

not a conductor of electricity in any condition. It is a better conductor after it has been prepared than in the ordinary condition. It is kept for several hours at a temperature just below its melting point. It is then spread over the space between parallel wires, better wound upon a porcelain tube, so that the two wires are quite near together. When it has cooled it is in the sensitive state. The current sent from one wire to the other will be increased by allowing light to fall upon the selenium cell, as it is called. The resistance will be several hundred ohms probably at the lowest. We would advise you to apply to the professor of chemistry or physics at the university in your city. These men are always glad to give advice and assistance to others.

(12002) R. S. McF. asks: Would you kindly explain how I could use a 100-volt induction motor on a 110-volt current? I tried one way by connecting a 10-volt lamp in series with it, but had no satisfaction. A small resistance coil placed in series with your motor will take up the extra ten volts and enable the motor to run with safety. The wire must be of a size which will carry the current without heating too much. The small lamp you used was not able to carry the current required. Its filament had too high a resistance to allow current enough to flow for the motor, and so the motor did not get current enough to turn it.

(12003) C. W. asks: In your issue of February 10, 1906, page 137, Notes and Queries (No. 9887), you state that absolute zero is -459° deg. Is it a fact that scientists have accepted this as absolute zero? On what is it based? How was it determined? And how is it measured? What does absolute zero mean? Is it a condition of temperature at which no heat whatever exists or is radiated? A. It may be positively stated that all modern scientists accept -273° deg. C. as absolute zero, or the temperature at which molecular motion would cease, all heat would be gone from matter. Astronomers believe that this is the temperature of the space outside of the earth's atmosphere. The degree we gave, -459° deg. F., is the Fahrenheit equivalent of -273° deg. C. The idea of absolute zero is based upon the fact that all gases at the freezing point of water expand and contract by the same amount if the temperature is changed one degree and this amount is $1/273$ of their volume if the temperature is changed one degree Centigrade. Since the volume of a gas is dependent upon its temperature it is evident that the cooling of a gas degree by degree will cause it to shrink proportionately till if it is cooled 273 degrees its power to shrink will be gone also; that is, all the heat will have left the gas. This reasoning is not weakened by the fact that the gas would change to liquid before the absolute zero is reached. Dewar has gone within a very few degrees of absolute zero in the attempts to liquefy helium. The absolute scale was devised by Lord Kelvin and is very frequently employed in giving temperatures in scientific papers. It is the only scale in which the degrees have a direct quantitative relation.

(12004) A. N. B. says: Will you kindly let me know how to boil a meerscham pipe that has been in use some time, so as to color readily? Also how to fix the color in the pipe when it is once there? A. Ordinarily the pipe is boiled for coloring in a preparation of wax which is absorbed, and a thin coating of wax is held on the surface of the pipe, and made to take a high polish. They are first soaked in melted tallow, then in white wax. Under the wax is retained the oil of tobacco, which is absorbed by the pipe, and its hue grows darker in proportion to the tobacco used. A meerscham pipe at first should be smoked very slowly, and before a second bowlful is lighted the pipe should cool off. This is to keep the wax as far up on the bowl as possible, and rapid smoking will overheat, driving the wax off and leaving the pipe dry and raw. A new pipe should never be smoked outdoors in extremely cold weather. Where the color has once existed it can be brought back by careful heating, which will drive the color out toward the surface.

NEW BOOKS, ETC.

AGE OF MENTAL VIRILITY. By W. A. Newman Dorland. New York: The Century Company, 1908. 16mo.; pp. 229. Price, \$1 net.

The widely-quoted statement of Dr. William Osler, "Take the sum of human achievement in action, in science, in art, in literature, subtract the work of the men above forty, and while we should miss great treasures, even priceless treasures, we would practically be where we are to-day. The effective, moving, vitalizing work of the world is done between the ages of twenty-five and forty," might be the text of this interesting little volume, part of which originally appeared in the Century. The pages show that Dr. Dorland has gone into his investigation earnestly and faithfully; and he has cast into interesting and valuable tabulated form the records of four hundred men famous in all lines of intellectual activity, upon which his conclusions are based. Dr. Dorland is convinced, and most readers will find his claims convincing, that the age of the acme of mental activity, as shown by these fairly chosen records of the famous men of modern

times, lies between forty and sixty, and that, provided health and optimism remain, the man of fifty can command success as readily as the man of thirty. It is a stimulating little book.

THE DESIGN, CONSTRUCTION, AND MAINTENANCE OF SEWAGE DISPOSAL WORKS. By Hugh P. Raikes, A. M. Inst. C. E., etc. New York: D. Van Nostrand Company, 1908. 8vo.; pp. 414; fully illustrated with photographs. Price, \$4.

Whereas the chemical and biological aspects of sewage disposal have been fairly fully dealt with by a number of more theoretical scientists there has been no recent publication dealing as fully with experiment and practice. This need Mr. Raikes's work seems to completely supply, being a record of fifteen years experience of the practical application of approved principles in the design and construction of sewage disposal works. Due credit is given for the initiation of experiments and the publication of valuable reports by the Massachusetts State Board of Health, but the book deals principally with sewage works in England, where the congestion of urban centers is so much greater and more frequent, the pollution of the much smaller streams and estuaries consequently greater, so that the need is more urgent and developments have been more rapid there. Particular methods of sewage disposal highly successful in one case will not necessarily prove equally satisfactory elsewhere owing to wide divergence of local conditions, but Mr. Raikes's experience as a consulting engineer has given him exceptional facilities for collecting, comparing, and coordinating the results of different methods and he presents his information not merely as a collection of clearly classified data valuable to the sanitary engineer desirous of comparing the results of the best practice, but in a manner interesting to the non-technical public.

FORGING. By John Lord Bacon. Chicago: American School of Correspondence, 1909. 112 pp.; 8vo., fully illustrated. Price, \$1.

Most of the publications of this school are practical condensations or simplifications, suited to the sometimes limited academic training of its students, of the subject matter of deeper or more complex text books, but we know of none of the contents of which less may be found elsewhere to take the place than the present work in forging. The author has obviously learned his subject in the workshop, but his position as instructor in forge-work at the Lewis Institute has given him a facility in explaining the reasons of what he knows to be the correct method which few expert smiths can possess. The book is full of simple practical instructions, illustrated by admirably clear diagrams for the performance of all simple and more complicated operations in blacksmithing as well as the making of a large number of tools—just the things that every amateur and many a professional smith wants to know but cannot find in large and more comprehensive works on metallurgy and mechanics—and it is brought completely up-to-date by descriptions of the operation of the latest labor-saving devices for mechanical forging and electric welding.

HANDBUCH ÜBER TRIEBWAGEN FÜR EISENBAHNEN. By C. Guillery. Berlin and Munich: R. Oldenbourg, 1908. 200 pp.; 93 ill.

This work consists of an exhaustive description of the construction and details of all the self-propelled passenger, inspection, and similar cars in use on the railways of the world, including electrical, gasoline, and steam cars. The necessity for and use of such cars being much greater in Europe, especially in the composition of multiple unit trains running at regular intervals all day into the suburbs of large cities and consisting of a single car at midday or of as many cars as may be required in the rush hours, it is not surprising to find the English and continental developments occupying most of the space, but the inspection and pay cars of the Union Pacific, Missouri Pacific, and C. & N. W. railways receive due attention and comparison. The author expresses no theoretical opinions and confines himself to a careful collection and comparison of methods and designs adopted and results obtained.

STEAM BOILERS. By C. H. Peabody and E. F. Miller. New York: John Wiley & Sons, 1908. 8vo.; 420 pp.; fully illustrated with diagrams and five folding plates. Second edition revised and enlarged. Price, \$4.

A considerable amount of new material and illustrations and a chapter on superheating added to the first edition of "Steam Boilers," bring the present work up to date, the latter chapter especially being all that was required for completely covering the subject. Though the book is primarily intended as a college text book, it contains much more that is useful to the boilermaker, fireman, or amateur, than the average text book, and, which is more to the point, extremely little that is not readily intelligible to them. There is little of the mathematics of thermodynamics or strength of materials, such calculations as are given being relative to practical boilermaking, simpler calculations of the stresses in members, and the strength of riveted joints, etc. The customary size, form, method of staying, and system of firing of boilers for various purposes are carefully described and clearly illus-

trated, tables of properly proportioned grate areas and heating surfaces have been compiled from the best practice, the methods and conditions for testing materials used, and the construction of boilers are briefly described and the results adequately discussed of the most recent investigation on the exact nature, causes, and effects of combustion, corrosion, and incrustation. Not the least valuable feature of a thoroughly useful book is a table of the composition and comparative heating value of all common American fuels.

PRECIOUS STONES. By W. Goodchild, M.B. Ch.B. With a Chapter on Artificial Stones by Robert Dykes. New York: D. Van Nostrand Company, 1908. 12mo.; pp. 309. Price, \$2.

After a general discussion of the subject, each form of gem is taken up in detail. Some of the illustrations are so good that it is hoped in subsequent editions their number may be very materially increased. There is an excellent glossary at the end of the book.

ALTERNATING CURRENTS SIMPLY EXPLAINED. By Alfred W. Marshall. London: Percival Marshall & Co. 18mo.; 82 pages. Price, 20 cents.

This is No. 33 of the "Model Engineer" Series, and gives a simple outline of the subject.

HYDRAULIC ENGINEERING. By F. E. Turneaure, C.E., and Adolph Black, C.E. Chicago: American School of Correspondence, 1909. 8vo.; 267 pp.; fully illustrated with diagrams and photographs. Price, \$3.

The last of the text books of the Chicago School begins the hydraulics and leads up to the latest developments of modern uses of water power. The necessary formulae for the measuring and calculation of rates of flow, power possibilities, pressure of, and strains generated by water under all conditions are given, and in accordance with the methods of the school, suitably to the general class of its students the development of each formula is carefully and simply shown. The second part of water power development does not seem to us comparably as good as the rest of the book. It is profusely illustrated with interesting photographs of large water-power works, with no very special reference to the text, and lettered diagrams from a number of sources are sometimes described in the text only by the names of the parts without reference to the principles involved or even to all the letters.

VALVE SETTING. By Hubert E. Collins. New York: Hill Publishing Company, 1908. 8vo.; 210 pp.; fully illustrated with photographs, diagrams, and tables. Price, \$2.

In this work Mr. Collins has collected a number of articles by himself and others which have appeared in "Power," but in their collection and arrangement has made a complete series which tells a continued story of the whole art of valve setting. The elementary principles of valve setting and the use of Zeuner diagrams are explained in a manner intelligible to the practical mechanic who may have no theoretical training. The tracing of the action of the valves in detail is more complete than usual and explained by diagrams throughout admirably clear, and the application of the quite general rules first given for plain slide-valve engines to automatic and other cut-off, Corliss and all well-known types of engines is carefully shown.

THE FRESHWATER AQUARIUM AND ITS INHABITANTS. By Otto Eggeling and Frederick Ehrenberg. New York: Henry Holt & Co., 1908. Large 12mo.; 352 pp. Price, \$2.

This volume gives clear and complete instructions to the amateur. It describes, and illustrates by some of the finest photographs ever taken from life, the great variety of plants, fishes, turtles, frogs, and insects that may be kept indoors in health and contentment. It furnishes information concerning food, treatment in health and sickness, methods of capture and handling, and what aquatic creatures will or will not live in peace together.

MECHANICAL DRAWING AND ELEMENTARY MACHINE DESIGN. By J. S. and D. Reid. New York: John Wiley & Sons, 1908. 8vo.; 440 pp.; fully illustrated with photographs and line drawings. Price, \$3.

The present issue constitutes a revised and enlarged edition of a former work under the same name, of which six thousand copies have been sold. The additions probably most valuable to the teacher—the principal purpose of the book being academic—are the assignment of a minimum time of execution to each problem such as would be allowed in a commercial drafting room and chapters on recent drafting room conventions as to the expression of details, bills of material, titles, etc., on working drawings. Beginning with simple instructions as to the use of instruments, lettering, and figuring, the student is taken through a complete course from the simplest to the most complex mechanism. The author professes only to give the elements of mechanic design, but if all the mechanical draftsmen knew as much about the object of the different parts of a machine—the slide valve for instance—as is given under "Engine Details," it would save much friction between designer, draftsman, and shop foreman.

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INDEX OF INVENTIONS

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