

off, so that from the most economical points of cut-off, which for an ordinary engine may be from 15 to 30 per cent of the stroke, a saving of from 25 to 50 per cent of the power value of the steam may be made.

(9333) A. C. A. writes: In regard to note 9316, A. F. S., page 164, I think a reason why lightning is so seldom seen in winter is because the condensation is never so rapid as in summer. His own observation shows that the harder the shower, the greater display of lightning. Now to my mind the electricity is produced in the cloud in the same manner as the rain-drop, by cohesion of electrical particles in the warm air that was carried up into the colder upper air, where the condensation takes place. Now, if the rain-drop was formed by cohesion of water particles until it becomes heavy enough to fall by gravitation to the earth, why not the other? There is rain without lightning, but never lightning without rain, thus showing that lightning is the result of rapid condensation, and rain not the result of lightning, as if the electric discharge started from the top of the cloud at the same time as a drop of water, it would reach the earth first, as it travels faster. The greatest display of lightning I have ever seen was in June, 1889, when nearly ten inches of rain fell from 1.40 to 2.20 P. M., forty minutes. This was a local shower, did not rain over two miles away from my point of observation in any direction, and I think I was in the center of it. There was no wind. The cloud did not move away, but just rained down until there was only a haze left. Even this remained full five hours after the rain ceased. This cloud could not have been electrified by induction from any other, for there was none other; clear sky all about. I observed the cloud at 11.30 A. M. directly overhead, and at 12.30 P. M. it had got quite black and was larger than when first noticed. At 1 o'clock my man and I went to work in a field, half a mile from house. I told the man we were going to get wet from that cloud overhead, and we did. There were about twenty flashes of lightning before any rain reached the ground, and they were close, not over ten seconds apart. When the rain began we started for shelter, but lost all sense of direction, as the rain was so thick we could not see, and but for the lightning flashes it would have been dark as night, but the flashes were almost continuous. The rain fell straight down, no wind to drive it. I do not take any stock in the idea of electric generation by friction between two clouds, nor by friction between cloud and air currents, because the clouds do not rub each other, any more than the exhaust steam from one locomotive rubs with that of another; they mingle and become one, the instant the two engines are side by side. The cloud goes with the current of air; is not steered like a ship, in some other direction. I have never seen any one who held the same idea as myself in regard to the formation of the electricity in the clouds, and I have asked many. Also have asked people to tell me as nearly as they could the size of a streak of lightning. I saw one strike a stump at least 30 inches in diameter, and the bright streak was broader than the stump. I was about 100 feet away, and looking at the stump at the time. Another time I saw one hit a barn a mile away, and the streak was as broad as a chimney on the house beside the barn, and the chimney was 26 inches wide. I could see the streak and chimney both at the same time; the barn showed fire in half a minute. I saw one streak hit my wood pile, and it looked as large as a 3/4-inch rod, and snapped like a gun cap, while there was a big crash on the opposite side of the house from me half a second later. This was a sliver from the main discharge, as I have frequently seen a flash divide into several small ones, and one when not over 100 feet from the ground, and the parts went away horizontally, while the main body was vertical. I have always watched the lightning whenever I could, and have seen some queer antics of it. A. The theory of our esteemed correspondent does not reach to the point of explaining the origin of the electricity of the atmosphere. It begins with electricity already present in the atmosphere. There is no difficulty in accounting for the rise of intensity of electrification in the thunder storm. The fact that the air is always in fair and stormy weather alike charged with electricity is more difficult to account for. We cannot follow him in the measure of the diameter of a flash of lightning. The great enlargement of a bright line of light in comparison with its real size by irradiation prevents the testimony of the eye from having much value in the case. The account of the cloudburst, as such heavy showers are commonly but erroneously called, is very interesting.

(9334) W. A. H. and others ask: Please tell me the difference between non-luminous radium and radium (luminous). I refer to the article in your paper of January 2, namely: "A Home-Made Spinharscope." Also, how can purple stains be removed from type-keys? A. Non-luminous radium is radium of so low a potency or purity as to give no light of itself, which can be perceived even after long effort in the deepest darkness. When a mixture of such radium and pulverized willenite is examined in the dark, it is found to be luminous. The willenite is caused to glow by the radium, which does not of itself glow. This is what is meant by the home-made spin-

tharscope. Prices quoted on chemicals a few weeks ago cannot be relied upon now, since these substances are rising very rapidly in market value. Purple stains can be removed from type-keys with alcohol if the stains are aniline.

NEW BOOKS, ETC.

CASSELL'S POPULAR SCIENCE. Vol. I. Edited by Alexander S. Galt. Illustrated. London, Paris, New York, and Melbourne. 1903. Square 8vo.

The book which lies before us comprises a series of articles well illustrated, and for the most part excellently written, describing in simple, terse language the scientific causes of the phenomena which play an important part in our daily lives. "How the Camera Works," "Meteors," "The Wizard Electricity," "A Piece of Sponge," "How and Why a Stone Falls," "Time Told by the Sun," "What is Radium?" are a few of the more suggestive titles of these articles. Since this is but the first volume, it is hardly fair to call attention to several topics which, in our opinion, should have been discussed, since they may find a place in subsequent volumes. Among these topics we may, however, be permitted to suggest those of "Bessemer Steel," "Aerial Navigation," "the Telephone," and the "Steam Engine." The subjects which are treated in this volume, however, cover a very wide range. They include astronomy, natural history, chemistry, electricity, anatomy, and geology. Each article, so far as we have been able to judge, gives a very comprehensive view of the particular subject which it discusses. The book shows what can be done in the way of treating science popularly and yet accurately.

GENERAL ZOOLOGY. Practical, Systematic, and Comparative. Being a Revision and Rearrangement of Orton's Comparative Zoology. New York: American Book Company. N. D. 12mo. Pp. 512. Price \$1.80.

The present textbook is suited to the needs of the general student, who wishes to learn the principal facts and theories of zoology, and thus to obtain a fairly comprehensive idea of the science. To this end it has seemed desirable to arrange a course of study, so that the student may gain by personal observation a concrete knowledge of the structure and activities of animals, and by so doing acquire some familiarity with the method of zoological investigation, so that he may also obtain a knowledge of the relationships of animals as expressed in an accepted scheme of classification. The laboratory exercises are well arranged, and the book is illustrated by 379 engravings, many of which are from life. We note particularly an excellent photograph of a beaver at work.

DIAGRAMMES ET SURFACES THERMODYNAMIQUES. Par J. W. Gibbs. Traduction de M. G. Roy, Chef des Travaux de Physique à l'Université de Dijon. Avec une introduction de M. B. Brunhes, Professor à l'Université de Clermont. Série Physico-Mathématique Scientia. Paris: C. Naud, éditeur. 1903. Pp. 100.

The influence exercised on contemporaneous chemistry by the ideas of Prof. Gibbs has constantly increased; and yet, even in its original English form, his work on thermodynamics remains comparatively inaccessible. The monograph before us is a French translation of two treatises on the geometrical representation of thermodynamic phenomena by means of diagrams and surfaces. The ideas of Prof. Gibbs have inspired many an interesting experiment for detecting the reactions which occur in thermic motors, by means of diagrams other than the exact figures of Clapeyron. The present work will doubtless find in France fully as welcome a reception as the original met with in English-speaking countries.

TABLES AND OTHER DATA FOR ENGINEERS AND BUSINESS MEN. Compiled by F. E. Ferris, D.S. Nashville, Tenn.: University Press. 24mo. Pp. 152. Price 50 cents.

An excellent little pocketbook adapted for the vest pocket. The tables are unusually well selected.

AMERICAN HANDBOOK OF THE BREWING, MALTING, AND AUXILIARY TRADES. A Book of Ready Reference for Persons Connected with the Brewing, Maltng, and Auxiliary Trades. Together with Tables, Formulas, Calculations, Bibliography, and Dictionary of Technical Terms. By Robert Wahl, Ph.D., and Max Henius, Ph.D. Second Edition. Chicago: W. C. Keener & Co. 1902. 16mo. Pp. 1,266. Price \$10.

If ever a reference book represented original work, this does. Its editors had no precedent whatever to guide them. To be sure, there are books on bottom fermentation brewing as practised on the continent of Europe; but these are in German. There are books on top fermentation brewing as practised in Great Britain. But even if all these books were available to the American brewer, they would not fulfill his requirements, for the reason that he employs neither of the two systems mentioned, exclusively. The American brewing industry is a thing apart. It was for the purpose of fulfilling American requirements that the present handbook was written. From an examination

of its contents we are convinced that the work is all that its authors desired it to be. They have been decidedly successful in preparing a book of ready reference which the brewing, malting, and auxiliary trades will find useful.

MANUAL OF SCREW CUTTING. By William Simpson. Wollaston, Mass.: Published by the Author. 18mo. Pp. 72. Price 40 cents.

This little manual deals with screws, screw cutting, and other mechanical powers. It will prove useful to all mechanics.

GRAPHIC STATICS. With Applications to Trusses, Beams, and Arches. By Jerome Sondericker, B.S., C.E. New York: John Wiley & Sons. 1903. 8vo. Pp. 137, three folding plates. Price \$2.

This book is the outgrowth of an extended experience in teaching graphic statics at the Massachusetts Institute of Technology. While it deals specifically with problems encountered in building construction, it should be found serviceable to engineers and engineering students generally. As a preparation the reader should have a knowledge of statics and the strength of materials, including beam stresses and deflections, as these subjects are commonly presented. The whole matter of graphic statics is a most important one in view of our modern system of building construction, and the book before us is a most thorough and excellent treatise on the subject.

WATER SUPPLY. A Student's Handbook on the Conditions Governing the Selection of Sources and the Distribution of Water. By Reginald E. Middleton. London: Charles Griffin & Co., Ltd. Philadelphia: J. B. Lippincott Company. 1903. 8vo. Pp. 168.

This is an excellent book for engineering students, as it sets forth in a compact manner the general scientific principles on which the subject is based, and serving as an introduction to larger and more technical works. Special prominence has, therefore, been given to such questions as the quality of the water, the interpretation of analyses, the stability of masonry dams, flow of water through the pipes, and the general application of mathematics to the subject. The book will prove of interest to those for whom it was written, even though some of the practice may be at variance with that of our own country. The formulas and diagrams are particularly to be commended.

THE SUGAR CANE IN EGYPT. By Walter Tiemann. Altrincham, near Manchester, England: International Sugar Journal. 1903. 16mo. Pp. 75, 16 plates. Price \$2.

The British occupation of Egypt, which dates from 1882, has been followed by remarkable progress, as the wonderful development of the agricultural interests bear witness. While the technical and mechanical conditions in the factories of the colonial sugar industry have made great strides in progress, the materia prima, the sugar cane itself, has in most countries remained subject to the old primitive methods of culture. The object of the present work is to outline the present methods, and to show how improvements can be made. The book contains some interesting field experiments.

THE LOCALIZATION OF FAULTS IN ELECTRIC LIGHT AND POWER MAINS. By F. Charles Raphael. London: The Electrician Printing and Publishing Company, Ltd. New York: D. Van Nostrand Company. N. D. 8vo. Pp. 205. Price \$3 net.

The subject of the localization of faults in electric mains is a most important one, and it appears to have been a rather neglected part of electrical engineering. Methods are constantly changing, and the very latest are described in this second and revised edition. The author justly says that since the publication of the first edition, considerable progress has been made in the art of cable making and cable laying, and increased practice and experience have led to a nearer approach to perfection. This book should be in the hands of all practical electrical engineers.

ACETYLENE GAS. How to Make and Use It. By Cyril N. Turner. London: Percival Marshall & Co. N. D. 18mo. Pp. 62. Price 20 cents.

The author states that the inventor of the process was either an American, Willson, or Henri Moissan, the celebrated French chemist. We have never heard Mr. Willson's claim to the invention disputed. He certainly has everything very tangible in the patent line. This little book will prove of interest to amateurs.

GENERAL DATA ON THOMSON RECORDING WATTMETERS. Schenectady, N. Y.: General Electric Company. 1903. 16mo. Pp. 217.

All who are interested in selling current will be glad of the present volume. It is filled with tables and diagrams.

THE TECHNOLOGY OF SUGAR. By John Geddes McIntosh. London: Scott, Greenwood & Co. New York: D. Van Nostrand Company. 1903. 8vo. Pp. 408. Price \$4.50.

The British and Colonial sugar industry has been on the wane. Obsolete machinery and methods contributed much to the decadence of

the industry. It has, therefore, been the aim of the author to show the most modern methods employed in this industry. There are a large number of books on sugar making, but there is ample room for the present book, which deals with the classification of sugar, beet sugar, cane sugar, sugar refining, and the selection of sugars. All who are in any way identified with the sugar industry should have a copy of this book.

THE HOME MECHANIC. By John Wright. New York: E. P. Dutton & Co. 1903. 8vo. Pp. 435. Price \$3.50 net.

The present work deals with carpentry, metal work, repairs, steam engines, and similar subjects. The practice is English, but for that reason it would prove more useful to American readers. Still, however, it is thoroughly practical, and will prove to be a very useful book in the amateur's library.

A QUARTERLY ISSUE OF SMITHSONIAN MISCELLANEOUS COLLECTIONS.

The Smithsonian Institution has commenced the publication of a Quarterly Issue of its Miscellaneous Collections, "designed chiefly to afford a medium for the early publication of the results of researches conducted by the Smithsonian Institution and its bureaus, and especially for the publication of reports of a preliminary nature." The first number of the Quarterly Issue is a double one, and contains seventeen articles, ranging in size from 1 page to 73 pages, in addition to interesting and timely notes on the activities of the Institution, its collections, etc., the whole accompanied with fifty-six plates and numerous text figures.

The scope of the journal is broad, the first issue embodying articles on Mammalogy, Astrophysics, Paleontology, Archeology, Geology, Ornithology, Ichthyology, Ethnology, etc., thus covering a considerable range of scientific subjects.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending March 15, 1904. AND EACH BEARING THAT DATE [See note at end of list about copies of these patents.]

Table listing inventions with patent numbers and dates. Includes items like Adding-machine, Air-braking systems, Air-heater, and various mechanical devices.

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