ever occurs in *Macrosporium* or *Alternaria*, or the possibility that these latter stages have cropped up here in cultures which showed the Phoma-stage in New Zealand. It is safe to say, however, that *Phoma lingam* can have no other conidial stage unknown to all those who have worked on it, and that, therefore, the fungi in question have no connexion with this parasite.

The results now announced are particularly important to the British seed trade, which supplies swede seed to New Zealand. Their full import lies in the fact that, so far as one can gather from Cunningham's paper (p. 25), the parasite which is characteristic of English seed belongs to his group IA, and is apparently represented by his 473 (IA). Now this fungus is almost certainly not a *Phoma*, and without any qualification is not *Phoma lingam*. It is also, according to Cunningham, only weakly parasitic; and putting all the evidence together, it is obvious that it can have no possible connexion with the common dry-rot caused by *Phoma lingam*. Our own limited experience confirms the last two points; for a fungus identical with 473 (IA) is not uncommon on seed of Irish and English origin, while no true *Phoma* has been found on the 3500 seeds so far examined, which were drawn from seven different samples. It would be premature to suggest that *Phoma* never occurs there, but it appears to us likely that further study of the hibernation of this parasite, otherwise than on the seed, would be profitable.

I wish to acknowledge the great help received from the Imperial Bureau of Mycology in looking up the rather inaccessible literature of this subject.

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The Resistance of Pipes of 'Negative' Diameters.

IT is well known, from the results obtained by Stanton and Pannell, that the resistance, R, in dynes per square centimetre at the surface of a pipe of diameter d, carrying *any* fluid of density ρ, and viscosity μ, at a mean velocity v, is given by $R/\rho v^2 = f(\rho vd/\mu) \equiv L$, say. Prof. Lees has given a well-known formula for L, namely, $L = 0{\cdot}0763(\mu/\rho vd)^{0{\cdot}35} + 0{\cdot}0009$, and this function is accordingly sometimes known as Lees' function.

Considering this function recently for large values of $\rho vd/\mu$, which of course may be obtained when d only is large, it seemed evident that there could be no discontinuity in $R/\rho v^2$ when the curvature of the surface—which is $2/d$—passed through zero and became negative; that is, when the fluid changed from being on the concave side of the surface to being on the convex side.

Now $(\mu/\rho vd)^{0{\cdot}35}$ has no relevant analytic value for negative values of $\mu/\rho vd$; but it is quite different if the index, which was only empirically determined, was not 0·35 but exactly one-third. This led to the idea that probably the correct way of expressing L is as a rational function of $(\mu/\rho vd)^{\frac{1}{3}}$; and that the function found in this manner would be true for negative values of $\mu/\rho vd$ as well as for positive values.

Carefully measuring the ordinates of the middle of the band on Stanton and Pannell's well-known diagram, I found that the following simple equations represented the results with remarkable accuracy:

$$L = 0{\cdot}000635 + 0{\cdot}0725x \quad . \quad . \quad . \quad (1)$$

where $x \equiv (\mu/\rho vd)^{\frac{1}{3}}$, from $x = 0{\cdot}023$ to $x = 0{\cdot}052$; that is, from $\rho vd/\mu = 82{,}000$ to 7000 about; and

$$L = 0{\cdot}000635 + 0{\cdot}0725x + (0{\cdot}023 - x)^2 \quad . \quad (2)$$

from $x = 0{\cdot}023$ to $x = 0{\cdot}012$; that is, from $\rho vd/\mu =$ 82,000 to 600,000.

For values of $\rho vd/\mu$ less than 7000, formula (1) begins to deviate owing to approaching the critical velocity. For viscous flow we have $L = 8x^3$ exactly.

Formulæ (1) and (2) agreed with the readings to within only slightly more than 0·00001, whereas the errors of Prof. Lees' formula varied systematically from 0·00006 positive, at $\rho vd/\mu = 160{,}000$, to 0·00006 negative, at $\rho vd/\mu = 10{,}000$. These divergences are of course small enough to be negligible for ordinary purposes. Formulæ (1) and (2) are much easier to use in practice than Prof. Lees' formula, as the cube root of $\mu/\rho vd$ can very readily be found on *any* slide rule, while the 0·35 power cannot.

The reason for putting forth new formulæ for L is not that a better fit is obtained, but because I believe L will pass through $x = 0$ into negative values of x without any discontinuity in either magnitude or slope; and I want to appeal for the experimental determination of L for negative values of x. This will entail finding the resistance to motion when long cylinders, of different lengths and pointed ends, are dragged axially through water at a depth of (say) ten times their diameter below the surface. This is obviously not work which can be undertaken in an ordinary university engineering laboratory owing to the size of tank required, but it could be done in a very short time in the Froude tank at the National Physical Laboratory.

It is almost certain that it will be found that L will pass through a minimum for a certain negative value of x, and then increase to a large value (probably ∞) as $x \rightarrow -\infty$. Formula (2) gives a minimum value of L of 0·000988 at $x = -0{\cdot}01325$; that is, at $\rho vd/\mu = -429{,}000$. In water at 50° F., at a speed of 10 ft./sec., this would give the diameter as just over seven inches.

The values of L, for what I have called negative values of $\rho vd/\mu$, may, for all I know, have been determined: if so, I should be grateful to have my attention directed to them. If not, I hope they will be determined owing to their scientific interest and the intimate connexion which exists between L and the transfer of heat from the surface to the fluid.

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X-radiation from Gases.

IN the years 1924–25 attempts were made by me at the Norman Bridge Laboratory of Physics, Pasadena, California, to get X-rays from gases by means of hot sparks, but without positive results (*Proc. Nat. Acad.*, **11**, 413; 1925). Since then I have been investigating some different methods of solving this problem. The method first used was the following:

A crucible with a 1 mm. hole at the top and containing a small piece of metallic sodium was placed in a vacuum and bombarded from above with an electron stream concentrated towards the hole in the crucible—that is, the top of the crucible corresponded to the target in an ordinary X-ray tube. In this way the crucible was heated; the sodium evaporated; and the vapour escaped through the hole and was hit by the electrons. The X-rays radiated from the vapour were revealed in the following way. Beside the crucible I fixed a screen of brass with a small hole covered with thin aluminium foil. On the other side of the screen I put a photographic plate, and in this way I obtained a picture of the crucible and of the space above it as through a pinhole camera. Exposures were taken when the crucible contained sodium as well as when it was empty. On the part of the plate corresponding to the vapour-beam, I