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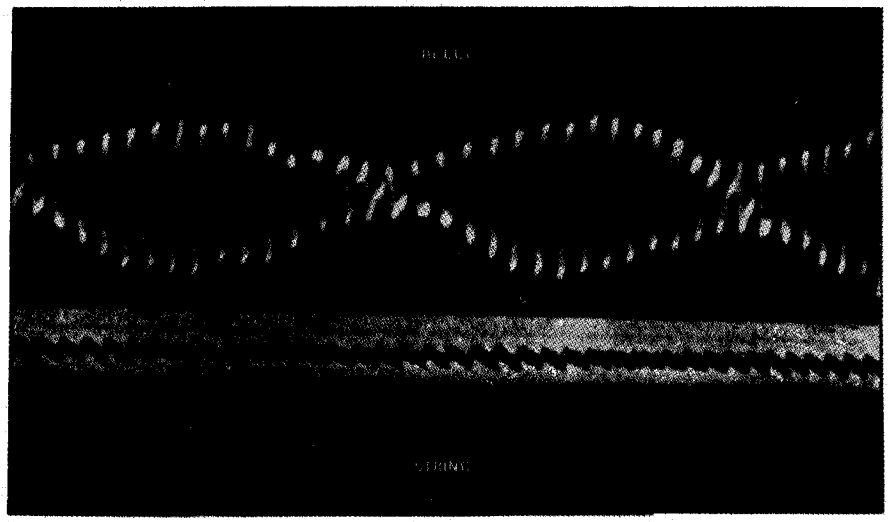
On the "wolf-note" of the violin and 'cello

It has long been known that on all musical instruments of the violin family there is a particular note which is difficult to excite in a satisfactory manner, and that when this "wolf-note," as it is called, is sounded, the whole body of the instrument vibrates in an unusual degree, and it seems to have been also understood that the difficulty of eliciting a smooth note of this particular pitch is due in some way to the sympathetic resonance of the instrument (Guillemin, *The Applications of Physical Forces*, 1877). In a recent paper (*Proc. Cambridge Philos. Soc.*, June, 1915) G W White has published some experimental work confirming this view. The most striking effect noticed is the *cyclical* variation in the intensity of the tone obtained when the instrument is forced to speak at this point. White suggests as an explanation of these fluctuations of intensity that they are due to the beats which accompany the forced vibration imposed on the resonator. The correctness of this suggestion seems open to serious criticism. For the beats which are produced when a periodic force acts on a vibrator are essentially *transitory* in character, whereas in the present case the fluctuations in intensity are *persistent*.

The following explanation of the effect, which is different from that suggested by White, occurred to me some time ago on theoretical grounds, and has since been confirmed by me experimentally. The effect depends on the fact (which is itself a consequence of theory) that when the pressure with which the bow is applied is less than a certain critical value proportionate to the rate of dissipation of energy from the string, the principal mode of vibration of the latter, in which the fundamental is dominant, is incapable of being maintained and passes over into one in which the octave is prominent. When the bow sets the string in vibration the instrument is strongly excited by sympathetic resonance, and the rate of dissipation of energy rapidly increases and continues to increase beyond the limit up to which the bow can maintain the string in the normal mode of vibration. The form of vibration of the string then alters into one in which the fundamental is feeble compared with the octave. Following this, the amplitude of vibration of the belly decreases, but this change lags behind that of the string to a considerable extent. When the rate of dissipation of energy again falls below the critical limit, the string begins to regain its original form of vibration with the dominant fundamental. This is accordingly followed, after an interval, by a fresh increase in the vibration of the belly, and the cycle then repeats itself indefinitely.

The accompanying photograph showing the simultaneous vibration-curves of the belly and string of a 'cello amply confirms the foregoing explanation suggested by theory, and is itself of interest. It will be seen that the changes in the



Time Axis ⟶

vibrational form of the string are about a quarter of a cycle in advance of those of the belly, and that in both curves the octave is conspicuous when the amplitude is a minimum.

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