We have, however, been surprised to find the total absence of embryos in all this material. The ovules have been found to develop quite normally upto the formation of the embryosac. The megaspore-mother cell gives rise to a complete row of four megaspores. The chalazal one of these develops into an 8-nucleate embryosac of the usual type. The megaspore-mother cell, the linear tetrad of megaspores and the embryosac are deep-seated, the embryosac being covered by about ten layers of parietal tissue. It shows an egg-apparatus of the normal form at the micropylar end, two polar nuclei about the middle, but slightly towards the micropylar end, and three antipodals at the chalazal end. The last resemble those of certain Ranunculaceæ[1] in shifting their position towards one side as the embryosac increases in size during endosperm development. On the contrary, no pollen on the stigmas of the carpels or any pollen-tubes penetrating the nucellus of the ovule have been seen even in more than two hundred ovules examined for the purpose. No fertilisation takes place and the various parts of the embryosac except the two polar nuclei gradually degenerate. The parts of the egg-apparatus lead in the process and then a little later the antipodals share the same fate. The behaviour of the polar nuclei is just the reverse. They fuse with each other in the micropylar half of the embryosac to give rise to a secondary nucleus and the latter without undergoing the process of triple fusion divides to form a large amount of endosperm. The growth of the endosperm on the ventral side of the carpel is very irregular and it consequently becomes ruminate. Along with the development of the endosperm, the embryosac goes on increasing in size and absorbing the nucellus. The integuments of the ovule change into the testa of the seed and the wall of the ovary differentiates into the epicarp, fleshy mesocarp and the stony endocarp of the drupaceous fruit, without any embryo being formed inside.

This absence of embryos in the seeds of apparently normal fruits of *Tinospora cordifolia*, we have also confirmed by dissecting many of them, though it is not possible to put forward any exact cause for the failure of pollination, which appears to be the primary cause for such a development. In the Benares Hindu University Botanical Garden while there are a number of female plants, there is only one male plant at a distance of a few hundred feet from the former. The pollen of this male plant is quite normal; and although no germination experiments have been tried, it appears from its structure to be quite viable. The lack of pollination may be, therefore, due only to the distance between the male and the female plants, the effect of which is enhanced by these plants growing on other trees often with dense foliage, like the mango. But whatever the explanation may be for the lack of pollination, it is quite clear that *in 'Tinospora cordifolia' without the stimulus of fertilisation and without the development of embryo inside, apparently normal seeds and fruits are formed.* In this respect, a comparison can be made with Kashyap's observation in Lahore on the ovules of *Cycas revoluta*.[2] There are only female individuals of this cycad in Lahore, but even then the ovules develop into seeds, which externally look quite normal. Inside only the female gametophyte is developed and there is no fertilisation and embryo formation. As the cause of such a development in *Cycas revoluta*, Kashyap suggested the possible influence of some foreign pollen. In angiosperms, the morphology of the endosperm being different, it is not unlikely that in *Tinospora cordifolia*, the necessary stimulus for the development of the seed and fruit may be coming from the formation of endosperm itself inside and its formation without fertilisation is not an unusual thing even in the Ranales.

A. C. JOSHI.
V. V. RAMAN RAO.
Department of Botany,
Benares Hindu University,
June 9, 1934

[1] Coulter, J. M., *Bot. Gaz.*, 1898, **25**, 73.

[2] Kashyap, S. R., *J. Ind. Bot. Soc.*, 1921, **2**, 116.

Kinks on Impact Curves of Struck Strings.

THE present note is meant to indicate that Kaufmann's theory is sufficient to explain the phenomena associated with struck strings, specially with reference to Pianoforte where the striking length a and the elastic strength of the felt hammer are small. In this case particularly Kaufmann's theory when modified for elasticity can be applied with advantage. In order to do this divide the total duration of impact into two parts: (1) the interval during which the string is not displaced while the hammer felt undergoes compression till at the end of this interval; the second (2) regime begins and the string is displaced from the equilibrium position when Kaufmann's assumption holds good. It may be mentioned that this mode of considering the phenomenon first pointed by the authors in 1930 (*Phil. Mag.*, 9, 1175, 1930) has also been accepted by Messrs. Ghosh and Kar of Calcutta, (*Phil. Mag.*, 17, 521, 1934). Now Kaufmann's assumption is

$$\dot{Y} = \dot{Y}_0 \frac{x}{\alpha} \quad \ldots \quad \ldots \quad (1)$$

initially at the beginning of second regime without any displacement, and at any subsequent instant the displacement is given by

$$Y = Y_0 \frac{x}{\alpha} \quad \ldots \quad \ldots \quad (2)$$

where $\dot{Y}_0$ and Y_0 are velocity and displacement of the striking point abscissa $x = \alpha$ measured from the nearer end.

A distribution of velocity in the position α given by (1) and without any displacement has been shown by Sir C. V. Raman, N.L., to be due to discontinuous velocity waves (Fig. 1); one set travelling positively, and

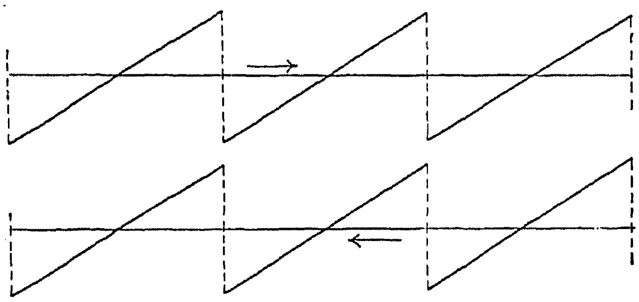

Fig. 1.
Discontinuous Velocity Diagram.

the other negatively. These produce displacements similar to that of bowed string, which appear as small kinks (Fig. 2) in the

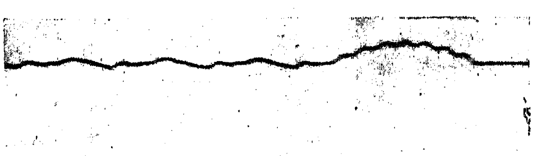

Fig. 2.

Fig. 3.

time displacement diagrams of any point of the string between the nearer end and the striking point, obtained during the time the hammer is in contact with the string. In fact Kaufmann's theory with slight modifications is sufficient to explain the presence of these kinks in the shorter portion, their absence at the striking point and on the longer side of the string. It is also adequate to explain the appearance of large kinks when α is increased and the length of the other portion is decreased. Fig. 3 shows a large kink, $\alpha = 30 \cdot 7$ cms.; $\beta =$ the point of observation 106 cms.; $\frac{T}{\phi} = \frac{\text{Period of vibration of the string}}{\text{Duration of contact}} = \cdot 7$; while Fig. 4 shows the same drawn theoretically. Details will appear elsewhere.

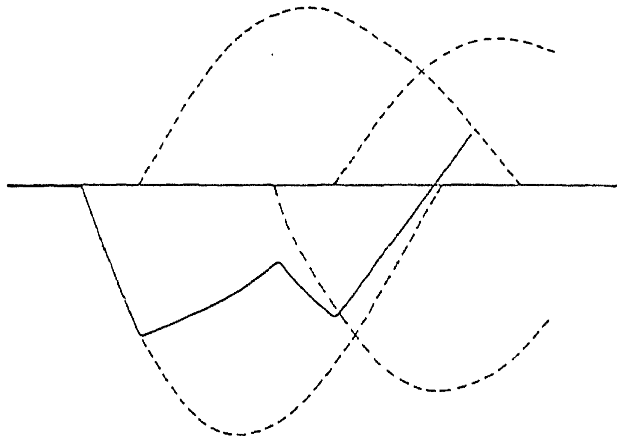

Fig. 4.

R. N. GHOSH.
HAJI GULAM MOHAMED.

Physics Department,
Allahabad University,
Allahabad,
June 21, 1934.

Molecular Weight of Lignin.

THE highest yield of formaldehyde recorded by Freudenberg and co-workers[1] from pinewood lignin is 1·2 per cent. Depending mainly on this result they advanced a structural formula for lignin[2] corresponding to a molecular weight of 2140 (in unpolymerised form). But as the molecular weights of various lignin derivatives lie between 800 and 1000,[3] it is difficult to reconcile Freudenberg's figure with these. The di-oxymethylene group has been found to be very unstable towards acids and by treating jute with 42 per cent. HCl at 20° for 24 hours a lignin has been obtained with a pale rose colour which after repeated washings with

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[1] *Ber.*, 1933, **66**, 262.

[2] *Cellulose Chemie.*, 1931, **12**, 269.

[3] Fuchs, *Chemie des Lignins*, 1926, 178.