Star Clusters (Harvard Observatory Monographs No. 2). By HARLOW SHAPLEY. xi + 276 pp. McGraw-Hill Book Company, New York, 1930. $3.00.

ONE of the reasons why many star clusters are worth studying is that they present stars of different physical characteristics at practically the same distance. The possibilities here offered have been utilized with startling success.

"Star Clusters" tells the story of the exploration of this interesting field of modern astronomical activity. The author of the book has had a lion's share in the advancement of the subject. The fifteen years of active study of star clusters have not lessened his enthusiasm for the subject, as is apparent from every page of the book.

The book deals with galactic and globular clusters but with the latter in the forefront. It does not pretend to give an exhaustive treatment of all the ground it covers but contains abundant references to subjects treated elsewhere. As part of its plan, and a very welcome part to its readers, it presents as one unit Professor Shapley's own researches, published in numerous papers, now extended and amended where necessary.

The author states in his preface that he has postponed the publication of this monograph till a revised system of parallaxes for globular clusters could be available. It is evident how much time-consuming labor members of the Harvard Observatory Staff, under Professor Shapley's direction, had to accomplish in order to provide for the finishing touch to many chapters.

The period luminosity curve for Cepheid variables is newly derived from a richer material of variables in the Small Magellanic Cloud only.

Theoretical considerations in connection with the period-luminosity relation are presented in two separate paragraphs (22 and 51). It is to be regretted that the subject has not been treated as a whole.

Paragraph 44 gives some historical notes in connection with the period luminosity relation. Hertzsprung is given credit for his early work on Cepheid variables. But the interesting fact that he was the first to use the relation for the determination of the distance of the small Magellanic Cloud is not stated. In the same paragraph, when reference is made to "some vigorous critical discussion of the data on galactic Cepheids," Dr. Schilt's contributions are not mentioned.

In recent years much has been written about the transparency of space. An interesting chapter is devoted to this subject of intrinsic importance when one deals with the huge distances of globular clusters and extra-galactic nebulae.

In a chapter, "Data Bearing on the Origin of the Galaxy," the knowledge of star clusters is used as a basis for an interesting tentative discussion of the galactic system as a unit of higher order in the universe.

Forty-six pages at the end of the book are devoted to four valuable appendices. They give catalogues of globular and galactic clusters and a very complete bibliography of star clusters containing 812 titles.

It may be a decided disadvantage when the author's own researches have covered practically the whole subject treated in a book. His presentation will almost necessarily be too subjective. In this book we frequently notice such a lack of objectiveness when important contributions of others are reviewed in a few words. This is especially regrettable if, on this account, work of original character does not receive proper emphasis.

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FEBRUARY 13, 1931

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A DEVICE FOR WASHING TISSUES

IN our laboratory it became necessary to devise an apparatus for washing fixed tissues in running water. It was desirable to arrange this apparatus to accommodate the material of a technique class of about a half-dozen students so that all individuals could use it without interfering with each other's material or hampering the efficiency of the apparatus.

The apparatus is so constructed that any one who is handy with a pair of tin shears and a soldering iron can put it up in an hour's time from a few scraps of thin galvanized iron at no cost whatever.

Essentially the apparatus consists of a tank (K), a rack (E) to hold the tubes containing the material and an overhead trough (C) to distribute the water. Fig. 1 shows the apparatus as it appears when assembled. It is set up from only three parts that need to be cut to pattern and two small tubes. The pattern of the tank itself is shown in Fig. 4. Dotted lines indicate folds in the metal. The nature of such folding will be apparent at once by reference to Fig. 1. The holes at A are to take screws to support the whole apparatus on the under side of a shelf above the laboratory sink. The hole (S) shown in Fig. 4 (not visible in Fig. 1) is a drain, but kept closed with a cork when the apparatus is in use. The overflow pipe (L, Fig. 1) is soldered over the hole L (Fig. 4) and the inflow pipe (M, Fig. 1) is soldered over the hole M (Fig. 4). These pipes are easily fashioned from small rectangular pieces of the sheet

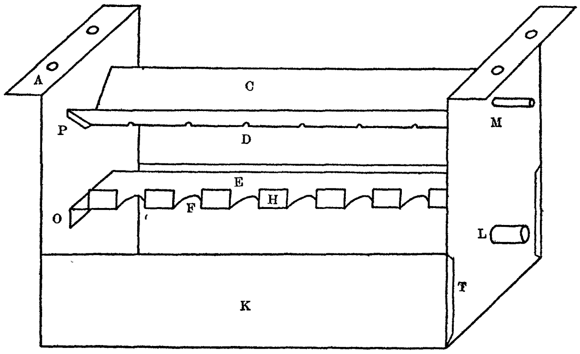


Fig. 1.

metal by using round objects such as bolts, etc., to hammer the metal around. Overlapping joints (T) are soldered to the upright ends of the tank so that the joints are water-tight.

The pattern of the rack is shown in Fig. 2. Its nature is apparent when reference is made to Fig. 1. The slots (F) are made by drilling the metal first with round holes of appropriate size and properly spaced. In our apparatus these holes were made

Fig. 2.

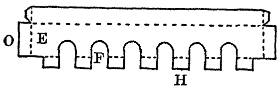
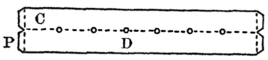


Fig. 3.



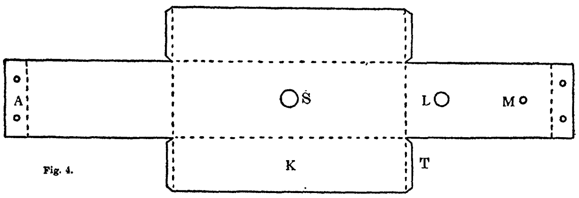


Fig. 4.

$\frac{3}{4}$ inch in diameter. After the holes are drilled they are cut into slots by the tin shears. The projecting ends (H) are then turned up as guards (Fig. 1). The part above the upper dotted line (Fig. 2) is bent at a right angle to the rest (E) and forms a strengthening flange not visible in Fig. 1. The ends (O) are turned and soldered down to the ends of the tank as shown in Fig. 1.

The construction of the water-distributing trough is simple (pattern in Fig. 3). It is merely a V-shaped trough (C, Fig. 1) with nail holes (D) punched in its bottom in such a manner that they will be properly centered over the slots (F) in the rack. The ends (P), as in the case of those of the rack, are turned over and soldered down to the ends of the tank.

The outlet pipe (L) is set so that the top side of it is about $\frac{1}{8}$ inch below the top of the side (K) of the tank and it is sufficiently large to be a positive drain. The inlet pipe (M) may be much smaller.

As stated before, our apparatus is fastened on the under side of a shelf over the laboratory sink. Water is supplied through a rubber tube slipped over the pipe M. In order for the apparatus not to interfere, even when in constant use, with ordinary use of the water faucet at the sink we had our college engineer set an $\frac{1}{8}$ inch petcock permanently into the faucet back of its valve.

Ordinary $\frac{3}{4}$ inch flanged test tubes make excellent tissue holders. These are cut off about 2 to $2\frac{1}{2}$ inches below the flange, or short enough to clear the bottom of the tank and permit a free flow of water through them. These cut ends are closed with silk or with bolting cloth. These tubes containing the tissues are suspended in the slots in the rack. The water is started and allowed to flow into the trough. It drips through the holes (D) into the tubes suspended in the slots, fills the tank and overflows through the outlet tube (L). The overflow may be allowed to fall directly into the sink or it may be carried to any desired point with a large rubber tube.

The tissue-containing tubes are constantly suspended in water even should the flow be stopped. While the water is flowing clean water constantly passes the tissues. The rate of flow may be regulated by the petcock.

Such an apparatus as this may be made of any suitable size. More or less slots may be made according to the number of students using the apparatus or the amounts of tissues being washed. Our apparatus measures $10\frac{3}{4}$ inches in length and has six $\frac{3}{4}$ inch slots. These slots may, however, be made to accommodate any size of tube.

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A MACHINE FOR PULLING GLASS MICROPIPETTES AND NEEDLES

IN designing a machine for this work a study was first made of the hand movements of an expert in making needles and pipettes. The essential movements seemed to be a removal of the glass from the heater at the correct temperature followed by a rather quick horizontal pull-out.

In the machine as designed a parallel motion was devised which, when the glass becomes plastic enough to stretch under a light pull, lifts the glass up and out of the heater, and, at the same time, increases the pull by an increase of leverage. The result is a rapid pull-out at the correct instant.

The machine as shown in the diagram is in its final