uncertain, as they do not agree with some results obtained by McLennan.[5] A careful study of both works on the subject shows that the difference between McLennan's results and mine is just what is to be expected, if the lower resolving power with which McLennan worked is taken into consideration. The line 4101, I found to possess four components with separations 0·000, 0·281, 0·380, and 0·658 $cm.^{-1}$: now the component at 0·380 $cm.^{-1}$ is weak and very close to the component at 0·281 $cm.^{-1}$; consequently, except with very fine lines and high resolving power, it could not be observed and the line would appear to possess only three components, as McLennan observed. Similarly, in the case of the line 4511, I observe four components, while McLennan only observed two; now the separations of the four components are 0·000, 0·045, 0·204, and 0·276 $cm.^{-1}$: here the components at 0·000 and 0·276 $cm.^{-1}$ are weak and very close to the strong components at 0·045 and 0·204 $cm.^{-1}$; so that except with the highest resolution they escape detection and the line appears to be a doublet; which is just what McLennan observed.

In order to see the full structure of the lines, it is necessary to work with a resolving power of at least 500,000; this I achieved by using a reflecting echelon grating with a resolving power of about 800,000 and a light source which operated at the very low temperature of about 80° C. With any less adequate means it is quite impossible to observe the smaller separations.

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[1] *Proc. Roy. Soc.*, A, vol. 121; 1928.
[2] *Zeit. für Phys.*, vol. 67; 1931.
[3] *Proc. Roy. Soc.*, A, vol. 128; 1930.
[4] *Zeit. für Phys.*, vol. 47, p. 176; 1923.
[5] *Proc. Roy. Soc.*, A, vol. 128; 1930.

Effect of Fungi upon the Strength of Timber.

THE fact that fungal decay considerably lowers the strength of timber has long been familiar to all who employ this material for structural purposes, but practically no information has been available as to the actual amount of damage caused in any specific wood at various stages of decay. Recently it has been shown that almost imperceptible decay may render Sitka spruce timber unsuitable for use where high mechanical strength is required. An investigation carried out at Princes Risborough by the Forest Products Research Laboratory of the Department of Scientific and Industrial Research has now taken the matter a step further. The rate of loss of mechanical strength in pieces of timber exposed to the attack of a fungus growing in pure culture, with the chemical and other changes taking place in the wood, have been accurately followed.

The timber used in these experiments was Sitka spruce, one which is unusually homogeneous and therefore suitable for the mechanical testing and analysis of small samples; it is also a wood frequently used in structures such as aeroplanes where any deterioration of its strength may be a serious matter. Previous work at the Laboratory has shown that this timber in certain circumstances is very susceptible to decay, and the fungus *Trametes serialis*, chiefly responsible for the development of brashness in it, has been studied.[1]

A large number of small, carefully selected test pieces were inoculated with cultures of *Trametes serialis* actively growing upon agar medium in culture flasks in which a high humidity was maintained.

A number of test pieces were removed from the cultures after periods of exposure to the fungus varying from one to ten weeks, and tested for strength upon apparatus specially designed for the purpose; while at the same time matched control pieces, which had been kept sterile, were tested. The progressive loss in weight and chemical change by the fungus were also determined, and these results were correlated with the strength figures. Sections were cut from certain of the test pieces and examined microscopically.

Two sets of experiments were carried out and the results will shortly be published as a Forest Products Research Bulletin. In each series there was an extremely rapid fall in the strength values; after only two weeks in the second experiment the average value for the strength of the pieces had fallen to about 80 per cent of that of the normal sound pieces, and afterwards the mechanical strength continued to fall rapidly until after ten weeks less than 20 per cent remained.

This loss in strength could be closely correlated with the chemical changes brought about by the fungus. The curve for the change in alkali solubility 'shadowed' quite closely the curve for the strength values. It is of interest, however, to note that loss in weight of the specimens did not become significant until several weeks after the strength of the timber had begun to fall. The increase in alkali solubility of the wood substance preceded the loss in weight caused by the respiration of the fungus.

Examination of the sections of the test pieces showed that the hyphæ of the fungus rapidly permeated the blocks and penetrated the cell walls, but the amount of mechanical damage caused by the formation of small bore holes could not be considered as the chief factor responsible for lowering the strength of the wood, which should rather be looked for in the chemical changes in the material of the cell walls brought about by the fungus.

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[1] *Forest Products Research Bulletin* 4. K. St. G. Cartwright. "A Decay of Sitka Spruce caused by *Trametes serialis*." (London: H.M. Stationery Office.)

An Unusual Solar Halo Complex.

AN unusual halo complex was observed at Saskatoon, Canada, on April 16 between 8.20 A.M. and 9.15 A.M., 105th meridian time. Its appearance when the altitude of the sun was about 35° is shown in the accompanying diagram (Fig. 1). The significance of the various letters is as follows: *HH*, horizon; *Z*, zenith; *S*, sun; *aa*, halo of 22°; *ee'*, parhelia of the halo of 22°; *cc*, *c'*, upper and lower tangent arcs of the halo of 22°; *bbb*, portions of the halo of 46°; *d*, arc tangent to the halo of 46°; *mm*, parhelic circle; *pp'*, parhelia of 90°; *tt'*, parhelia of 120°; *h*, anthelion; *ss'*, narrow-angle oblique arcs of the anthelion; *rr'*, apparently portions of wide-angle oblique arcs of the anthelion; *gg'*, apparently secondary parhelia of the parhelia of 22°; *f*, arc vertically above, and concave towards the sun. Coloured halos and arcs are shown by a solid and a dotted line, the latter indicating the blue side of the halo.

Features which are worth noting in this halo complex are (1) the colour of the oblique arcs *r*, *r'*; and (2) the arcs *f* and *d*. When the arcs *r*, *r'* were observed first they were so faint that it was impossible to be certain of their colour, but shortly before the disappearance of the halo they brightened to such an extent that the red colour on the side next the horizon was very noticeable. The ends of the arc *f* appeared to merge into the upper horizontal arc *cc*, and the region enclosed by the two was much brighter than