More details of these experiments and of their interpretation will be given elsewhere.

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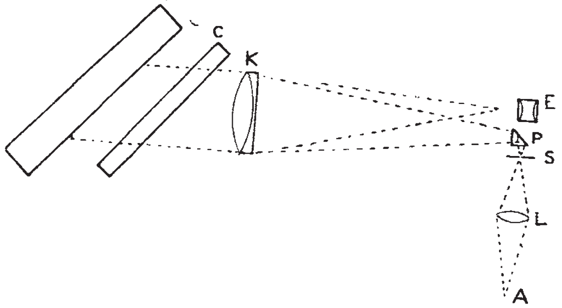
Use of Diffraction Gratings Ruled on Cylinders

I HAVE recently described[1] a method of ruling diffraction gratings on cylinders by a method which gives results substantially free from the periodic errors otherwise difficult to avoid; and by coating such cylinders with a plastic pellicle, which is afterwards removed, it is possible to prepare flat gratings in hardened gelatine on optically flat glass.

I have recently found that it is possible to use these ruled cylinders as the dispersing element in a spectroscope. When a flat grating is used, the collimating lens (or a reflector) ensures that the rays shall fall on the grating at the same angle. In using the cylinder grating as a dispersing element, this condition is fulfilled by the use of a cylindrical lens placed obliquely in the beam of parallel rays from the collimating lens, the axis of the cylinder grating being set accurately parallel to the axis of the cylindrical lens and at right-angles to the plane of the slit. A simple disposition of the optical parts involved, which illustrates the method, is shown in the accompanying diagram. In this the Littrow arrangement is used, the same lens being used as collimator and telescope and the light from the slit being directed towards the collimating lens by means of a small right-angle reflecting prism.

Observations of the image are made with an eyepiece either just above or below or to one side of the right-angle prism. Light from the source A is brought to a focus on the slit S by means of the condensing lens L and is reflected towards the collimating lens K by means of the prism P. The rays then fall on the cylindrical lens C, the axis of which is parallel to



the axis of the ruled cylinder R. The distance from C to R is adjusted so that rays proceeding from a point in the centre of the slit would be focused as a line on the axis of the ruled cylinder R. The axis of the cylinder R is disposed, in relation to the optic axis of the collimator, in such a way that the rays fall on the ruled cylinder at right-angles to the individual flat facets of the cuts made by the diamond in ruling the grating, the order of the spectrum observed in the eyepiece E being thus that order into which the greater part of the energy is thrown. It will be seen that the rays fall on the ruled cylinder at the same angle.

This arrangement has been tried with a cylinder grating one inch in diameter ruled with 4,000 lines to the inch, and excellent definition was obtained in the fourth order, which showed a fairly good 'blaze'. A similar arrangement, in which lenses are replaced by reflectors, follows on obvious lines and should be applicable to instruments designed for use in the infra-red. The resolving power and dispersion can be evaluated in precisely the same manner as if a plane grating were used; but whereas in the case of a plane grating the light-gathering power is proportional to the area of the ruled surface, with the method described above the light-gathering power is independent of the diameter of the ruled cylinder. With flat gratings of very large ruled area, the total distance travelled by the ruling diamond may be so great as to impair the diamond through wear before the whole area can be covered; but with the cylinder grating this difficulty should be greatly reduced. It should also be possible to bore cylinder gratings axially and so maintain a constant temperature by circulation of water.

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Dielectric Relaxation of Alcohol–Heptane Mixtures

IT is well known[1] that pure alcohols exhibit a large dielectric absorption at radio frequencies, together with a very much smaller absorption in the centimetre region. For measurements at a fixed wave-length of 10 cm., this corresponds to the occurrence of loss peaks at temperatures of the order of $+ 100°$ C. and $- 100°$ C. respectively. In practice, the low-temperature loss peak thus found would be largely obscured by the loss at high temperatures; but this is no longer the case when the alcohol is dissolved in a non-polar solvent.

A 10-cm. H_{01} resonator has been used to measure the dielectric absorption of solutions of n-amyl alcohol in heptane. Curves are given in the accompanying graph showing the variation of ε'' with temperature for a number of concentrations between 0·6 and 25 mol. per cent. The curves show how the 'low-frequency' loss maximum falls rapidly with dilution, such that at the intermediate concentration of 15·5 per cent the losses due to the separate relaxation mechanisms are approximately equal. On the other hand, the loss at $- 70°$ C., which for these concentrations is almost entirely due to the high-frequency mechanism, falls proportionately with concentration. At very low concentrations (less than