

tubes, pipes, canals, and rivers. The measurement of water-power, the dynamic pressure of flowing water, hydraulic motors, and naval hydro-mechanics are treated in separate chapters, the latter subjects being given less space than their importance would seem to warrant. The book is amply illustrated.

A General Formula for the Uniform Flow of Water in Rivers and other Channels. By E. GANUILLET and W. R. KUTTER. Tr., with additions, by Rudolph Hering and John C. Trautwine, Jun. New York, Wiley; London, E. and F. N. Spon. 8°. \$4.

To all engaged in the study of hydraulic problems, as well as to engineers who deal with the flow of water, this book will be of great service. It is the first published translation of the authors' chief work on the subject; though unauthorized translations from articles in German periodicals on this subject, by the same authors, were published in London several years ago. The first part of the work is devoted mainly to historical matter, and to a review of present knowledge of the laws governing the flow of water. A treatise on the new formula, showing its close agreement with a large number of experimental results obtained under differing conditions, makes up the second part. A supplement contains a more direct method of deriving the formula, for the benefit of those who desire mathematical brevity. A second general formula is also sketched, though not made prominent, as the first one is considered preferable.

The translators call attention to the fact that the authors have been erroneously regarded as holding their formula to be scientifically perfect, and covering both possible and impossible conditions of flow. They disclaim for them any such intention, insisting, that, as the formula is purely and essentially empirical, it must not be expected to apply to cases beyond the range of the data from which it has been derived. Its application is limited to cases where the slope of the water-surface can be ascertained with a degree of accuracy sufficient for the given case.

Nine appendices and five tables for practical use, which form part of the volume, contain much additional matter of value to those interested in the subject. In Appendices I. to IV. are given extracts from the works of Mr. Kutter upon the formula. Appendix V. contains directions for constructing the diagram used for a graphical solution of the formula. Appendix VI. is devoted to Kutter's modification of Bazin's general formula, useful for special purposes because of its simplicity. In Appendix VII. are given a number of formulæ and data concerning the relation between the mean and surface velocities in streams; the views of a number of investigators on velocities beyond which a scouring of the bed takes place in channels formed of different materials, are given in Appendix VIII.; and an account of Harlacher's method of ascertaining the discharge of rivers, in Appendix IX.

In Table I. are collected the hydraulic elements of over 1,200 gaugings, made in 300 different channels and pipes, under varying conditions of mean hydraulic depth and slope. In the original work the corresponding table is confined to 81 gaugings; so that this table is virtually the work of the translators, who believe it to be the most complete and comprehensive one yet published. The other tables contain the computed values of different elements of the formula, and the conversion of units of measure. An immense amount of labor has been bestowed upon this work by translators as well as authors.

AMONG THE PUBLISHERS.

THE delay in the publication of Sir Monier Williams's book on Buddhism has been caused by difficulties which have arisen in connection with the illustrations. A certain number of copies will be in Mr. Murray's hands at once. The work will be published in America by Macmillan & Co.

— Lee & Shepard have in press Samuel Adams Drake's "Decisive Events in American History, Burgoyne's Invasion of 1777, with an Outline Sketch of the American Invasion of Canada, 1775-76." It will be an admirable historic narrative, intended to be used as a text-book, or as a supplementary reader in schools, as well as for general reading. A valuable book, arranged especially for

young people, yet by no means unsuited to any time of life, entitled "Every-Day Business: Notes on its Practical Details," by M. S. Emery, will be published soon by this house. It gives careful instruction regarding many matters closely connected with business transactions. The book will be a valuable companion for young people, and its pages will contain instructions on business subjects, being designed for ready reference, and also as a text-book for use in schools.

— Macmillan & Co. will publish shortly "Natural Inheritance," by Francis Galton; a second series of Sir John Lubbock's "Pleasures of Life;" and A. R. Wallace's work on Darwinism.

— Harper & Brothers will publish this month the second volume of W. P. Frith's "Autobiography and Reminiscences," and a new and revised edition of the "Manual of Historical Literature," by President C. K. Adams of Cornell.

— Wolcott & West, Syracuse, N.Y., will shortly publish "Theories of Knowledge," by Rev. W. D. Wilson, D.D., Professor Emeritus in Cornell University.

— D. C. Heath & Co. have just ready, in their series of Guides for Science Teaching, "Hints for Teachers of Physiology," by Dr. Henry P. Bowditch of the Harvard Medical School. It will show how a teacher may supplement his text-book instruction by simple observations and by experiments on living bodies or on organic material.

— Dodd, Mead, & Co. have in preparation the letters and diaries of Emin Pacha, which, besides containing matter of interest as biography, relate largely to the author's scientific investigations. The volume has for an introduction a biographical sketch of Emin, with two portraits, one of them recent. They have also in press Bayard Tuckerman's biography of Lafayette, to be issued in two volumes.

— T. Y. Crowell & Co., in connection with the announcement of a cheaper cloth and a paper edition of Tolstoi's great work, "Anna Karénina," translated by Nathan Haskell Dole, state that Mr. Dole's translations have been received with great favor by the Tolstoi family. In a recent letter to Mr. Dole, the Countess Tatiana Lyovna Tolstoi says, "My father has read your translations, and is much pleased with them. They are to his mind very carefully and accurately done."

— Ulric Blickensderfer, Chicago, Ill., has just issued "Blackstone's Elements of Law, etc.," with analytical charts, tables, and legal definitions, arranged and displayed by a systematic and attractive method. Mr. Blickensderfer is an attorney-at-law, and claims that these charts will be found time-saving helps to his colleagues. Sample copies may be had on application. He also has published a chart of the "Historical and Genealogical Descent of the Crown of England," which by an ingenious arrangement of types brings the history of England on one side of a sheet of paper six inches wide and eighteen inches long, which folds up like an ordinary legal document. The succession covers from A.D. 827 to the ascent of Queen Victoria in 1837.

— The article on "Climbing Mount St. Elias," to appear in *Scribner's* for April, is the work of an American member of the Alpine Club, Mr. William Williams, who, with two English fellow-members, succeeded, during the summer of 1888, in reaching the highest point ever attained on that mountain, — about 11,400 feet. Charles Francis Adams, president of the Union Pacific, will contribute a railroad article to the number, on the "Prevention of Strikes." He proposes a plan which, if carried out, would be almost a revolution in the relations of railroad employers and employees. William H. Rideing, who made a careful inspection of the great Clyde ship-yards during the past summer, will give a description of them, showing the various stages in "The Building of an Ocean Greyhound."

— Ticknor & Co.'s March books include "Dragon's Teeth," translated from the Portuguese of Eça de Queiros, by Mrs. Mary J. Serrano; and in their Paper Series, "Forced Acquaintances" (No. 53), by Edith Robinson, and "Under Green Apple Boughs" (No. 54), by Helen Campbell.

— An important undertaking is promised by the Leonard Scott Publication Company, in the American edition of the *Nineteenth Century* for March, in the shape of an American supplement containing a series of papers by some of the foremost of our educators on the relation of examinations to education. This subject has attracted considerable attention in England of late, having been started by the "Signed Protest" in the November *Nineteenth Century*. The present papers, presenting the subject from an American standpoint, will be by ex-President McCosh of Princeton, Presidents Adams of Cornell, Angell of the University of Michigan, Carter of Williams, Eaton of Marietta, Gilman of Johns Hopkins, Magill of Swarthmore, Pepper of Colby, Rhoades of Bryn Mawr, and Sharpless of Haverford; Chancellors John Hall of the University of the City of New York, and Sims of Syracuse; Professors Cook of the University of California, Harper of Yale, Harris of Concord, Hunt of Princeton, Rogers of Haverford, and David Swing of Chicago; Rev. Dr. Crosby, Hamilton W. Mabie, Esq., and Barr Ferree, Esq., of New York. Dr. William H. Burnham will also contribute, and Professor Thompson of the University of Pennsylvania. The symposium promises to form a most important contribution to the discussion of a very difficult question of educational methods. The March number of the *Nineteenth Century*, in addition to the papers on education and examination in the American supplement, will contain an article by Mrs. Humphry Ward, the author of "Robert Elsmere," on the new reformation as viewed from her own standpoint. Professor Huxley writes on "The Value of a Witness to the Miraculous;" and the review contains criticisms on his paper on agnosticism in the February number, by the Rev. Dr. Wall, principal of King's College, and Dr. Hagee, bishop of Peterborough.

— The *Popular Science Monthly* for April will contain a scientific explanation of the power to ensnare the human mind possessed by the leading delusion of the present day. The article is by Professor Joseph Jastrow, and is entitled "The Psychology of Spiritualism." It contains accounts of the manifestations by the Fox sisters, Dr. Slade, Englington, and other mediums, all of which have been proved to be "gross intentional fraud throughout." Professor Huxley has written a racy reply to certain criticisms of agnosticism made at the Church Congress of 1888, and to a recent deliverance by Frederic Harrison, who attempts to prophesy on this subject. The article contains an account of how the name "agnostic" originated, and explains why agnosticism, as Professor

Huxley conceives it, cannot have a creed. It will also be published in the April *Popular Science Monthly*, as will an article on "The Chemical Elements," by Professor Josiah P. Cooke of Harvard, telling the story of the changing beliefs about what substances are made of, from the time when earth, water, air, and fire were thought to be the elements of all things, down to the present day, with its list of over seventy simple substances, and when the idea is gaining ground that perhaps there is only one kind of matter, after all.

— The paper in the *Political Science Quarterly* for March that will attract most attention is that by Mr. H. O. Arnold-Foster, on "Irish Secession." It gives what is probably the best presentation of the Unionist argument that has appeared in this country, and should be carefully read by every one desirous of understanding the question at issue. The author takes up the home-rule arguments one by one, and gives a conclusive answer to some, at least, of them; while at the same time he presents very forcible considerations to show that an Irish parliament is equally undesirable for England and for Ireland. Another article of interest is that by A. Gauvain, on "The Crisis in France." M. Gauvain is deeply impressed with the low character of French political life, with the feebleness of the senate and the fickleness of the Chamber of Deputies, and with the instability of the administration; and he evidently views the future with some alarm. He affirms, as other observers have done, that there is no statesman of ability in the country, and that the republicans are drifting towards radicalism. Meanwhile the monarchists are gathering strength, and, with the aid of the Boulangists, stand a good chance of carrying the coming elections. The *Quarterly* has still another article on foreign affairs, that by Professor Gustav Cohn, on "Income and Property Taxes in Switzerland." Injustice has often been done in all countries to the poorer classes by raising too large a portion of the national revenue by indirect taxation; and Professor Cohn here shows how the Swiss have endeavored to remedy this by laying a large share of the burden on property and income. Mr. H. L. Osgood has a paper on "Scientific Anarchism," in which he traces back the doctrine to Proudhon as its real originator, and then shows what changes it has undergone at the hands of the "Individualistic Anarchists" and the "Internationals," concluding with a brief but decisive argument against the whole scheme. Besides the various essays, the *Quarterly* has an extended review of Bryce's "American Commonwealth," by Professor Woodrow Wilson.

READY MONDAY, MARCH 11.

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BELFORD, CLARKE & CO., Publishers, New York, Chicago, and San Francisco.

— Houghton, Mifflin, & Co. have just issued a new life-size portrait of Dr. Holmes, which is even better than the earlier one.

— Charles Scribner's Sons have in preparation a handsome popular library edition, in four 12mo volumes, of Bourrienne's well-known "Memoirs of Napoleon," a standard work of which many hundreds of imported sets have been sold every year. This new edition will be an exact reprint of the latest English edition, and will contain the thirty-eight portraits of the original, together with all the other features that give distinction to the work. The price will be sufficiently low to bring these volumes within reach of all would-be readers.

— G. P. Putnam's Sons have in press, as their own commemoration of the centennial anniversary of the inauguration of Washington, a unique limited edition of Irving's "Life of Washington," — a work for which Bryant predicted "a deathless renown." The set will be issued in five volumes, handsomely printed in large quarto form, and will contain 200 illustrations, comprising 130 steel plates and 70 woodcuts printed on India paper and inlaid in the text. The plates include portraits of all the noteworthy generals and statesmen of the American Revolution. But 300 sets will be issued, and the type will be distributed as printed from. The price to subscribers has been fixed at \$50.

— Mrs. Stowe has been able to revise the biography of herself, written by the Rev. Charles Stowe and Mr. Kirk Munroe. It will be published at an early day by Houghton, Mifflin, & Co.

— Baron Grancy will shortly issue, in Paris, a volume on American customs. It is to be in the shape of a novel, to be entitled "A French Ranch in Dakota," and will treat wholly of Dakotan affairs. The author, according to a despatch to the *New York World*, is the original founder of the Fleur de Lys settlement of French horse-breeders, whose life in Dakota this book is meant to describe.

LETTERS TO THE EDITOR.

*Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith. The editor will be glad to publish any queries consonant with the character of the journal. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

An Acoustic Mill.

WHEN a vibrating tuning-fork is brought near to a light body, like a pith-ball or a small piece of paper, the latter moves towards the fork as if attracted by it. This phenomenon was observed by Guyot in 1832, and was rediscovered by Guthrie in 1870. It has been supposed by some that gravitation could be explained by the vibratory motions, such as atoms and molecules are known to have; but it does not appear that gravitation sustains any quantitative relation whatever to the temperature of a body, such as would be the case if molecular vibration was the cause of it. The observed phenomenon may be accounted for thus. When the prong of the tuning-fork beats outwards, the air is driven before it and is condensed, while behind it there is a partial vacuum. If the velocity of the prong was greater than that of a particle of air in its free path movement, then there would be a complete vacuum behind the prong. As the latter beats to and fro, it is obvious that the density of the air adjacent to the prong must be less than if the latter was at rest, the difference depending upon the relative velocity of the prong to that of the molecules of air in their free path movements. As the pressure of the air varies as its density, it follows that the air-pressure is less in the neighborhood of the vibrating fork than at a distance from it. Hence, if an object is near to the vibrating fork, the air-pressure will be greater on the remote side, and will push the object towards the source of vibrations.

Numerous devices have been invented by Doornak and Strop to illustrate this principle. Most of them are too complicated and costly to be had by more than a few. The following is simple enough, and can be available for any one having a Chladni plate.

Cut a disk three or four inches in diameter out of letter-paper, and then cut eight or ten radial slits from the circumference halfway to the centre, and turn up one edge of each sector so as to form a kind of paper windmill. Suspend this by a thread from

its centre, and see that it hangs horizontally, which may be done by fixing a bit of beeswax to the middle of the disk, and have the thread go through it. Adjustment will be easy and quick by slight pressure upon the wax, changing the relative position of the thread.

This disk may now be brought over a properly mounted Chladni plate near the edge, and as close to it as possible, while allowing it free space for rotation without touching the plate. If the plate be made to vibrate vigorously, the disk will begin to spin, turning in the same direction as if a current of air were blowing upon it from above. The lower components of the sound of the plate will be necessary to make so large a disk as the above to spin, as the higher ones have too many nodes. The fundamental is the best; and, if it can be produced with an amplitude of an eighth of an inch or more, the disk will go round two or three times a second. Of course, the bow should be drawn across the edge opposite to the disk, in order to prevent a node being formed underneath it, and also to avoid the disturbance from movements of the air. I have found that the fundamental vibration of the Chladni plate can more easily be produced by bowing it with a round wooden rod well rosined, than with the ordinary violin-bow. In this experiment the pressure of the air is lessened between the nodes at the surface of the disk, and the space thus affected extends to the height of an inch or two. It is also evident that the light dust that moves to the place of greatest disturbance is moved there by the difference in air-pressure instead of by little whirlwinds caused by the vibrations, as it was explained by Faraday.

A. E. DOLBEAR.

College Hill, Mass., March 5.

Note on the Robinson Anemometer Constant.

THIS is the factor by which the velocity of the central point of the cups is reduced to the actual velocity of wind. When Dr. Robinson first invented his anemometer in 1860, he determined the value of this factor, for all patterns of the instrument, to be exactly 3, and this has been in use for all patterns ever since. But by the experiments of Dr. Dohrandt at St. Petersburg in 1878, this constant, for the Kew pattern at least, was found to be much less, which led Dr. Robinson to repeat his experiments; and the result was a confirmation of Dr. Dohrandt's result, and showed that his own factor is erroneous. Experiments at the Deutsche Seewarte in Hamburg have also given a factor much smaller.

The labor of the wind-force committee of the Royal Meteorological Society, referred to in my previous note (*Science*, xiii. p. 171), has been directed mostly toward determining this factor for several anemometers of different patterns, which are as follows:—

	Arms.	Diam. of Cups.
	Inches.	Inches.
Kew Standard	24.00	9.0
A 19	5.80	4.0
A 21	6.75	2.5

These were placed near the end of a long arm of a whirling apparatus, moved by a small steam-engine with varying velocities. The number of turns of the anemometer compared with that of the whirling apparatus during any given time of uniform velocity, the relations between the length of the arm of the anemometer and the distance on the arm from the centre of whirling being known, gave the ratio between the velocities, and so the value of the constant, which is found to be about the same for all, except very small, velocities.

The average of 58 experiments with the Kew Standard gives 2.15 instead of 3 for the value of this constant. From 51 experiments made with A 19, the value 2.51 was obtained, while the average of 49 experiments with A 21 gave 2.96, which is very nearly that determined by Dr. Robinson, and now in use. It is seen, therefore, that while the Robinson factor is very erroneous for the Kew pattern, and also for A 19, but especially the former, it is very nearly