

a most astounding series of libels, against which he seemed to have been utterly powerless.

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# A SIMPLE CONTINUOUS ELECTRIC CALORIMETER FOR STUDENTS' USE

For several years we have been using, with considerable success, a simple form of the continuous-flow calorimeter for measuring Joule's equivalent in the electrical laboratory work of our elementary students. I venture to describe the apparatus here in the hope that it may commend itself to those engaged in practical work, as being simpler of operation than the older electrical methods of measuring this important constant.

A glass tube, about 50 cm. long and 2 to 3 mm. internal diameter, is cemented at both ends to brass collars carrying washers and

mix the water as it flows through. A copper or tin vessel with overflow maintains a constant head of water from the city mains at any desired elevation, and a tube conveys the water to the inflow end of the calorimeter. An air trap, made from an inverted thistle tube, serves to catch any air bubbles liberated or carried down by the water. The temperature of the inflowing water is measured on the thermometer. After passing through the flow tube, the water passes out at the outflow end to a suitable measuring vessel. The temperature of the outflowing water is recorded at regular intervals on the second thermometer. The upper end of the brass T, to which the outflow pipe is attached, is open to the air and establishes the head independent of the exact level of the end of the outflow pipe. Having obtained a reading on the two thermometers before any heating current is turned on, the electrical circuit is completed, and after four or five minutes, during which the temperature of the outflow water becomes

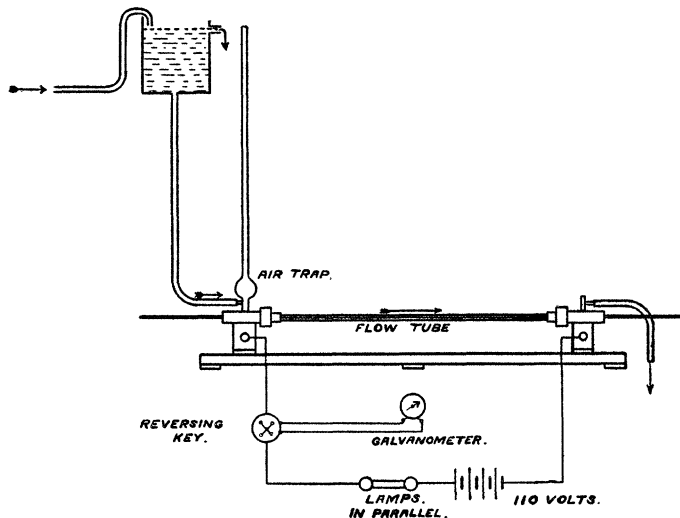


FIG. 1

nuts, which screw into brass castings drilled out to receive suitable thermometers. A heating wire, of about 10 ohms, coiled in a long helix, passes through the tube and is soldered to the brass collars. The helix serves to break up the stream-lines, and thoroughly

steady, readings are commenced. These consist in measuring the current at regular intervals on a tangent galvanometer or a Weston ammeter and reading the inflow and outflow temperatures during the time taken to obtain a suitable amount of water to weigh,

or during the time necessary to fill a vessel of known capacity. From these readings the average flow per second and the difference in temperature can be determined and hence the number of calories of heat carried off by the water per second calculated. Knowing the electric current and the resistance of the heating wire, the electrical energy in Watt seconds can be calculated and the ratio of this to the heat produced gives the value of  $J$ . In place of knowing the resistance of the heating wire, the drop across the calorimeter may be obtained on a voltmeter. In our work the ordinary 110-volt direct-current circuit is used through a number of lamps, which may be connected either alone or in parallel. Various experiments may be performed with different flows and different heating currents. An alternating heating current may be equally well employed when a suitable A.C. ammeter or dynamometer is introduced.

The value of the method lies in its directness and great simplicity. No corrections are necessary for heat loss, provided the mean temperature of the flow water does not differ more than about 5 degrees from the temperature of the room, and even for larger differences the correction is very small. The object of the experiment, which is the measurement of  $J$ , is not lost sight of by the elementary student in determining troublesome corrections. A few values, taken at random from the students' results, are as follows: 4.16, 4.20, 4.12, 4.25, 4.18 joules per calorie. These were obtained with heating currents from 2 to 4 amperes. The rise of temperature ranged from 6 to 12 degrees, and the water flow was varied from 2 to 4 grams per second.

Professor Ervin S. Ferry, of Purdue University, LaFayette, Ind., writes me of the success attending the use of the calorimeter in his elementary classes. He has included an account of the apparatus and method in his recent text-book of "Practical Physics," Vol. 1. The accompanying diagram shows the general plan of the apparatus and connections.

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#### EVOLUTION IN RHYME

A LITTLE book has recently come into my hands that may be as new to most of the readers of SCIENCE as it is to me. It is called "Das Neue Laienbrevier des Haeckelismus," is in two parts, was published in 1878 in Berne and Leipzig, and evidently enjoyed a considerable popularity in its day, as the first part is marked, "3te Auflage." The first part is called "Genesis, oder die Entwicklung des Menschengeschlechts, nach Haeckel's Anthropogenie in zierliche Reimlein gebracht," while the second is "Exodus, oder der Auszug des Menschengeschlechts aus Lemurien, eine kritisch-analytische Komödie." The author is one Herr Reymond, and the very effective comic illustrations are by Steub, a one-time popular contributor to *Fliegende Blätter*.

The book is a burlesque in rhyme of the descent of man, and is introduced by a short statement of the history and status of the theory of organic evolution and an abstract and general table of contents of Haeckel's "Anthropogenie." The parts of the Laienbrevier are arranged exactly according to the chapters and titles of the "Anthropogenie," and the whole extremely clever *tour de force* must have been received with great glee by the anti-evolutionists, especially the anti-Haeckelians.

The contents of the book are arranged in the general form of a play with the *dramatis personæ* speaking rhymed dialogue and introducing many songs in solo or chorus, the melodies for these songs being mostly well known folk, soldier, and especially student songs. There are so many clever verses and the whole performance is so well sustained throughout the two volumes (the second was only written in response to the popular acclamation of the first) that in selecting a couple of sets of verses to illustrate the character of the Laienbrevier I have made no attempt at particular choice but have taken practically the first to attract my attention. Dissociated, however, from the well-organized total performance they give but little more than a suggestion of the entertaining character of this delightful bit of evolution literature. I