have been made, using batteries giving enormous pressures. 3. When lamps are lighted by electricity from alternate-current dynamos, how is it that the light appears constant and does not seem to flicker? I suppose commutators cannot be used with continuous-current dynamos. In the alternate-current machine does not the current enter the lamp alternately by opposite wires? A. An alternating current is the result of an alternating electromotive force, which is conceived to start from zero and rise to its highest point of voltage, then to fall through zero to a point as far below zero as it rose above zero, after which it returns to zero, thus making a cycle of changes. The polarity of the current is reversed while the E. M. F. is below zero. The fluctuation of lamps is not visible under such a current, because the changes are more rapid than the eye can take note of. The shortest interval of time the eye can note is about a tenth of a second, while the alternating current passes through 30 to 60 cycles per second. A commutator can be used with a continuous-current dynamo whose voltage is not too high and current is low enough. The transformation of a direct to an alternating current is usually made by a rotary converter or a motor dynamo. We furnish Sloane's "Electrician's Handy Book," which discusses all such matters, for $3.50 by mail.

(12018) J. W. L. says: 1. Does a gyroscope consume the same amount of energy while rotating in either the vertical plane or horizontal plane? R. P. M. Equal, I think, owing to the fact that while rotating in the vertical plane one side of the rotating part would be moving toward the earth; that the force of gravity on that side should be decidedly below normal, while on the opposite side (which would be receding) the force of gravity should be above normal. Under these considerations would not gravity alone tend to bring the gyroscope to rest? A. The power necessary to maintain a gyroscope in motion would not seem to depend upon the angle made by the wheel with the horizon. Any excess on one-half of a revolution is made up by as great a deficiency in the other half revolution, leaving the mean value the same. 2. Is this not the reason that the moon does not rotate on its axis as viewed from the earth? A. The reason of the moon not rotating upon its axis as referred to the earth is that tides have in the past acted to bring the moon to rest with reference to the earth. See Darwin's theory of tidal evolution in Moulton's "Astronomy." This theory is now quite generally accepted by astronomers. We can send you the book for $1.75 postpaid.

(12019) J. E. W. asks: 1. If at the equator a hole 2 feet wide pierced the earth through its center, and a ball a half inch in diameter were dropped into the hole, I figure that in about nine and one-half seconds, and at a depth of about 1,440 feet the ball would impinge against the east side of the hole, because at that depth the earth would be revolving a little over one-tenth of an inch slower than at the surface; and from that point down to the center the continually decreasing speed of revolution would cause the ball to press continually against the east side. Supposing now, that there were neither air nor friction to retard the ball, would it acquire the same velocity as if it could have fallen without touching the side; and would it rise again to the opposite surface of the earth? A. The best experiments to determine the easterly deviation of falling balls, according to Prof. Young in his "College Astronomy," showed from 160 trials, a deviation of 1.12 inches in a fall of 520 feet into a mine. If a ball were dropped into a hole in the earth it would in time come against the side of the tube and roll down to the center of the earth and pass some distance beyond the center. How far no one can tell, since it depends entirely upon the degree of friction upon the sides of the hole. It could not rise as far as it had fallen, since it could not pass the center with the full velocity due to free fall. 2. If the earth were a hollow sphere inclosing a vacuum, and a rock fell from the inner side, would it not gradually assume a convolute course till it reached a point where its increasing momentum would equal the earth's decreasing attraction, and at that point begin to revolve in a circular orbit? If so, at what depth would this occur? A. If the earth were a hollow shell a rock which had become detached from its interior surface could not fall at all. A body anywhere within such a shell is equally attracted in all directions and has no weight. This is usually demonstrated in textbooks of mechanics. 3. In such a sphere a ball falling from either pole would go to the center direct and rise again to the opposite pole; but if as in the case of the earth, the poles themselves had a slight rotary motion in space, would not the ball be gradually deflected into a circular orbit? A. A ball falling along the polar axis of the earth would not be deviated at all in the time required to fall from the surface to the center of the earth, since the deviation of the pole is very slow and very small.

(12020) T. H. asks: Do any of our planets ever swing beyond the zodiac? If so, which ones, and how far beyond? A. All the major planets have their orbits wholly within the zodiac. The belt of the zodiac was originally taken to be 8 deg. on each side of the celestial equator, simply because with that width it included all the known planets and the moon. Many of the minor planets depart from the zodiac.

NEW BOOKS, ETC.

VORLESUNGEN ÜBER INGENIEUR-WISSENSCHAFTEN. Vol. II. Eisenbruckenbau. By G. C. Mehrtens. Leipzig: Wilhelm Engelmann, 1908. 800 pp.; 970 ill.

It is possible that the mathematics of bridge construction may have been more fully treated in some text book, the details of some particular bridge more fully described in a magazine article, but it is inconceivable to us that the whole subject of iron-bridge building could be more exhaustively treated in the same compass than by the present volume. Many of its pages could be used as text book for the calculation and distribution of strains and stresses in bridge members, but much more of it is as interesting to the amateur as to the engineer. We cannot imagine that any history of bridge building could commence further back and conclude more up-to-date, or include a wider range of examples from the most primitive to the most complex structures. The author begins with pictures from the Bayeux tapestry of Alexander the Great bridging the Euphrates and coins commemorating Trajan's bridge over the Danube, and includes representative work of all leading bridge builders from Vespasian and Maximian to Roebling, Baker, Brunel, and Lindenthal, leading up through twenty centuries to the last word in braced arch and cantilever construction. Mr. Mehrtens even goes outside his title and the above range of period to include all types from natural bridges in the Cordilleras, and bamboo and rattan suspension bridges in Java, from the pyramid of Cheops, the principle of which is illustrated by working drawings, and Hannibal's stone bridge at Barcelona, to the latest developments of masonry and ferro-concrete. Many forms of fastenings and details are illustrated, each new system of strain distribution involved in a bridge described is explained by diagrams, and the reader is conducted through the entire series of operations from the rolling from the ingot of members of various forms to their location in the finished structure. In glancing over the excellent illustrations one cannot help regretting that in the development of the American iron-bridge system, admirably as it was suited to meet conditions nowhere else encountered with the same limitations imposed, the artistic beauty so noticeably superior in many European bridges has had to be to some extent sacrificed to economy and efficiency.

TWO FAMILY AND TWIN HOUSES. New York: William T. Comstock, 1908. Small 4to.; 127 pages. Price, $2.

This work consists of a variety of designs contributed by leading architects in all parts of the country, showing the latest ideas in planning this class of dwellings in city, village, and suburbs, together with very complete descriptions covering all the latest improvements in sanitation.

OLD EDINBURGH. By Frederick W. Walkeys. Boston: L. C. Page & Co., 1908. 2 vols.; 16mo.; pp. 380-360. Price, $3.

This is an account of the ancient capital of the kingdom of Scotland, including its streets, houses, notable inhabitants, and customs in the olden times. It is beautifully illustrated with reproductions of old prints and photographs. A charming book of travel, well written and well illustrated.

RESERVOIRS. For Irrigation, Water Power, and Domestic Water Supply. By James Dix Schuyler. London: Chapman & Hall, 1908. Imported by John Wiley & Sons. Large 8vo.; pp. 573; 281 ill. Price, $6.

This is a second edition revised and enlarged of the original work of the author, well known to all engineers concerned in such work. The rapid development in dam construction since the original publication has necessitated the complete revision of the work in order to bring it up to date, and this having obviously been done with great care, must have involved labor equivalent to, if not indeed greater than, that of writing a new book. Much new matter has been added and some of the old describing practice obsolete or superseded by modern methods has been omitted, the most noticeable addition being that descriptive of hydraulic fill dams, a method of using natural streams for the transportation of material and for the natural solidification of dams of great height at small cost almost unknown at the time of the appearance of the author's first edition. Improvements in photography have also increased the interest of the book, especially to the layman, by the addition of over 200 new illustrations, many of striking and historic dams.

THE MECHANICAL APPLIANCES OF THE CHEMICAL AND METALLURGICAL INDUSTRIES. By Oska Nagel, Ph.D. New York: Published by the Author, 1908. 8vo.; pp. 302; 292 ill. Price, $2.

It must be difficult to find a new field for authors and compilers nowadays, but we are unfamiliar with any other work covering exactly the ground of the present. All the machinery used in industrial chemistry and metallurgy from the generation of steam and producer gas to the conveyance and disposal of their waste and by-products, from the crushing of ores to the handling of their residues after cyaniding and filtration, from reverberatory furnaces to sublimation, is critically described and classified, including all kinds of conveying apparatus for solids, liquids, and gases, grinders, mixers, separators, purifiers, evaporators, and dryers. There is a good deal of rather obvious compilation from manufacturers' catalogues, but this in a work of this sort could hardly be avoided, and one of the author's professed objects is to save the manufacturer from the toils of the salesman and the perusal of endless half-understood descriptions by presenting the essentials of the different systems. This he successfully achieves and leavens the work with a few usefully simple formulæ for calculating drafts, etc., and rules for the selection of material and fittings.

THE ELEMENTS OF PHYSICS. In Three Volumes. Volume II. Electricity and Magnetism. By Edward L. Nichols and William S. Franklin. New York: The Macmillan Company, 1908. 8vo.; pp. 303; 196 figures. Price, $1.60.

This is a college textbook, being the second volume of Nichols and Franklin's "Elements of Physics." The volume was originally published in 1896, but has since been entirely rewritten. It differs from other works on the same subject in beginning with magnetism and electro-magnetism and thence leading up to electrostatics. The latter subject is approached from the standpoint of the ballistic galvanometer.

THE PHYSICAL PROPERTIES OF SOILS. By Arthur G. McCall. Fully illustrated with photographs and diagrams. New York: Orange Judd Company, 1909. 12mo.; pp. 100. Price, 50 cents.

This book is rather suggestive than didactic, telling nothing of the physical properties of soils but giving rules for the carrying out of systematic experiments for determining them; nor does it explain the relation to or effect in agriculture of the physical properties so discovered, the author contenting himself with referring the student to the best works extant on these subjects. As a guide to the student in the most practical methods of pursuing a study as yet little formulated while leaving him free to original research the book should prove of great value.

HOW TO USE A CAMERA. By Clive Holland. London: Routledge & Sons. Imported by E. P. Dutton. 12mo.; pp. 132.; ill. Price, 50 cents.

The object of the author is to supply up-to-date practical information, useful especially to the beginner rather than a profound treatise, and this he does in a readable and entertaining manner. The advice as to the important matter of selection of the right camera is good, and whereas the artistic eye for the selection of the right subject can hardly be taught, the chapter on that subject will assist many to avoid mistakes. The hints on variation of light and the way to estimate correct exposures are good, as are especially the instructions for local improvement of negatives, by following which many a hopeless picture may be retrieved. Many formulæ are also given for developing, toning, and fixing baths, hints for finishing and for artistic applications of photography. The illustrations, apart from those intended to illustrate defects, are a little disappointing compared with the excellent amateur work nowadays seen in newspaper competitions, and the subject matter is worthy of a better style of publication, the paper being poor and conspicuously different from that of the illustration and advertising pages.

THE AMERICAN APPLE ORCHARD. By F. A. Waugh. New York: Orange Judd Company, 1908. 12mo.; pp. 215; fully illustrated. Price, $1.

Although modestly described as a "sketch" this book forms a very complete treatise on American apple growing and the instruction it contains is given in a very interesting manner. Beginning with the geographical distribution of the industry and the different varieties, the author explains the desirable qualifications of soils for orchards as well as the exposures and wind protection desirable. He proceeds with the causes and effects of winter killing, the preparation of land for an orchard, selection of trees, propagation, times of planting and all the methods of working, discusses the advantages and disadvantages of cover crops, pruning, and feeding the trees, their principal diseases and the protection of them from insects, including formulæ for all the best mixtures for spraying, and concludes with harvesting, sorting, and packing apples for the market. The book makes our mouth water for the apples it describes and makes us hungry for the scent of the soil and the breezes blowing through the apple blossoms, and we should say that any intelligent farmer who has grown anything else should be well equipped for a start in commercial apple growing by its careful perusal.

FOUNDRY PRACTICE. By James M. Tate and Melville O. Stone, M.E. Revised third edition. New York: John Wiley & Sons, 1909. 12mo.; pp. 234; 112 ill.; cloth. Price, $2.

This work is essentially a text-book for the use of students, the work of the shop and of the class-room being carefully correlated in a manner infrequently found in books on foundry practice, which are generally adapted to the requirements of the advanced foundryman rather than to those of the beginner. In this respect the object of the authors seems to have been achieved. The first-named of the authors adds to a life-long experience as practical pattern-maker and foundryman some fifteen years of putting what he has learned in practice into the form of precept intelligible to others and has therefore an ability to explain what he knows rare in the practical operative. His associate has graduated under his instruction and made a special study of foundry chemistry and metallurgy. The result of their joint efforts is an eminently practical work, giving all the essentials and fundamental principles of foundry work, and, without going into details of special processes or machines, covers sufficiently for the student everything from the simplest green-sand molding to the latest machines for handling molds and cleaning castings, concluding with tables of alloys for foundry use. Not the least useful feature is a glossary of foundry terms, given especially to avoid waste of space in needless explanations, and a glance through which prevents any possible obscurity.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending March 2, 1909,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]