a jump in the value of the dielectric constant of carbon disulphide and a distinct change of slope in the density curve. Moreover, this is a point of change from one liquid modification of carbon disulphide into another one, also liquid.

The sudden change of the value of P at -90° suggests that the structure of the carbon disulphide molecule undergoes a change at this point. We have already observed a similar effect with ethyl ether.¹

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¹ NATURE, 126, 684; 1930: 127, 236; 1931.

Diamagnetism of Liquid Mixtures.

WE have been for the past year working on the diamagnetism of liquid mixtures. Our method was to determine the mass susceptibility by a Curie balance, using a powerful electromagnet of the Pye type. Several mixtures have been studied carefully. By careful adjustments we are confident that our error in susceptibility value is not more than half per cent. In all cases studied, straight lines have been obtained between the mass susceptibility and composition. It is thus clear that the additive law is generally obeyed by liquid mixtures. Our list includes mixtures of benzene with chlorobenzene, hexane, carbon tetrachloride, and nitrobenzene, mixtures of hexane with nitrobenzene, and mixtures of acetone with chloroform.

Density curves obtained in all these cases have shown a departure of nearly three per cent, the maximum being about five to six per cent in the cases of benzene-nitrobenzene and acetone-chloroform. We therefore agree with Ranganadham¹ that the results of Trew and Spencer² require correction, but so far we have not been able to obtain departures from the additive law when mass susceptibilities are considered. Work with many other liquid mixtures is in progress.

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¹ NATURE, 127, p. 975; 1931.

² Proc. Roy. Soc., A, 131, p. 209.

Duration and Magnitude of a Lightning Discharge.

A SOMEWHAT unusual case of damage by lightning has recently been brought to the attention of the National Physical Laboratory by Capt. A. J. Mayne, Chief Electrical Adviser for the Aldershot Tattoo. An illuminated notice-board was supplied through fuses from a bare overhead line, by means of two cables, of the type used for house wiring, each having a conductor formed of three strands of tinned copper wire each about 0.75 mm. in diameter, insulated with pure and vulcanised india-rubber, a spiral covering of tape, and an outer braid, and suitable for currents up to 8 amperes: the diameter of each cable was about 5 mm. The two cables were taped together at intervals of about ten metres, and were supported by the creosoted wooden terminal pole of the overhead line and one other similar pole.

At a time when the circuit was not energised, a lightning discharge took place through the cable line, and passed to earth down the supporting poles, in each of which a spiral track was cut: the fuses pro-

tecting the cable line were shattered, but no damage to the overhead line was evident. As a result of this discharge, the rubber insulation and tape have been cleanly slit throughout their length and the conductor extracted; the outer braiding has been slit and hangs loose; and each copper conductor has been greatly deformed on one side. At certain points the two conductors have partially cohered. There is no evidence of melting of the copper, and, at most points, no burning of the insulation. At a few points, however, and particularly where the two cables were taped together and the conductor remained in contact with the insulation, burning or melting of the rubber and singeing of the braid have occurred.

It is evident that the lightning current was in the same direction in both cables, and gave rise to an attractive force, under the influence of which the conductors cut the insulation as scissors would do, and came violently into contact.

It is of interest to attempt to calculate very roughly the limiting duration and magnitude of the discharge. For this purpose it is necessary to know the temperature rise of the copper, and the force necessary to cut the insulation. The maximum temperature attained evidently lay between 1100°C. , the melting point of copper, and 200°C. , a temperature at which no damage to the insulation occurs in 1 minute. Some experiments in which a piece of the conductor was heated to a known temperature, placed in contact with the insulation, and allowed to cool naturally, suggest that 700°C. is a probable value for the temperature rise.

An approximate figure for the force necessary to cut the insulation was obtained by laying a piece of the three-strand conductor on a length of insulation resting on a copper plate, and applying pressure with a hydraulic press: the conductor was first run through a bath of solder to avoid spreading of the strands, since the tendency to spread would not be present during the actual lightning discharge. It was found that the insulation and braid were completely cut by a pressure of 150 kgm. per centimetre, the time of application being about 2 seconds, and were not cut by 100 kgm./cm. Taking a spacing of 0.5 cm., the minimum current in each conductor necessary to produce a force sufficient to cut the insulation is 60,000 amperes. This current must have supplied the energy required to raise the conductor temperature by 700°C. , approximately 3000 joules per metre, in the duration of the lightning discharge. Hence it may be calculated that the maximum duration of the discharge was 20×10^{-6} seconds.

It may be noted that the average rate of energy input to each metre of conductor was at least 150,000 kilowatts.

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Structure of the Azide Group.

L. E. SUTTON has given¹ measured values of the dipole moments of the *liquids* phenyl azide, *p*-chlorophenyl azide, and *p*-tolyl azide, and applies this evidence to discriminate between the structural formulæ below (1-4). The evidence is strongly in favour of the ring structure (1).

In contradistinction to this, in each of the *crystal-line* azides for which structures have been obtained hitherto, the crystals of sodium, potassium, thallium,