globular clusters. Absolute photographic magnitudes range from -4 to -7 with maxima at -5.0 and -6.2. Diameters range from 4 to 16 parsecs. Galactic globular clusters, according to Shapley's data, are systematically brighter than the objects in M 31 by amounts varying from 0.75 to 1.95 mag., depending on the interpretation of the data. Known clusters in the Magellanic Clouds are comparable with the brighter objects in M 31. Objects apparently similar to those in M 31 are found in NGC 6822, M 33, M 81 and M 101.

The determination of the orbit of an object moving under the attraction of the sun and of the combined mass of earth and moon: A. O. LEUSCHNER and E. C. BOWER. As a measure of preparedness in case of the discovery of an object so close to the earth that the usual methods of orbit determinations do not apply, a solution is proposed, based on the equations of motion for three bodies, which in the first approximation determines whether the object is a planet or a satellite to the earth. A satellite would be revealed graphically through the intersection of a straight line with a bump in a curve, due to parallaxic terms arising from the difference of direction of the object as seen from the observer and the center of the mass of the earth-moon system. The process was illustrated by application to the recently discovered fast-moving Delporte object. The earlier observations of this object indicated the possibilities of its nature. It could be either a planet moving in a cometary orbit similar to that of Eros and passing through perihelion about the time of discovery near the earth. In that case its distance from the sun would be nearly the same as the distance of the earth from the sun. Or the object might be a new but tiny satellite to the earth, giving us a second moon. In fact in that case its distance from the earth would have been about 1.5 times the distance of the moon and its period of revolution about five months. Application of the new method of solution readily revealed that the latter possibility is definitely excluded and that the object is a planet moving in a cometary orbit. It may have been observed years ago as a comet. Its importance lies in the fact that it can approach closer to the earth than Eros and therefore furnishes the best opportunity for more accurate determination of the distance of the sun from the earth.

Trial of a projection method for measuring astronomical photographs: FRANK SCHLESINGER and ARTHUR L. BENNETT. In this method of measuring, a strong light is placed behind the photographic plate and is kept in the line of collimation of the measuring microscope. The images of the plate and of the cross wires are then thrown upon a white mat surface with a magnification of about thirty. The microscope being moved with reference to the plate by means of a long and accurate micrometer screw, the settings are made by superimposing the image of the cross wires upon the star images. A large number of plates were measured in this way and also by the usual method; the two results are equally accurate, or if there is any difference it is in favor of the projection method. The new method has the advantages of being a little more rapid and far less tiring.

Curvature theorems in dynamics (illustrated): EDWARD KASNER.

A deaf speaker: FREDERICK BEDELL (introduced by Ernest Merritt). The microphone, phonograph and radio, and the loud speaker which they operate have reached a high stage of development for the entertainment and education of people with normal hearing, and the benefits of this development have been far-reaching. There are, however, in this country some fifteen million people who on account of defects in hearing are completely debarred, or to a large extent debarred, from enjoying these benefits. The need, therefore, is evident for a "deaf" speaker which will give audition to the deaf similar to the audition given by a "loud" speaker to those who have normal hearing. Such a speaker for the deaf, utilizing bone conduction from a vibrating applicator applied to the teeth or bony structure of the head, has been developed. Sound vibrations are thus detoured around the middle ear, where defects causing deafness are usually located, and are picked up by the bone-encased fluid of the inner ear. Special attention has been paid to matching mechanical impedance, so that the vibrations are given proper force and amplitude for transmission through the bone, and to controlling frequency response so as to give best audition for different types of deafness. In this way people who have not heard for years have been able to hear.

On the theory of ferromagnetism: PAUL S. EPSTEIN. According to Heisenberg the ferromagnetic phenomena are due to the magnetic spin moments of the valency electrons. In spite of some work done by Bloch and others, the theory was not sufficiently carried through mathematically, so that there remained doubts whether the spin moments are a sufficient cause of ferromagnetism. The author succeeded in finding expressions for the probability of a given magnetic moment of a crystal which are rigorous within the simplifying assumptions of the theory. They permit to set up the criteria for a substance becoming ferromagnetic and to say positively that, under certain conditions, the spin moments can produce ferromagnetism.

(To be concluded)

BOOKS RECEIVED

BORRADAILE, L. A. and F. A. POTTS. *The Invertebrata: A Manual for the Use of Students.* Pp. xiv + 645. 458 figures. Macmillan. $5.50.

BROWN, F. E. *A Short Course in Qualitative Analysis.* Pp. xiii + 332. 6 figures. Century. $2.25.

HOPKINS, B. SMITH. *Essentials of College Chemistry.* Pp. vi + 544. 195 figures. Heath. $3.24.

MAHIN, EDWARD G. *Quantitative Analysis.* Fourth edition. Pp. xiii + 623. McGraw-Hill. $4.00.

TIMM, JOHN A. *An Introduction to Chemistry.* Pp. xiii + 553. 150 figures. McGraw-Hill. $3.50.

TÔHOKU IMPERIAL UNIVERSITY: *Science Reports.* Second Series (Geology). Vol. xiii. Pp. 168. 5 figures. 5 plates. The University. Yen 11.70.

WEYL, HERMANN. *The Open World.* Pp. 84. Yale University Press. $2.50.