tions of the current are timed to its movements. For instance, present an electro-magnet to the strings of a piano. It will be found that the string which is in unison with the rheotome included in the circuit will be thrown into vibration by the attraction of the magnet.

Helmholtz,* in his experiments upon the synthesis of vowel sounds caused continuous vibration in tuning-forks which were used as the armatures of electro-magnets. One of the forks was employed as a rheotome. Platinum wires attached to the prongs dipped into mercury.

The intermittent current occasioned by the vibration of the fork traversed a circuit containing a number of electro-magnets between the poles of which were placed tuning-forks whose normal rates of vibration were multiples of that of the transmitting fork. All the forks were kept in continuous vibration by the passage of the interrupted current. By re-enforcing the tones of the forks in different degrees by means of resonators, Helmholtz succeeded in reproducing artificially certain vowel sounds.

I have caused intense vibration in a steel strip, one extremity of which was firmly clamped to the pole of a U-shaped electro-magnet, the free end overhanging the other pole. The amplitude of the vibration was greatest when the coil was removed from the leg of the magnet to which the armature was attached.

7. All the effects noted above result from rapid interruptions of a voltaic current, but sounds may be produced electrically in many other ways.

The Canon Gottoin de Coma,† in 1785, observed that noises were emitted by iron rods placed in the open air during certain electrical conditions of the atmosphere; Beatson ‡ produced a sound from an iron wire by the discharge of a Leyden jar; Gore § obtained loud musical notes from mercury, accompanied by singularly beautiful crispations of the surface during the course of experiments in electrolysis; and Page ‖ produced musical tones from Trevelyan's bars by the action of the galvanic current.

8. When an intermittent current is passed through the thick wires of a Ruhmkorff's coil, very curious audible effects are produced by the

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* *Helmholtz.* Die Lehre von dem Tonempfindungen.

† See "Treatise on Electricity," by De la Rive, I., p. 300.

‡ Ibid.

§ *Gore.* Proceedings of Royal Society, XII., p. 217.

‖ *Page.* "Vibration of Trevelyan's bars by the galvanic current." Silliman's Journal, 1850, IX., pp. 105–108.