was caught just before mailing the description to the *Canadian Entomologist*. It was very disconcerting because *furcata* does not look like a Sympetrum. Neither does the writer understand Needham's treatment of the three species, *Ophiogomphus phaleratus* Needham, *O. occidentis* Hagen and *O. severus* Hagen. The description states that the superior appendage of the male *occidentis* is less pointed than that in *severus*, but the illustration shows the reverse. Also to which of three species do the female genitalia in the figures on pages 74 and 76 belong, presumably to the top and bottom species.

Walker has already pointed out[8] that the illustrations for *Gomphus furcifer* Hagen and *G. villosipes* Selys are interchanged as are those of *Somatochlora whitehousei* Walker and *S. septentrionalis* Hagen. To these can be added the transposition of the figures of *Lestes vidua* Hagen and *L. forcipatus* Rambur. A half dozen critical mistakes have already been discovered in the keys in spite of the fact that catching such errors is the real work of taxonomic writing. Dr. Needham has been frank about these errors and has already circulated a mimeograph sheet to specialists for the listing of such mistakes. These will be published as an extra folder to go with each volume sold. After we have written these corrections into the beautifully printed volume and forever marred its craftsmanship one rather wishes that the authors would give a slight rebate on the price to offset this injury to a seven dollar book.

The handbook will be useful in that it will stir up interest in the Odonata, but before publishing the student will still have to review and check up the literature that has appeared since Muttkowski's catalogue came out in 1910. This can be done by the use of the bibliography at the end of the book which lists the literature since 1910 and appears to be well done. Thus, as stated in the preface, "The Handbook of the Dragon-flies of North America" is "a book for collectors," but it is a book of doubtful value to specialists.

CLARENCE HAMILTON KENNEDY

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A METHOD OF RECORDING MAXIMUM AND MINIMUM TEMPERATURES OF FOREST SOILS

INVESTIGATORS who have had occasion to use maximum and minimum soil temperatures have found that present methods are cumbersome even if technically adequate. Bates and Zon[1] state that "the use of registering maximum and minimum thermometers in soil temperature work is not very satisfactory." To secure accurate readings it is essential that the bulb of the thermometer be in direct contact with the soil. Furthermore, the instrument should receive a minimum of exposure to the atmosphere while the readings are being taken. Because of the differences in diathermic properties of air and soil, thermometers placed in wells are subject to considerable error, while the sudden temperature changes necessary to reset the instruments produce strains which may affect the accuracy of such instruments.

Various means have been suggested for the elimination of the difficulties mentioned above. Bates and Zon[1] proposed a bent tube minimum thermometer and a superrefined maximum thermometer with a constriction fine enough to prevent absolutely the return of mercury to the bulb even when in an upright position. Toumey and Stickel[2] used a system whereby the thermometers are placed in a small hole in the side of a pit and at a distance of several feet from the pit.

Thermographs are suitable for accurately recording soil temperatures but necessitate great care in the installation of the instruments, besides requiring frequent checking by standard thermometers. The price of thermographs also tends to make general use of them prohibitive.

In seeking to develop an improved technique for soil measurements, the writer found that there is on the market[3] a modified Six's maximum and minimum thermometer well adapted to recording soil temperatures in the forest.

The instrument, originally designed for incubator use, consists of the usual maximum and minimum features of the Six system, incased in a glass tube. The upper portion of the tube contains the scale, while the lower end is constricted and elongated to hold the bulb, which is some seven inches below the recording scale. The greater diameter of the casing is .7 inches and the smaller .3 inches; the entire thermometer is fifteen inches long. The scale reads from minus 20° to plus 50° C. The Six type of thermometer is generally considered somewhat less precise than standard recording thermometers, but apparently the instrument here described is constructed with sufficient accuracy to warrant its use in forest investigations. Table I shows the differences in reading between such an instrument and a standard soil thermometer read each day at 8:00 A. M. from January to June, 1929, at the one-foot soil depth.

[8] *Can. Ent.*, May, 1929.

[1] C. G. Bates and Raphael Zon, "Research Methods in the Study of Forest Environment," U. S. D. A. Bul. No. 1059, May, 1922.

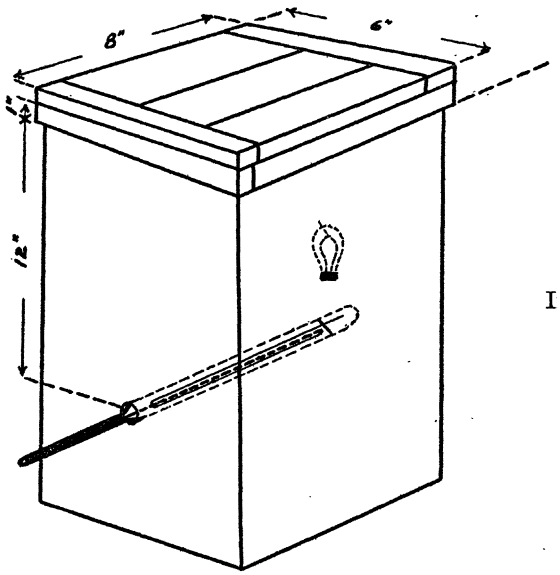
[2] J. W. Toumey and P. W. Stickel, "A New Device for Taking Maximum and Minimum Soil Temperatures in Forest Investigations," *Ecology*, vol. vi, No. 171, 1925.

[3] Arthur H. Thomas Co., distributor, Philadelphia, Pa.

TABLE I

	Mean (Degrees Fahr.)	Standard deviation (Degrees Fahr.)
Standard thermometer	67.77 ± .57	11.00 ± .40
Six's thermometer	67.27 ± .56	10.90 ± .40
(D) Difference	.50	.13
(PED) Probable error of difference	.79	.56
D/PED	.6+	.2+

In use this thermometer is placed horizontally in a boxed pit so that the bulb extends into the soil six inches from the side of the pit. The two ends of the scale rest on the sides of the box within the pit (Fig. 1). When readings are made the cover of the pit is



BOX PIT WITH SIX'S THERMOMETER IN POSITION

removed, the temperatures recorded, the indices drawn back to the mercury by means of a magnet and the pit is again covered. In application the thermometer can be placed at any desired distance from the surface of the ground, within the reach of the observer. Its most practical uses are at six-inch and one-foot depths. Greater depths will require a flashlight for reading and a considerable enlargement of the pit to facilitate resetting.

The principal advantage of the Six's maximum and minimum thermometer in obtaining soil temperatures are: (1) The bulb remains at all times in contact with the soil. (2) Readings can be taken with the least possible exposure of the instrument to the atmosphere. (3) The instrument is relatively inexpensive, costing no more than a single standard instrument. (4) The instrument can be used with satisfactory results under forest conditions even in heavy brush where it is often difficult to reset standard maximum thermometers.

E. W. GEMMER, JR.
SOUTHERN FOREST EXPERIMENT STATION

A QUANTITATIVE CLOSING NET FOR CATCHING PLANKTON ORGANISMS

FOR many years investigators of quantitative distribution of plankton, both of marine and fresh-water types, have recognized the need for a device capable of capturing the organisms in a certain quantity of water. For most of the fresh-water plankton, and for particular kinds of marine plankton, closing bottles have been found to give satisfactory results. But none of these bottles are large enough for many of the important forms of marine zooplankton.

It seems to be generally understood that a net of cylindrical shape is most likely to be practicable for accurate operation in taking a sample of designated size, but it has been found difficult to plan construction which would result in an instrument which could be operated easily and rapidly. After several years of more or less frequent consideration of the problem I have finally developed a design which is simple, fairly easy to operate, and which can be manufactured at moderate cost. Inasmuch as the Scripps Institution is not doing quantitative work with zooplankton at present it may be a considerable time before a model is constructed and I offer this brief note so that others can make use of the idea if they have need for such equipment.

In outer view when closed the net is a cylinder with metal ends connected by side walls of cloth (*e.g.*, No. 12 silk or No. 000 linen). A median sectional view in approximately half-open position is roughly indicated in Fig. 1. The sliding wheel (S) to which the lower edge of the cloth is attached has been raised from the bottom plate (B) to which it was tightly fastened when closed. The cloth (F) is thrown into folds between the margins of S and the top plate (A). The central support and guide rod (C) is left exposed to view by lifting of the fabric.

The bottom plate (B) is offset upward in the center to form a dome into which the central rod (C) can be fixed, and through the open sides of which water can drain from the plate into the detachable cup (R) indicated by the dotted line beneath. Plate B must be heavy and rigid to prevent distortion and consequent ill fit when the wheel (S) joins it to close the net and prevent escape of enclosed organisms. Its margin must be recessed or otherwise provided