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ling to one While the was dipped into water included in the circuit. A sound proceeded from the distant telephone. When two tuning-forks of different pitch were connected together, and simultaneously caused to vibrate in the water, two musical notes (the unisons respectively of those produced by the forks) were emitted simultaneously by the telephone.

A platinum wire attached to a stretched membrane, completed a voltaic circuit by dipping into water. Upon speaking to the membrane, articulate sounds proceeded from the telephone in the distant room. The sounds produced by the telephone became louder when dilute sulphuric acid, or a saturated solution of salt, was substituted for the water. Andible effects were also produced by the vibration of plumbago in merenry, in a solution of bichromate of potash, in salt and water, in dilute sulphuric acid, and in pure water.

14. Sullivan * discovered that a current of electricity is generated by the vibration of a wire composed partly of one metal and partly of another; and it is probable that electrical undulations were caused by the vibration. The current was produced so long as the wire emitted a musical note, but stopped immediately upon the cessation of the sound.

15. Although sounds proceed from the armitures of electro-magnets under the influence of undulatory currents of electricity, I have been unable to detect any audible effects due to the electro-magnets themselves. An undulatory current was passed through the coils of an electromagnet which was held closely against the enr. No sound was perceived until a piece of iron or steel was presented to the pole of the magnet. No sounds either were observed when the undulatory current was passed through iron, steel, refort-carbon, or plumbago. In these respects an undulatory current is curiously different from an intermittent one. (See par. 2.)

16. The telephonic effects described above are produced by three distinct varieties of enrrents, which I term respectively intermittent, pulsatory, and undulatory. *Intermittent currents* are characterized by the alternate presence and absence of electricity upon the circuit; *Pulsatory currents* result from sudden or instantaneous changes in the intensity of a continuous current; and *undulatory currents* are produced by gradual changes in the intensity of a current analogous to the changes in the density of air occasioned by simple pendulous vibrations. The varying intensity of an undulatory current can be

* Sullivan. "Currents of Electricity produced by the vibration of Metals." Phil. Mag., 1845, p. 261; Arch. de l'Électr., X., p. 480.