definitely better than an order of magnitude. Experiments are in preparation with automatic current and temperature control in order to obtain more accurate proton mobility determinations.

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Electrostatic Attraction between a Liquid Surface and a Needle Height-Gauge

WHERE the height of a liquid surface needs to be measured accurately, it is customary to use a needle height-gauge. In a typical gauge a needle point is slowly lowered by a micrometer screw until the point just touches the liquid surface. The instant of contact is detected either visually or electrically, and the micrometer reading at that instant gives the height of the liquid surface. Such gauges are regarded as accurate to within $\pm 0 \cdot 001$ in. It has been found, however, that with a non-conducting liquid that has become electrically charged, errors of $0 \cdot 025$ in. can easily occur.

A laboratory needle gauge was being lowered towards a surface of mineral oil in a 'Perspex' vessel, when it was observed that, when the needle was held at a height of about $0 \cdot 05$ in. above the oil surface, a rhythmic disturbance of the surface occurred immediately below the needle. The frequency of this disturbance was usually of the order of 1 c./sec.

Subsequent investigation revealed that the 'Perspex' vessel had become electrostatically charged when it was being cleaned immediately before being filled with oil, and that this was the cause of the disturbance. When an earth wire was brought into contact with the oil at the site of the disturbance, the disturbance ceased at once, only to start again (but with diminished vigour) when the wire was withdrawn.

When the oil was replaced by de-ionized water, which has a much lower resistivity than the oil, the phenomenon did not occur. After the oil had been allowed to stand exposed to the atmosphere for a few days, only very slight disturbances could be produced. This was due to the absorption of atmospheric moisture by the oil and the consequent decrease in resistivity; the oil was afterwards dried by prolonged agitation in a vacuum desiccator, and immediately it became possible to produce the disturbances again on the same scale as when the oil had been fresh.

Evidently the cycle of events is as follows: (1) When the oil is put into the charged container the charge slowly spreads across the surface of the oil. (2) When the needle is brought close to the oil, the charged oil immediately below is attracted towards it, thus producing a hump in the surface, in which the combined effects of gravity and surface tension are balanced by the electrostatic attraction. (3) The needle, being earthed, acts like a lightning conductor and the hump is rapidly discharged. (4) The hump collapses suddenly. (5) The electrostatic charge on the surrounding area spreads slowly over the discharged area, and the cycle begins again.

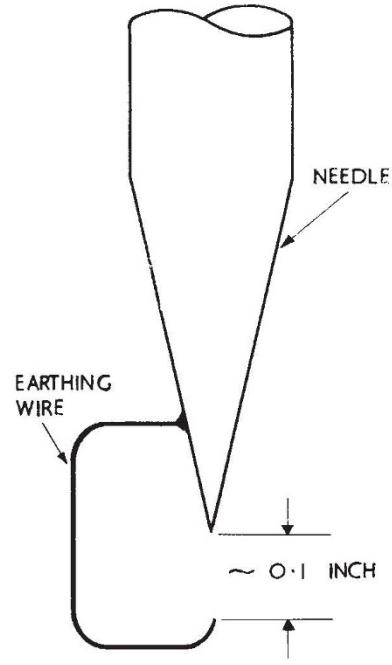

Fig. 1

Once started, this cycle of attraction and collapse is likely to continue for hours before the charge is completely dissipated.

When the needle is lowered closer to the surface of the liquid, a point must obviously be reached when the hump in the surface comes into contact with the needle. Contact once having been made, it is maintained permanently by surface tension. In the experiments described above, contact usually occurred when the needle was between $0 \cdot 020$ and $0 \cdot 025$ in. above the level of the surface.

There is thus a serious risk of erroneous readings when a needle gauge of the normal design is used to measure the level of a non-conducting liquid. This risk may be eliminated very easily by adding an earthing wire to the needle, as shown in Fig. 1.

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Finely Ground Quartz: Evidence against a 'Disturbed' Layer

BRISCOE *et al.*[1] discovered that the rate of solution of a finely ground quartz powder decreases slowly from an initially high value to a much smaller steady value. Kitto and Patterson[2] concluded that the effect could not be accounted for on the basis of particle size alone and attributed it to edge effects and the presence of a 'Beilby layer', presumably of amorphous silica. Further evidence of an amorphous layer has been reported by various authors using X-ray diffraction[3,4], electron diffraction[5], differential thermal analysis[6,7], rate of solution[8,9], and density[6,9]