North American Continent. For years it served as the stimulus and basis for all work on the taxonomy of the families and genera of the Coleoptera of this country.

Since this noted work appeared two generations have come and mostly gone. Many coleopterists of note, as E. A. Schwarz, Frederic Blanchard, Thos. L. Casey, H. C. Fall, F. E. Blaisdell, E. C. Van Dyke, Chas. Schaeffer, Chas. W. Leng, W. D. Pierce and a score of others, have prepared monographs of many families, subfamilies or tribes in which they have founded hundreds of genera and described thousands of new species. However, until now, no one has attempted to bring together in one volume, covering the entire country, a work showing the relationship of these new subfamilies and genera and giving keys which would enable the student to determine and make the proper generic placement of his specimens taken afield.

Such a work, long needed, has just appeared in the form of a clothbound quarto volume of 360 pages entitled "A Manual of the Genera of Beetles of America North of Mexico." It was prepared by Dr. J. Chester Bradley, professor of entomology and curator of invertebrate zoology in Cornell University, and is published by Daw, Illston and Company, of Ithaca, New York. In his preface Dr. Bradley states that he "has been compelled to undertake the work for the use of his students in their laboratory work, as they stood in need of a manual that will correspond with present ideas on the classification of the order."

This manual is, as the subtitle informs us, a compilation of "Keys for the Determination of the Families, Subfamilies, Tribes and Genera of Coleoptera with a systematic list of the Genera and Higher Groups." As Dr. Bradley states, his work as compiler "has been to select, rearrange, abbreviate, combine and translate keys from all the most recent sources scattered throughout the world's literature on insects."

His work has apparently been well done, and the original source of each key has, for the most part, been given. The manual is essentially a book of keys, but there are brief characterizations of each of the 111 families of Coleoptera recognized as belonging to the fauna of North America; with a note referring to the principal habitats of its members. In most cases two or more clear-cut characters are used in separating closely allied genera. In but few instances are there indefinite characters of little or no value but which are often used in keys. Examples of these are: "body small in size" and "body very much larger in size." In such cases the approximate length, as (1.–2.3 mm) or (6–9 mm), should have been added in parentheses. No authority or date of founding is given for any of the genera nor are any synonyms (except those of a few of the families and subfamilies) mentioned. For these Dr. Bradley's Manual will have to be used in connection with Leng's "Catalogue of the Coleoptera of America North of Mexico" and the supplement thereto, whose sequence and nomenclature it closely follows. With these two books the average student, with a little practice, should be able to readily identify and arrange as far as the genera his specimens of beetles. For the naming of the species, especially the majority of those from west of the Mississippi River, he will still have to search through many monographs and periodicals until some one or more coleopterists can devote the time and patience necessary to bring forth a "Manual of the *Species* of Coleoptera of America North of Mexico." Let us hope that this will soon be done and that it will be as complete and comprehensive as Dr. Bradley's "Manual of Genera."

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A COOLING UNIT FOR LOW-TEMPERATURE THERMOSTATS

DIFFICULTY in maintaining temperatures between 0° and that of the room may be overcome by using a SO_2 compression circuit.[1] Such a scheme will control the temperature of an ordinary bath to within ± 0.01° C. for days without requiring any attention. However, in experiments where it is possible to give attention occasionally to the operation of the thermostat, the following cooling unit which will give a constancy of temperature regulation to within ± 0.01° C. can be substituted. Its cost of construction is about $1, as compared with about $250 required for assembling a cooling unit made up with a commercial SO_2 compressor.

The details of construction appear in Fig. 1. The spout of a copper funnel is closed by a rubber stopper or by a piece of copper. A hopper made of heavy linoleum (smooth surface *inside*) or of some other non-conducting material is attached to the top of the funnel. The hopper is filled with pieces of cracked ice about the size of a walnut and is snugly closed by a felt pad. To insure efficient operation water from the melting ice must be quickly removed by a syphon working in conjunction with a constant level

[1] W. J. Crozier, and T. J. B. Stier, 1927, *J. Gen. Physiol.*, X, 503.

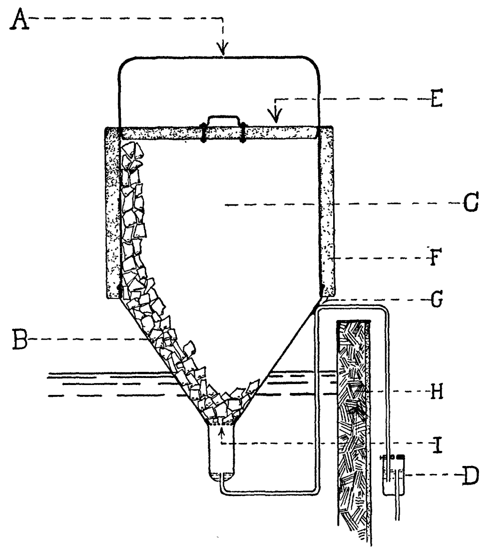

FIG. 1. *A*, cooling unit to be attached by its strap-iron handle to a system of pulleys or a heavy "ring stand"; *B*, copper funnel, 8 inches in diameter; *C*, hopper containing 20 pounds of cracked ice; *D*, constant level device, clamped to ¼-inch copper pipe which is soldered to the funnel at *G*; *E*, heavy linoleum lid; *F*, walls of hopper made of heavy linoleum; *H*, wall of thermostat, insulated by a layer of felt; *I*, removable brass sieve.

device, or by a suction line attached to a water aspirator.

By means of a pulley system and a counterweight the conical portion of the funnel is lowered into the water bath (or air thermostat) to different levels. A position is found, by trial, where the heat removed from the bath is roughly equal to the heat added from the air. Regulation of temperature within the body of the thermostat is obtained by setting the cooling unit so that it undercools the tank, constancy being maintained automatically by a large-capacity mercury thermoregulator actuating a relay-controlled bank of heating lamps (*cf*. Crozier and Stier, 1927, *ibid*).[2]

The following tests of this device were made in a well-insulated thermostat containing 10 gallons of water, adequately stirred by a motor-driven agitator. Fluctuations of temperature of the water were estimated to within 0.001° C. by a Beckmann thermometer.

Ice was not replaced more frequently than once every 1½ hours. The cooling unit could be made to function without attention for 12 hours if the storage space for ice were increased and if the ice were moved into the metal funnel at a uniform rate by a motor-driven agitator.

[2] A simple form of this device, involving regulation by manual control of the depth of immersion of the funnel, was made by the writer during 1929–30, in the Physiological Laboratory, Cambridge, England.

TABLE I

	Room temperature	Extreme variation of temperature within the thermostat	Constancy	Amount of ice used
	°C.	°C.	°C.	lbs.
Cu needle in thermoregulator	16.1 to 19.6	5.946 to 5.914	± 0.016 for 5½ hrs.	10
	17.5 to 18.1	5.919 to 5.881	± 0.019 for 7½ hrs.	25
Nichrome needle in regulator	13.8 to 19.1	16.989 to 16.971	± 0.009 for 4½ hrs.	3
	16.6 to 20.3	4.007 to 3.993	± 0.007 for 4 hrs.	14

If a more sensitive system of thermoregulation were employed in conjunction with this cooling unit, one might obtain a constancy of temperature control even closer than ± 0.007° C.

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A VACUUM TUBE METHOD OF TEMPERATURE CONTROL[1]

IT is customary to regulate the temperature in water baths used in biological and physical chemical work by arranging a competition between the cooling effect of water flowing through a copper coil, and the heating effect of the electric current passing through a submerged resistance unit. The flow of water is usually set at an arbitrary rate while the electric current is controlled by a platinum-mercury contact through an electromagnetic relay.

This relay system has been a source of considerable annoyance in the past owing to the pitting of the relay contacts and to the fouling of the mercury surface of the thermoregulator owing to the passage of relatively high currents, usually of the order of 0.1 ampere, which resulted in considerable temperature fluctuation. This was particularly objectionable in certain experiments on nerve metabolism where temperature fluctuations in over-night runs were sufficient to ruin a number of experiments. To eliminate this difficulty we have devised a vacuum tube relay which has proven so surprisingly superior in every respect to the electromagnetic relay that it was considered of sufficiently general interest to warrant brief description.

As stated, the chief objection to electromagnetic

[1] From the Department of Zoology, Washington University, St. Louis, Missouri.