

silica gels which became normal in ignited gels. White, Urban and Van Atta<sup>4</sup> found very low values for stream potentials in pyrex glass capillaries of less than 0.001 cm. diameter. Wolkowa, in measuring the velocity of penetration of liquids into finely powdered materials, found regular behaviour with non-polar liquids but anomalous results with water and other polar liquids. Measurements carried out at the Building Research Station of the dielectric constant of liquids in porous materials and its variation with frequency have been found to exhibit discrepancies which may prove to be related with observations on water in soils made by Smith-Rose<sup>5</sup>.

It is suggested that Hardy's<sup>7</sup> conception of molecular orientation in thin liquid films formed on the surface, for which strong evidence is afforded by their behaviour as lubricants, may provide a means of reconciling the anomalies to which we now direct attention. In such films, the work required to tear up 'by the roots' orientated chains of molecules, as is necessary in molecular exchanges between film and gaseous phase or across a semi-permeable membrane, may be much greater than that required to slide layers from the surface in a manner which may be considered to occur when a direct hydrostatic suction is applied. This crude picture is, of course, open to objections which it is not possible to discuss here, but it may serve to emphasise the desirability of carrying out measurements by two or more different methods in any studies designed to further our knowledge of the capillary properties of liquids in finely porous systems.

B. H. WILSDON.  
D. G. R. BONNELL.  
M. E. NOTTAGE.

Building Research Station,  
Garston, Herts.  
Dec. 1.

<sup>1</sup> Shereshevsky, J. L., "Vapour Pressure in Small Capillaries", *J. Amer. Chem. Soc.*, **50**, 2966; 1928.

<sup>2</sup> Szigetli, P., "Über sog. negative Adsorption und Dampfdruckisothermen an Permutiten und Tonen", *Koll. Beih.*, **38**, 99; 1933.

<sup>3</sup> Glixell, S., and Wiertlak, J., "Das Elektrokinetische Potential des Kieselsäure Gels", *Koll. Z.*, **43**, 85; 1927.

<sup>4</sup> White, H. L., Urban, F., and Van Atta, E. A., "Correlation of Stream Potentials and Surface Conductance", *J. Phys. Chem.*, **36**, 3152; 1932.

<sup>5</sup> Wolkowa, Z. W., "Porositätsbestimmungen von Dispersoiden nach der Eindringgeschwindigkeit von Flüssigkeiten", *Koll. Z.*, **67**, 289; 1934.

<sup>6</sup> Smith-Rose, R. L., "Electrical Properties of Soil", *Proc. Roy. Soc.*, **A**, **140**, 359; 1933.

<sup>7</sup> Hardy, Sir W. B., "Problems of the Boundary State", *Phil. Trans.*, **A**, **230**, 1; 1932.

### Galvanometer Relays

THE use of the rectifier photo-cell to amplify galvanometer deflections is now well known; but I have never seen any explicit mention of the fact that, with the customary set-up<sup>1</sup>, the deflections of the second galvanometer are not in general proportional to those of the first. The discrepancy arises because the area of the photo-cell illuminated changes as the deflection of the primary galvanometer changes.

I am now using a modified system in which this defect is absent. The beam of light from the primary galvanometer mirror forms a rectangular image on a lens, immediately behind which is a pair of right-angled prisms, which throw part of the light on to one cell and part on to another. The lens forms an image of the galvanometer mirror on each cell. As the rectangular image moves across the lens more light is thrown on to one cell and less on to the other: but there is no change of the cell area illuminated in either case, the only effect being to vary the bright-

ness of the images on the cell surfaces. Thus, non-uniformity of the sensitivity of the surfaces cannot affect the proportionality between the deflection of the two galvanometers.

The two cells are connected across the galvanometer in parallel with, and in opposition to, each other; this method of connexion gives considerably greater amplification than can be obtained with a divided cell of the same photo-electric sensitivity.

D. H. FOLLETT.

Adam Hilger, Ltd.,  
98 Kings Road,  
London, N.W.1.

<sup>1</sup> A. V. Hill, *J. Sci. Instr.*, **3**, 262; 1931. *NATURE*, **133**, 685; 1934.  
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### Addition of Hydrogen Bromide to Olefines

THE results of several investigations have confirmed the discovery<sup>1</sup> that oxygen and peroxides ('oxidants') may greatly affect the addition of hydrogen bromide to olefinic substances<sup>2</sup>. In all these investigations the double-bond has been in the terminal position ( $\text{CH}_2 = \text{CH} - \text{CH}_2 -$ ), oxidants causing the addition of hydrogen bromide to yield  $\text{CH}_2\text{Br} - \text{CH}_2 - \text{CH}_2 -$ , and 'anti-oxidants' allowing the formation of  $\text{CH}_3 - \text{CHBr} - \text{CH}_2 -$ .

In order to ascertain whether the same effect could be produced in the reactions of an olefine containing a non-terminal double-bond, we have studied additions to *iso*-undecylenic acid<sup>3</sup> ( $\text{CH}_3 - \text{CH} = \text{CH} - (\text{CH}_2)_7 - \text{COOH}$ ). This olefine adds hydrogen bromide relatively slowly, and yields the same proportions of 9- and 10-bromoundecic acids, whether oxidants or anti-oxidants are present. As undecylenic acid ( $\text{CH}_2 = \text{CH} - (\text{CH}_2)_8 - \text{COOH}$ ) clearly shows the peroxide effect (Ashton and Smith, loc. cit.) there is now some evidence that only terminal double-bonds are susceptible.

J. C. SMITH.  
P. L. HARRIS.

Dyson Perrins Laboratory,  
University, Oxford.  
Dec. 18.

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<sup>2</sup> Kharasch and co-workers, *ibid.*, **55**, 2521, 2531; 1933. **56**, 244, 712, 1212, 1243, 1642, 1782; 1934. Smith, *NATURE*, **132**, 447; 1933. Linstead and Rydon, *ibid.*, **132**, 643; 1933. Ashton and Smith, *J. Chem. Soc.*, **435**, 1308; 1934. Brouwer and Wibaut, *Rec. trav. chim.*, **53**, 1001; 1934.

<sup>3</sup> Krafft and Seldis, *Berichte*, **33**, 3571; 1900.

### Ionisation of the Kennelly-Heaviside Layer

THE eclipse observations of August 31, 1932, and Appleton's Tromsø observations, indicate fairly certainly that the normal daytime ionisation in the E layer (100 km. height) is due mainly to solar wave radiation, and not to neutral corpuscles as Chapman suggested. But the ionising wave radiation may not be ultra-violet light (in amount corresponding to Planck's formula at the sun's temperature) as now generally supposed. As Eckersley has remarked, if the ionising agent is wave radiation, it must be so penetrating as to be of Röntgen type; but he disbelieves in the emission by the sun of an adequate amount of such radiation (Elias, however, for a time considered such rays to be the cause of the E-layer).

But solar conditions seem not to preclude such radiation. If, as Swann has suggested, very fast electrons are produced in sunspots, most of them