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To cite this article: G.F.F. Chladni (1802) XLII. On the spiral vibration of a stick or rod , Philosophical Magazine Series 1, 12:47, 259-260, DOI: [10.1080/14786440208676057](https://doi.org/10.1080/14786440208676057)

To link to this article: <http://dx.doi.org/10.1080/14786440208676057>

Published online: 18 May 2009.

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*XLII. On the Spiral Vibration of a Stick or Rod. By
G. F. F. CHLADNI *.*

THE vibrations hitherto known of a stick or rod, that is to say, of an elastic body extended in a certain direction, are either transversal vibrations, where the rod or the parts into which it divides itself vibrate sideways, in such a manner as to form a great number of curved lines; or longitudinal vibrations, where the rod or each of its parts contracts and extends itself according to the direction of its length, so that it sometimes rests against one and sometimes against the other of the vibration nodes. The former kind of vibrations were first determined by Daniel Bernoulli, and afterwards, in a more complete manner, by Euler, in the Transactions of the Imperial Academy of Sciences for 1769: but the latter were first made known by myself in a paper on the longitudinal vibrations of rods and strings, published at Erfurt in 1796, and which may be found also in the Transactions of the Electoral Academy of Sciences of that city. For some time I have observed, that, besides these two directions of vibrating motion, there is a third, where the rod, or each part into which it divides itself, turns alternately to the right and left in a spiral form, while the vibration nodes or the boundaries of the vibrating parts remain motionless, as in the other kinds of vibration. Such spiral vibrations may be produced with most ease on a sufficiently long cylindric rod, the surface of which has been made as smooth as possible, if the rod be held gently between two fingers at the place where there is a vibration node, and if it be rubbed in a spiral direction in a vibrating part with a piece of woollen rag held between the fingers of the other hand. When the rod is of wood or metal, the rag must be previously strewed over with resin; but when a glass rod, or, what is the same thing, a thermometer or barometer tube is employed, it must be moistened with water, or be strewed over with very fine sand. The ways in which a rod, when it is either entirely free, or fastened at one end and free at the other, or fastened at both ends, can divide itself into vibrating parts, and the position of the vibration nodes, are entirely the same as in the case of longitudinal vibrations. The sharpness and flatness of the tone depend also on the same laws; and therefore, to avoid all unnecessary prolixity, I shall refer to the above-mentioned essay

* From *Der Gesellschaft Naturforschender Freunde zu Berlin Neue Schriften*, vol. ii. 1799.

on longitudinal vibrations. There is this difference, however, that, as far as I have observed, the tone, when the vibrations take place in a spiral direction, is a fifth lower than when the rod vibrates in a longitudinal direction under the same circumstances.

By the spiral vibration one phænomenon, which I have mentioned in my discoveries respecting the theory of sound, but respecting which I formed an erroneous opinion, can be explained. On a prismatic rod, one end of which was fastened in a vice, when I rubbed one of its edges, in a diagonal direction, with a violin bow, and strewed sand over one of its horizontal sides, there appeared on this side a line proceeding along its length, where the sand, which was thrown from the other parts by the vibration, remained at rest; and this appearance took place on each side of the rod when held horizontally. The reason of this is, because at the edges which are further distant from the axis the range during the vibrations is greater than in the middle of each side; and on this account the sand which is thrown from the nearer places to those on the edges must accumulate themselves longitudinally in the middle of each side nearest the axis where the vibrations are weakest.

XLIII. *Observations on Maddering; together with a simple and certain Process for obtaining, with great Beauty and Fixity, that Colour known under the Name of the Turkey or Adrianople Red.* By J. M. HAUSSMANN.

[Concluded from p. 175.]

The Process.

AFTER making a caustic ley of one part of good common potash dissolved in four parts of boiling water, and half a part of quicklime, which I afterwards slaked in it, I dissolved one part of powdered alum in two parts of boiling water; and while this solution of sulphate of alumine was still warm, to avoid re-crystallization, I speedily poured into it successively, always stirring it without interruption, the above-mentioned caustic ley, till the alumine it had at first precipitated after saturation to excess with sulphuric acid had been redissolved. I left at rest this solution of alumine, which exhaled ammonia, and which, on cooling, formed a precipitate of sulphate of potash in very small crystals. I then mixed a thirty-third part of
linseed-