photographed in the second order of the 21-ft. grating in the Physics Department of University College, Dublin, and despite the weakness of the band and the presence of the first positive system, a rotational analysis proved possible. Three components were found, each consisting of a fairly strong P, Q and R branch together with a number of weaker satellite branches. A detailed examination of the results shows unambiguously that the upper state is of species $^3\Sigma^-_u$. A preliminary value of B_{n+1} determined from the Q branches alone gives $1 \cdot 38_0$ cm.$^{-1}$. The analysis also verified beyond doubt that the lower state of the 8265·5 A. band is the level of $v = 1$ of $B^3\Pi_g$. This is shown by the excellent agreement between the combination differences derived from the present analysis and those formed from the data on the 1–0 band of the first positive system[6].

The vibrational numbering of the levels in the $^3\Sigma^-_u$ state is not known with certainty at present. However, one can say that the $v = 0$ level cannot lie above about 71,700 cm.$^{-1}$ and that it very probably lies within a few vibrational quanta of this value. Now Mulliken[4], in his theoretical work on nitrogen, has predicted that a $^3\Sigma^-_u$ state, with a B value of approximately 1·47 cm.$^{-1}$, should occur at about 70,700 cm.$^{-1}$. It is seen that the results of the present work are in satisfactory agreement with Mulliken's theoretical predictions.

A full account of the above work will be published elsewhere in the near future.

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Luminous Spots on Electrodes in Insulating Oil Gaps

IN 1955 we reported the observation of luminous spots on electrodes in transformer oil[1]. The spots were detected by a photographic plate in the oil between the electrodes with application of a.c. and d.c. voltage stresses for 2–30 min. The oil was usually degassed but not filtered. The luminous spots occurred at random on the surface of a plane electrode and were more concentrated at sharp edges. One of the electrode systems used was an American Society for Testing Materials oil-breakdown test-cup. The threshold average electric stress seemed to be of the order of 50 kV./cm. minimum. At the time of those experiments it was not known whether these luminous spots were due to discharges in tiny bubbles or to another cause.

Since those preliminary experiments, more refined and efficient techniques have been used in the investigation of these luminous spots, whereby the electrodes are observed face on through a glass window coated with transparent semiconducting tin oxide. Microscopic examination has shown that, while bubbles do occur sometimes at high stresses under low hydrostatic pressures, or with fibres present, bubbles are not responsible for the luminous spots observed on electrodes in well-filtered, degassed oil. The luminous spots have been shown to occur only at the negative electrode with d.c. stresses and are therefore attributed to fluorescence of the oil molecules excited by field-emitted electrons from points of high localized electric stress on the electrodes. They have been detected by 10-min. exposures with Ansco Super Hypan Film (*ASA* 500) in a camera having an $f2$ lens opening at a distance of about 5 in. It is believed that these luminous spots are similar to the luminosity reported seen by Darveniza[2] at 600 kV./cm., but detected here at much lower average electric stresses. The threshold voltage stress seems to be of the order of 50–250 kV./cm., depending on the degree of polish of the electrodes and filtering of the oil. The local electric stress is very likely 10 or more times higher.

M. Wachtel (Westinghouse Research Laboratories, private communication) and Llewellyn-Jones[3] have reported electron field emission into a vacuum or low-pressure gas at average electric stresses of the same order as used here.

The occurrence of luminous spots is not significantly affected by applied hydrostatic pressure from 10 mm. mercury to 2 atmospheres. They also occur with a.c. voltages between glass surfaces, indicating that field emission occurs from glass surfaces. The luminosity is not affected by an efficient additive, benzil, reported by Basseches and McLean[4] to prevent gassing.

It is believed that observation of these luminous spots assists in explaining the statistical effect of electrode area (and volume) on breakdown, particularly in commercial tests, and the dependence of long time a.c. electric strength on time of voltage application. It also suggests the origin of the development of gas (hydrogen) in stressed oils, since the electrons exciting fluorescence (requiring about 3 eV.) may also have or gain by acceleration sufficient energy to decompose the hydrocarbon oil molecules (requiring about 4 eV.).

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Compaction of Briquettes

WHEN a powder is compacted by a simple application of pressure, the density and strength of the compact so formed (measured after the pressure has been released) are determined by the pressure used, but ultimately they approach limiting values which are not exceeded by further increasing the pressure. The limiting density of the compact falls short of the density of the material of the powder by an appreciable margin, say 4–20 per cent, depending on the material used (Fig. 1).

This failure to achieve complete compaction arises in two ways. First, as the briquetting pressure is applied it is opposed by forces set up in the powder