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The sonorous voltameter

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and the importance of this question will be especially apparent if we observe that in the best treatises superabundant data are taken from observation, even for constructing the simplest theory of all (that of gases). We then arrived at a result which can in brief be enunciated thus:—To know all the isothermal lines of a body, and one of its adiabatic lines, is sufficient.

The law which forms the object of the present investigation conduces to the following much more satisfactory and quite unexpected result:—*In order to know all the isothermal lines and all the adiabatic lines of a body, and consequently to be able to study it completely, it is necessary and sufficient to know two of its isothermal lines and one only of its adiabatic lines.*

In physical terms, one may say that it is sufficient to observe:—1st, the dilatation of a body under *two* different pressures, or, more generally, for two series of states answering to two curves arbitrarily traced in the plane of the (pv)'s (which is equivalent to saying that the ∞^2 observations, of which we spoke at the outset of our previous communication, are replaced by two simple infinities of observations); 2ndly, one of the specific heats, or *one* particular pressure *only*, or, more generally, for *a single* series of states of the body corresponding to a curve arbitrarily traced in the plane.

If we admit, with MM. Clausius and Hirn, that the thermal capacity of every substance is a constant, this second series of observations reduces itself to a single observation.—*Comptes Rendus de l'Académie des Sciences*, Sept. 30, 1878, t. lxxxvii. pp. 488–491.

THE SONOROUS VOLTAMETER. BY THOMAS A. EDISON, PH.D.

The sonorous or bubble voltameter consists of an electrolytic cell with two electrodes—one in free contact with a standard decomposable solution, and the other completely insulated by vulcanized rubber except two small apertures, one of which gives the solution free access to the insulated electrode, and the other allows the escape of bubbles of hydrogen as they are evolved by electrolysis. With a given current and a given resistance a bubble is obtained each second, which is seen at the moment of rising, and which at the same time gives a sound when it reaches the air. The resistance may be reduced so as to give one bubble in one, five, ten, or fifty seconds, or in as many hours. I have compared this instrument with the ordinary voltameter, and find it much more accurate. By the use of a very small insulated electrode and but one aperture, through which both the gas and water current must pass, great increase of resistance takes place at the moment when the bubble is forming; and just before it rises, a Sounder magnet included within the battery-circuit opens, closing again when the bubble escapes, thus allowing by means of a Morse register the time of each bubble to be recorded automatically. This apparatus, when properly made, will be found very reliable and useful in some kinds of work, such as measuring the electromotive force of batteries &c. By shunting the voltameter and using a recorder it becomes a measurer, not only of the current passing at the time, but also of that which has passed through a circuit from any source during a given interval.—Silliman's *American Journal*, November 1878.