

circuit. I failed to obtain audible effects in this way when the pitch of the rheotome was high. Elisha Gray\* has also produced audible effects by the passage of induced electricity through the human body. A musical note is occasioned by the spark of a Ruhmkorff's coil when the primary circuit is made and broken sufficiently rapidly. When two rheotomes of different pitch are caused simultaneously to open and close the primary circuit, a double tone proceeds from the spark.

9. When a voltaic battery is common to two closed circuits, the current is divided between them. If one of the circuits is rapidly opened and closed, a pulsatory action of the current is occasioned upon the other.

All the audible effects resulting from the passage of an intermittent current can also be produced, though in less degree, by means of a pulsatory current.

10. When a permanent magnet is caused to vibrate in front of the pole of an electro-magnet, an undulatory or oscillatory current of electricity is induced in the coils of the electro-magnet, and sounds proceed from the armatures of other electro-magnets placed upon the circuit. The telephonic receiver referred to above (par. 4), was connected in circuit with a single-pole electro-magnet, no battery being used. A steel tuning-fork which had been previously magnetized was caused to vibrate in front of the pole of the electro-magnet. A musical note similar in pitch to that produced by the tuning-fork proceeded from the telephonic receiver in a distant room.

11. The effect was much increased when a battery was included in the circuit. In this case, the vibration of the permanent magnet threw the battery-current into waves. A similar effect was produced by the vibration of an unmagnetized tuning-fork in front of the electro-magnet. The vibration of a soft iron armature, or of a small piece of steel spring no larger than the pole of the electro-magnet in front of which it was placed, sufficed to produce audible effects in the distant room.

12. Two single-pole electro-magnets, each having a resistance of ten ohms, were arranged upon a circuit with a battery of five carbon elements. The total resistance of the circuit, exclusive of the battery, was about twenty-five ohms. A drum-head of gold-beater's skin, seven centimetres in diameter, was placed in front of each electro-magnet, and a circular piece of clock-spring, one centimetre in diameter, was glued to the middle of each membrane. The telephones so constructed were placed in different rooms. One was retained in

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\* Elisha Gray. Eng. Pat. Spec., No. 2640, see "Engineer," Aug. 14, 1874.