a pressure member which rotates a mirror suitably linked to it. The rotation of the mirror is used to give an optically enlarged indication of the deflexion of the pressure member. These methods have attendant disadvantages. In such gauges we have found it possible to use a photomicrographic method of magnification and recording pressure time curves.

The movement of the pressure member is communicated to an operating rod rigidly connected to the pressure member where the maximum movement takes place. The free end of the operating rod carries a needle at right angles to its longitudinal axis and direction of motion. By means of suitable illumination by light, an enlarged image or shadow picture of the edge of the needle is formed on the film of a drum camera used in photographing the records. The enlarged image is concentrated in a direction normal to the long axis of the needle by means of a cylindrical lens so that a linear image in the form of a black and white line is formed on the film of the camera. The

optical system employed for enlarging and recording the very small motions of the needle attached to the operating rod of the gauge is essentially similar to that used for photographic registration with the Einthoven string galvanometer.¹

In this manner, by dispensing with mirror systems, we have been able to cut down the mass of the working parts of a rifle pressure time recorder of the piston type to about 10 gm. An example of a pressure time curve

FIG. 1.

obtained in discharge of a British service rifle is shown in the accompanying photograph (Fig. 1).

We have also employed the system for closed vessel gauges, and found it useful for recording small motions of various descriptions.

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¹ See "Oscillographs", Irwin, 1925, p. 24.

Temperatures of the Wolf-Rayet Stars

IN a recent paper¹ C. S. Beals has published the contour of the emission line of ionised helium 4686 in the spectrum of the Wolf-Rayet star H.D. 192163. We may suppose that the mechanism of excitation of emission lines in the spectrum of Wolf-Rayet stars is identical with that of planetary nebulae. According to Zanstra's theory, we can obtain the temperature of star from the ratio:

$$\frac{\text{whole intensity of line}}{\text{intensity of 1 A. of continuous spectrum}}$$

According to the contour of line 4686, this ratio for the star under consideration is nearly equal to 200. Neglecting the presence of other lines of ionised helium, we find from Zanstra's Table 7² the temperature $T = 65,000^\circ$ as a lower limit. For many Wolf-Rayet stars the intensity of line 4686 is much greater, and therefore we may expect even higher values of surface temperature.

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¹ *Mon. Not. Roy. Ast. Soc.*, 92, 196; 1932.

² *Pub. Dom. Astrophys. Obs., Victoria*, 4, 240; 1931.

Planetary Positions on Medieval Maps

A RECENT issue (Feb. 27) of the *Illustrated London News* contained a reproduction of an old map believed to have been used, and possibly drawn, by Columbus. At the side of the world map is a map showing the celestial 'spheres' according to the Ptolemaic system. It is of special interest because it shows the positions* of the heavenly bodies approximately as follows: Sun, Aries 0; Moon, Libra 0; Mercury, Aries 22; Venus, Aquarius 17; Mars, Cancer 2; Jupiter, Virgo 7; Saturn, Scorpio 22.

* Degrees are not given in the figure. I have merely estimated the degree according to the distance of each planet from the commencement of the sign in which it is placed.