

sunset. In a primary bow the red is on the outside of the arch. If two bows are seen, the outer one has the red on the inner side of the arch. If a bow is formed by the moonlight at night, the colors are very faint, and very rarely or never can more than three colors be distinguished—red, yellow, and green. Lunar rainbows are not frequent, and one is fortunate to see one. The writer has seen two in forty years. They are doubtless formed more frequently in one's field of vision, but are so faint as to escape notice. Halos, on the other hand, occur frequently, and are seen without any difficulty in the vicinity of both the sun and the moon. The rings of colored light, seen close to the sun and the moon, or nearer than 10 deg., are called coronæ. The smallest halo has 22 deg. radius, or about half that of the primary bow, but it is a ring with the sun or moon in its center. It surrounds, when seen fully, the sun or the moon. A halo of 46 deg. radius and one of 90 deg. radius are also formed. White circles are also seen, which pass through the sun or moon and are parallel to the horizon. Where these circles cross the circle of the halo, we sometimes see so bright a spot of light that it is called a mock sun, or sun dog. Complicated figures are sometimes formed by the crossing of these circles. The halo of 90 deg. is very rarely formed. The writer has never seen but one. Halos are always at a very great height above the earth's surface, so high that water cannot exist, and the halo is formed by refraction and reflection of the light in crystals of ice. They are signs of a storm, since they indicate the saturation of the upper air, and the lower air will soon be affected. These are not discussed very fully in recent meteorologies. The reader is referred to Loomis's "Meteorology" for much interesting matter upon all these subjects.

(10978) M. D. S. asks: I desire to secure the formula of the solution for making blue prints; how to apply it to the paper, and how to develop and finish it, after printed. Can you inform me of any book treating on the matter and where to procure it? A. To make solution for blue-print paper, make a solution of potassium ferricyanide, 1 ounce to 5 ounces of water; also a second solution of 1 ounce of citrate of iron and ammonia to 5 ounces of water. These two solutions will keep indefinitely in separate bottles. To prepare the paper, take equal parts of each solution and mix them. The mixture is sensitive to light, and the rest of the work must be done in a feeble light. With a swab dipped in the solution cover the paper by passing across in parallel lines, and afterward crosswise of these, so as to have an even layer of liquid all over the paper and yet not enough to flow or drip. The paper is hung by a pin in the dark to dry. It is then ready for printing. After printing in bright sunlight, the picture is developed by putting it under water. Wash thoroughly till the white parts of the picture are clear.

(10979) W. K. asks: 1. What action (chemical) does zinc chloride furnish in a dry cell? Sal-ammoniac? Does manganese furnish any action besides its depolarizing effect? A. The zinc chloride does not exert any chemical action in a dry cell directly; that is, the action of the zinc and ammoniac chloride (sal-ammoniac) is to form zinc chloride. The zinc salts put into a dry cell serve principally to keep the paste porous and moist, since these have a strong affinity for water. Manganese dioxide serves simply as a depolarizer in a dry cell, as it does in a wet cell. 2. Does high initial amperage increase life of a battery, or does it mean that it will be short-lived? A. The amperes of a cell depend upon the external resistance, and there is no propriety in giving amperes, unless it is stated also against what resistance the amperes are flowing. If a large number of amperes are drawn from a cell at first, the cell will be shorter lived than if a low amperage is drawn. A cell will have a certain number of ampere-hours of life. If 100 ampere-hours, the cell will last approximately 100 hours if 1 ampere is the rate of current, but only 10 hours if 10 amperes be drawn. This law is as true of dry as of wet cells. 3. What do you consider best type of wet and dry cells on market to-day for telephone service? A. We have no judgment to give as to the best dry or wet cell. We presume there is no cell which deserves such a distinction. There are many reliable houses offering cells. We presume your local dealers are reliable, and that you are safe in taking their advice. We do not advertise in Notes and Queries. Our advertising columns may be consulted, and we think our advertisers are unusually reliable. We doubt if there is any such thing as a superlatively best thing of any kind. We are not willing to say that there is. 4. In gas and gasoline engines, what affects the life or service of the batteries? A. There is nothing very peculiar in the service a battery performs on a gas engine, except the regularity of its action. It wears out as any other battery does by the work it does, and rather sooner because of the constancy with which it is called upon for current. It is a popular impression that a battery should last indefinitely, but really it is like any other source of power. It can only give back the power which is given to it, and when that is done the battery stops work. No one is ever ready to have the battery stop. Few understand that a battery uses up materials as an engine uses up coal. So much zinc and chemicals, so much electricity. It is a simple matter.

NEW BOOKS, ETC.

ARTS AND CRAFTS IN THE MIDDLE AGES. A Description of Mediæval Workmanship in Several of the Departments of Applied Art, Together with Some Account of Special Artisans in the Early Renaissance. By Julia De Wolfe Addison. Boston: L. C. Page & Co., 1908. 8vo.; 378 pages. Price, \$3.

The very general and keen interest in the revival of arts and crafts in America is a sign full of promise and pleasure to those who are working among the so-called minor arts. In this connection, it is interesting to look into the past, particularly those centuries known as the Middle Ages, in which the handicrafts flourished in special perfection, and to see for ourselves how these crafts were pursued, and exactly what these arts really were. There are very few books dealing with the arts and crafts of the olden time, which are adapted to inform those who have no intention of practising such arts, and yet wish to understand and appreciate the examples which they see in numerous museums or exhibitions, and in traveling abroad. Mrs. Addison's book, consequently, will be welcomed by a large class of readers. "Arts and Crafts in the Middle Ages" is not merely a beautifully illustrated "art book." It is a valuable work, destined to fill a special niche in the library of books which are worth while.

MARINE ENGINEERING. A TEXT BOOK. By Engineer-Commander A. E. Tompkins, Royal Navy. London: Macmillan & Co. New York: The Macmillan Company, 1908. 8vo.; 812 pages. Price, \$4.50.

The writer was until recently instructor in steam and marine engineering, marine construction, etc., at the Royal Naval College, Greenwich, England. All those who go down to the sea in ships have a profound respect for those that oversee that mechanical underworld of the great vessels. It is more than surprising to note what a vast amount of detail the marine engineer has under his control. Even to those who are moderately familiar with marine practice, this book will prove a revelation. It is filled with the most valuable material. The illustrations are numerous, well executed and, as far as we can see, they are new. Engines of all sizes and descriptions are dealt with as well as auxiliary engines, such as capstan-engines, blowing engines, and pumps. Great attention is paid to the propeller. The water-tight system is also taken into consideration. Electrical machinery comes in for a fair share of attention. Boiler preservation and repairs, care and adjustment of machinery, the engineer of the watch, are all adequately dwelt upon. The subject of marine steam turbines is very well discussed, and the very latest practice, as the engines of the "Mauretania" are outlined. Internal-combustion engines for boat propulsion are also included. The entire book has been rewritten and revised, and forms a complete text book for the construction and working of steam engines and boilers.

INTERNAL COMBUSTION ENGINES. Their Theory, Construction and Operation. By Rolla C. Carpenter, M.M.E., LL.D., and H. D. Diederichs, M.E. New York: D. Van Nostrand Company, 1908. 8vo.; 597 pages. Price, \$5.

This is a very well-made book and the intention of the authors in its preparation has been to present in as simple terms as possible the fundamental and theoretical principles relating to the internal combustion engine, and to describe the various methods of applying these principles to practical construction. The book does not in any way treat of the proportion and strength of the various machine parts. It is largely a compilation from different sources and is, in the main, an outgrowth of a course of lectures on the internal combustion engine delivered to students of Sibley College during the past three years. The thermo-dynamics of the gas engine, the theoretical comparison of various types, combustion, fuels, history of the gas engine, modern types of internal-combustion engines, ignition, mufflers, starting apparatus, estimation of power of the gas engine, methods of testing internal-combustion engines, and performance of gas engines and gas producers, cost of installation and operation all come in for liberal treatment. One of the most peculiar-looking engines in the book is the Sargent complete-expansion engine. It is built as a double-acting tandem. There is but one valve to control admission and exhaust for each end of each cylinder. A single cam performs these various phases while a second cam operates the igniter. The construction is radically different from that used by other designers.

THE MOTORMAN AND HIS DUTIES. By Ludwig Gutmann. Sixth Edition. Revised and enlarged by Lawrence E. Gould. Chicago: The Wilson Company, 1907. 16mo.; 195 pages. Price, \$1.50.

The purpose of this book is to familiarize the reader with the operation of an electric car. It tells in simple, terse language, devoid of all technicalities and mathematics many points not generally understood by the average employee who has to do with the operation of a great electric railway rolling stock. Such knowledge cannot fail to make his services more valuable to his company and more satis-

factory to himself, and fit him for promotion. The book is intended not only to explain the parts of an electric motor car, but to give some general instruction and advice to those who desire to make the handling of cars their livelihood. It is based on experience gathered during a number of years in the electric railway field, instructing motormen in their duties and work and on results and observations made on operating roads.

MOTOR CAR PRINCIPLES. The Gasoline Automobile. By Roger B. Whitman. New York: D. Appleton & Co., 1908. 12mo.; 318 pages. Price, \$1.25 net, postage extra.

As the technical director of the New York School for Automobile Engineers Mr. Whitman is peculiarly well fitted to write a book on the mechanical principles of the motor car. His little volume is primarily intended for the man who is not endowed with over-much technical knowledge, but who wishes to learn all that he can about his car. For that reason Mr. Whitman has written his treatise in an easy, simple style, which will not strain the mind of a man who is not a trained engineer. The book is divided into thirteen chapters, in which are discussed gasoline engine principles, engine parts, engine balance, 2-cycle engines, carbureting and gasoline feeds, ignition, transmission, running gear, the location of troubles and maintenance and construction.

AMERICAN MACHINIST'S HANDBOOK AND DICTIONARY OF SHOP TERMS. By Fred H. Colvin, A.S.M.E., and Frank A. Stanley. New York: Hill Publishing Company, 1908. 18mo.; 511 pages; full leather limp. Price, \$3.

It is with a feeling of confidence that we open this handsome little pocketbook, for the American Machinist has always stood for accuracy and reliable shop methods. The book is filled with good diagrams and tables. We always welcome an accurate pocketbook as it is always certain to cut down trying mental work. This work is very largely devoted to machine shop practice. It is worthy of a good sale.

SMALL HOLDINGS. By F. E. Green. London and New York: John Lane Company. 16mo.; 122 pages. Price, \$1 net.

The author has written of conditions which obtain in England, but at the same time it will prove of great interest to those who have small places of say 10 to 25 acres. Full details of receipts and expenditures are given. The book is charmingly illustrated with engravings printed in duotone.

NOTES ON PRACTICAL MECHANICAL DRAWING. By Victor T. Wilson, M.E., and Carlos L. McMaster, B.S. in C.E. East Lansing, Mich.: Published by the authors, 1908. 8vo.; 160 pages.

Of making books on drawing there is no end. The present work contains some unique features, such as machine sketching, which is most admirably treated. The section relating to lettering is also good.

A SHORT HISTORY OF ENGRAVING AND ETCHING. For the Use of Collectors and Students. By A. M. Hurd. Boston: Houghton, Mifflin Company, 1908. 8vo.; 473 pages. Price, \$5.

A beautiful book, illustrated by 110 engravings and a frontispiece in photogravure. There is a full bibliography and a classified list and index of engravers. The selection of examples is well made. The extensive classified list of engravers is a monument of patience. Collectors will hail this book with delight.

KRAFT. By Prof. Dr. E. Reyer. Leipzig: Verlag von Wilhelm Engelmann, 1908. 8vo.; 380 pages. Price, \$1.50.

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