Letters to the Editor

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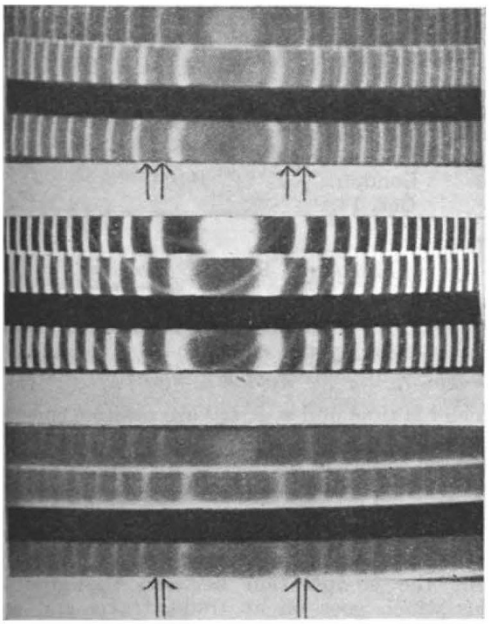
Notes on points in some of this week's letters appear on p. 799.

Correspondents are invited to attach similar summaries to their communications.

Debye Heat Waves in Highly Viscous Liquids

For the spectroscopic study of the light scattered in solids and fluids using interferometers of high resolving power, it is very important to be able to work with a light source giving sharp and intense spectral lines without accompanying hyperfine structure components or continuous spectrum. A zinc–mercury amalgam lamp in 'Pyrex' glass has been



1. Phenol 2. Direct light 3. Glycerine

developed in this laboratory by one of us (C. S. V.) which gives the zinc triplet of lines 4680, 4722 and 4811 A., satisfying these requirements. It may be run continuously for days together without trouble, and is found to be a great advance on the ordinary mercury arcs for such investigations.

A very surprising and interesting result obtained using the zinc–amalgam lamp is the discovery that the light scattered backwards even by such a highly viscous liquid as glycerine at 20° C., when analysed with a Fabry-Perot étalon, exhibits well-defined Brillouin components on either side of the incident lines, along with a continuous background. A similar result is also shown by liquid phenol at room temperature. These facts are illustrated in the accompanying reproductions (1 and 3), 2 being the corresponding pattern for the zinc triplet in the incident light. It will be noticed that the undisplaced lines in the scattered light are very intense relatively to the accompanying Brillouin components. The failure to observe these latter components with glycerine and phenol at room temperatures in earlier investigations[1] with the mercury arc is readily understood; with the mercury radiations, the hyperfine structure of the undisplaced central line would completely overwhelm the much feebler displaced components in the scattered light.

The viscosity of glycerine at 20° C. is 8·3 poises, and if this viscosity were effective in the propagation of compressional waves having a wave-length comparable with that of the incident light, these waves would be so highly damped that they could have no physical existence, and the corresponding Brillouin components would therefore be unobservable. The fact that the latter are actually to be seen, and indeed are quite sharply defined, seems to indicate that the usual hydrodynamic viscosity has little influence on the propagation of thermal sound waves of very high frequencies.

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Sept. 20.

[1] Raman, C. V., and Rao, B. V. R., Nature, **139**, 585 (1937); **141**, 242 (1938).

Mathematics of Air Raid Protection

In view of the discussion which is occurring on this subject, it seems desirable to have some quantitative measure of the degree of protection afforded by a given shelter. In order to limit the problem we may consider only risks of death, and further confine ourselves to high explosive bombs. Incendiaries have proved a negligible danger to life in Spain, and gas is also negligible except for babies and those whose respirators do not fit.

Consider a given type of bomb, say, a 250 kilo. bomb, which is commonly used on central areas of Spanish cities, and a man in a given situation, whether in the street or in a shelter. Let n be the expected number of bombs falling in his neighbourhood (say, 1 square kilometre) during a war, the distribution of bombs over this area being supposed even, since aim is poor when cities are bombed. Let p be the probability that a single bomb falling at the point (x,y) in this area will kill him. Then the probability that he will be killed in the course of the war is $P = \frac{n}{A}\int p\,dx\,dy$, integration being taken over the whole neighbourhood of area A.

The values of n and p will, of course, be different for each type of bomb, and the different expressions so obtained must be summed. Further, the man will be in different places during the war, and thus another summation is necessary. Finally, P must be summed for the whole nation.