REMARKS ON A PAPER BY J. S. STOKES ON "SOME CURIOUS PHENOMENA OBSERVED IN CONNECTION WITH MELDE'S EXPERIMENT."[1]

By C. V. Raman.

AT the conclusion of the paper referred to, the writer remarks: "As far as the demonstrator has been able to ascertain, these phenomena have not been hitherto observed or described by any one." I may therefore be permitted to observe that the phenomena described in the paper (with the exception of the effect on the rotation of the pulley of waxing the thread) were observed by me about five years ago, when working in collaboration with Mr. V. Apparao at the Presidency College, Madras, and were subsequently shown by us to a large number of others. As however, other phenomena of interest were then observed which seemed to be of greater importance and which could be explained less readily, I did not seek an opportunity of publishing my observations on the subject.[2]

I may also state that the phenomena of the rotation of the pulley was independently observed about two years ago by Mr. A. W. Porter, who published a note on the subject in Knowledge and Scientific News at that time.

My observations furnish a clue for the explanation of an effect which Mr. J. S. Stokes says he is unable to account for, *i. e.*, the increased speed of rotation of the pulley when the overhanging vertical portion of the string was vibrating and the horizontal part seemed not to be doing so. In a future paper I shall endeavor to show that with the large amplitudes of oscillation maintained in practice, Lord Rayleigh's theory of the maintenance of oscilla-

[1] Phys. Rev., May, 1910, p. 659.

[2] For the outcome of some of the other observations mentioned, the following publications in Nature may be referred to: On the Small Motion at the Nodes of a Vibrating String, Nature, November 4, 1909; The Maintenance of Forced Oscillations of a New Type, Nature, December 9, 1909; also an addendum to the latter in Nature, February 10, 1910.

tions by forces of double frequency[1] has to be seriously modified to enable the experimentally observed phase-relations to be accounted for. It comes out that we are not dealing with one, but with two variations of tension: not merely with the variation of tension *imposed* by the motion of the prong, but also with the periodic part of the variation of tension associated with an oscillation of large amplitude. In actual practice, these two variations approach equality in amplitude and opposition in phase, with the result that when the string is maintained in vigorous oscillation, the net periodic variation of tension is very small indeed compared with what we should expect from the range of excursion of the end of the string which is attached to the prong; the torque exerted upon the pulley and the speed of rotation, if any, of the latter are quite small. But when the string between the fork and the pulley has no transverse oscillation, the full effect of the oscillation of the prong is felt in varying the tension of the string periodically, and the torque on the pulley being greater, the speed of rotation of the latter becomes very considerable. This is exactly what is observed.

[1] Phil. Mag., 1887, and Theory of Sound, 2d ed., Vol. I., pp. 82–84.