of these leaflets will in all probability become a permanent activity of the society. In the present volume the first fifty, separately distributed from 1925 to 1933, have been collected into a handy volume with a foreword by Dr. Aitken, director of the Lick Observatory. The reviewer commends the volume to the attention of teachers of science and to all others who, starting with some knowledge of astronomy, wish to keep themselves informed as to recent developments. Most of the leaflets have been written by astronomers at one of the great institutions in California, but occasionally the editors have come east for their authorities and in two instances have even crossed the Atlantic Ocean. All of them are written in clear non-technical language and much thought has been given to making them as serviceable as possible to the general reader.

*Dix Leçons d'Astronomie.* By E. ESCLANGON. Second edition. 115 pages, 14×21 cm. Gauthier-Villars et Cie, Paris, 1933. Price, 25 francs.

THIS little book, written by the director of the Paris Observatory, gives in simple and eloquent language a rapid review of the whole science. This task is skilfully performed, and the book will be read with profit and pleasure by those for whom simple French is not difficult. It has been used more than once by graduate students in this country who wish to improve their knowledge of scientific French and is excellent for this purpose.

*When the Stars Come Out.* By ROBERT H. BAKER. ix+188 pages, 14×21 cm. The Viking Press, New York, 1934. Price, $2.50.

THIS work is one answer to the astronomer's prayer for a simple but authoritative exposition to which he can refer young readers and their parents. The make-up of the book is especially attractive; the star charts and numerous excellent illustrations have dark blue backgrounds that are not a bad imitation of the color of the night sky. The high standard of accuracy and clarity that the author has established for himself in his two earlier popular expositions is well maintained in this.

*Handbook of the Heavens.* Edited by H. J. BERNHARD. 54 pages, 16×23 cm. Published by the Junior Astronomy Club of the American Museum of Natural History, New York, 1934. Price, $0.50.

THIS handbook, reproduced from typewritten manuscript by a photo-offsetting process, is chiefly a guide to the constellations, with clear instructions and numerous charts for finding and identifying them. In addition, the book indicates what objects are suitable for observation with field glasses and small telescopes. There are very few errors of statement or printing. A pleasant feature of the printing is the justification of the lines so that all of them come accurately to the right-hand edge; this is done by using a typewriter that has a device for introducing spaces of various widths. The number of characters in each line of the manuscript must then either be carefully counted, or better, the typewriting is done twice.

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## TIMBERS OF NORTH AMERICA

*Identification of the Timbers of Temperate North America.* By SAMUEL J. RECORD. Pp. i–ix+196. John Wiley and Sons, Inc. 1934.

THE first edition of Record's "Identification of the Timbers of Temperate North America, including Anatomy and certain Physical Properties of Wood" represents a complete rewriting and recasting of the material earlier treated in his "Economic Woods of the United States" and extends it to include the timbers of all temperate North America. As before, the book is divided into two parts, Part 1 treating of "The Anatomy and Certain Physical Properties of Wood," and Part 2 of "Timbers of Temperate North America." This book, as now available, is excellently illustrated, includes introductory material on the essentials of development and of xylem anatomy and is followed by a key to the woods of timber trees of North America as well as comments on their distribution and uses. The bibliography has been brought up to date.

In more detail, Part 1 has been written around the recent "Glossary of Terms Used in Describing Woods," published in *Tropical Woods,* No. 36, December 1, 1933. This glossary was compiled by a Committee on Nomenclature of the International Association of Wood Anatomists in a first attempt to standardize terms used in the description of woods. Dr. Record has fitted these terms into an excellent treatment, well illustrated, of the developing and mature xylem, a treatment which might well be utilized in any course in plant anatomy. Tables, increased in number, of statistical matter concerning size of xylem elements, distribution of parenchyma, types of vessel perforation, specific gravity of woods, etc., are now found in this part of the text instead of in an appendix as before.

Part 2 comprises a key to the timbers of North America as well as comments on each genus and species referred to in the key. The major differentiation of the woods is made on characteristics to be observed in macroscopic study or in free-hand sections. Microscopic details are indicated in smaller

type. The key has been modified and the new terminology of Part 1 introduced into the descriptive material. The "Notes and References" following the key give comments on the geographical distribution and the economic significance of the species concerned.

This book represents a decided contribution, valuable to botanists, to foresters and to all those interested in North American woods.

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# SCIENTIFIC APPARATUS AND LABORATORY METHODS

## WATER-COOLED RESISTORS

THERE are numerous occasions when a resistor of high current-carrying capacity is needed in the laboratory; for example, in regulating the current of electric furnaces, in charging large storage batteries and in testing the regulation of some generators. It is the purpose of this note to describe two types of water-cooled resistors which are extremely simple and cheap to construct and which have been found satisfactory. Probably resistors of this type have been employed by others, but since their value and simplicity do not seem to be generally known, a description of them may be of interest.

The resistor is essentially a piece of wire of high specific resistance located inside of a tube through which water flows. Fig. 1 shows the construction of a fixed resistor. The tube consists of two pieces of copper tubing, C and C′, joined by a section of rubber tubing, R. A wire of nichrome, N, is soldered to the inside surfaces of the copper tubes and the external leads, L and L′, are soldered to their outside surfaces. Of course, the rubber tubing must be doubled back upon itself during the soldering process in order that it will not be injured by excessive heating. If heavy rubber tubing is employed, so that difficulty is experienced in doubling it back upon itself, it is easier to use two pieces of it joined by a piece of glass tubing. The rubber can be pushed back over the glass while soldering and then pulled back to join the copper.

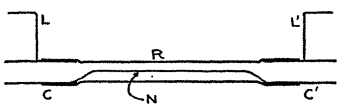

Fig. 1

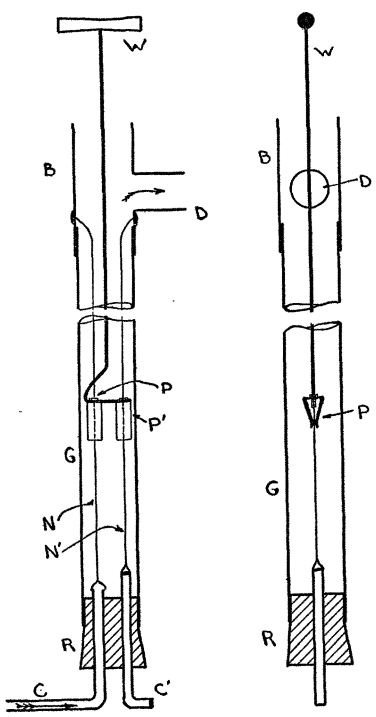

Fig. 2

Fig. 2 shows two views of a variable resistor which has proved satisfactory. G is a large glass tube arranged vertically, B a piece of brass tubing and R a two-hole rubber stopper. C and C′ are pieces of copper tubing which serve as the terminals of the resistor composed of two pieces of nichrome wire, N and N′. Cooling water flows in at tube C and out at tube D. P and P′ are phosphorbronze clips which are connected to a piece of heavy copper wire, W, by which they can be moved along the resistor, thus varying the resistance between C and C′. The upper end of W is insulated so that the operator will not receive a shock.

Nichrome can be obtained in straight wire, in helically wound wire and in flat ribbon. The variable resistors must be made of straight wire or ribbon, but the fixed ones can also be made of helical wire, thus keeping them small. No. 22 straight wire, having a resistance of approximately one ohm per foot, is readily obtainable. When water-cooled, it can carry 40 amperes safely. The quantity of cooling water required depends upon the power dissipated by the resistor. A flow of one liter per minute is ample for a resistor dissipating two kilowatts or less.

Any number of either fixed or variable resistors can be connected together so that the cooling water flows through them successively. They can then be connected electrically either in series to give a higher resistance or in parallel to give a greater current-carrying capacity. The entire group of resistors should be connected to the water supply with rubber or glass tubing so that they will be insulated from ground.