(9370) G. S. T. asks: 1. By what rule would you determine the size boiler to build to supply a cylinder of a given size? A. The cylinder size is usually made to represent a certain horse-power at some assumed pressure, cut-off, and speed of the piston, and for each horse-power an allowance of 12 square feet of heating surface and a half square foot of grate surface must be provided for in the boiler. 2. What chemical composition is it that when it comes in contact with water immediately burns and bubbles up like lava on the surface? A. Any dry mixture of an acid and an alkali, as for example tartaric acid and carbonate of soda, will make a rapid effervescence when water is dropped on the dry mixture. 3. What is the meaning of the word "phase"? I have several electrical volumes and sets, but one or two of them explain it in such a manner as to make it incomprehensible to a person not very far up in electrical knowledge. Really what I want to know is the difference between a two and a three-phase machine, and how you tell the difference? A. Phase is a current impulse which may be multiphase by alternating two, three, or more times in a multipolar generator of four, six or more poles for each revolution of the armature. The difference may be known by the different direction of the pole winding. See two and three phase system illustrated in SCIENTIFIC AMERICAN SUPPLEMENT Nos. 822, 831, 10 cents each mailed.

(9371) F. A. M. says: We are setting a new steam boiler 60 x 16 inches, and in bringing up the question of water supply, our local steam engineers all contend that with a given amount of fuel more steam can be generated by supplying the boiler with water from a nearby spring by means of an injector, or inspirator which will heat the water before entering the boiler, than can be had if we use the local gravity water system, which has sufficient pressure to force the water into the boiler directly against the steam pressure, but which would be cold as it entered. The writer contends in favor of the gravity system, inasmuch as the effort of lifting the spring water will be overcome. Will you please advise us as to the correctness or advisability of both methods? A. We advise the use of the gravity system to feed your boiler, if it can be trusted for full pressure at all times, but do not neglect other means of feeding your boiler to guard against accidents. The same heat power must be used from the boiler whether the water is fed cold or is heated by the injector. If the gravity supply can be supplemented by waste heat of the exhaust steam or chimney heat, the greatest economy may be obtained. If cold-water feed is adopted, the water should enter the boiler above the tubes and be distributed through a perforated pipe for best effect.

(9372) J. P. M. asks: With a heating apparatus for a residence, that seems to burn either anthracite or bituminous coal with equal facility, what will be the comparative heating value of the two of average market quality, weight for weight? A. The total heat units of combustion of the good marketable coals of the United States scarcely varies 1,000 heat units from the mean of 14,000 heat units per pound of the various kinds, as semi-bituminous, bituminous, and the various grades of anthracite. The available heat per pound of fuel depends much upon the method of firing and the kind of furnace used. In furnaces for heating dwellings, far the larger number are designed for anthracite coal and are not suitable or economical with bituminous coal. The excessive waste of smoke fouls the heating surfaces and the heat is lost through the chimney. In furnaces with underfeed appliances the economy in heating gives bituminous coal an equal quality with anthracite; but the care is somewhat greater.

(9373) E. H. A. writes: I was much interested in what you had to say about the reason for water hammer (Query 9329, page 239 of SCIENTIFIC AMERICAN for March 19, 1904). We are troubled with musical water pipes, always in the cold-water pipes. Will you kindly give the cause of it? Can it be stopped permanently? Turning on the cold water and then shutting it off stops it for the time being. Sometimes it stops for a long time. A. We have little experience with musical water pipes, except from the tremor of loose valves when drawing water, which may be heard all over the house when any bibb is running with a loose valve disk. The noise from the kitchen boiler by the condensation of the steam from the water back is quickly stopped by opening the hot-water bibb and drawing off a quantity of hot water. This noise is also heard all over the house by the reverberation of the pipe system. Sometimes leakage through the rubber disks of compression valves makes a musical sound by the vibration of the rubber lip of the valve disk. Its location is easily traced, when a new disk may be inserted. Your plumber should know all about this trouble and its correction.

(9374) S. G. A. asks: Would thank you to inform me in the next issue of your paper, whether the buoyant effect of water at the surface is greater in deep water than in shallow; that is, will deep water carry a greater weight in a boat than shallow water will? A. The buoyant effect of water on a boat is the weight of water the boat displaces. It is therefore not greater at one part of the sea than at another part. The depth of the water has no effect on buoyancy.

(9375) J. A. M. says: In rounding a curve on a railroad one rail is longer than the other; the wheels on a car that are on the longest rail must travel farther than the wheels on the short rail. As axle and wheel are one piece, both wheels must make the same number of revolutions. Please explain how this is done. A. It is very evident that with fixed car wheels on the axle, a considerable slipping must be done in rounding a curve. The taper tread on the wheels was designed to help the curve traverse by riding the high side of the tread on the outer rail and the low or smaller part of the tread on the inner rail from the centrifugal force of rounding the curve. This but slightly fills the requirement, and slipping of the wheels does the rest. By the centrifugal force of rounding a curve, the greatest pressure or load is thrown on the outer wheels and the inner ones do most of the slipping forward. By close observation of the rails on curves, it may be plainly seen that the wheels slip on both the rails, as shown by the wear.

(9376) M. G. D. writes: In a discussion I contended that steam from a boiler at say 100 pounds pressure, allowed to expand to atmospheric pressure in a system of heated tubes, will issue from this heating coil at or above the temperature of the steam in the boiler if the tubes are kept hot enough; in other words, that high-temperature steam can be obtained without high pressure by an arrangement as above described. The other party says that under no condition can steam be obtained above 212 deg. F. without increasing the pressure above that of the atmosphere. A. Steam circulating in heating coils cannot be kept as hot as the steam in the boiler without outside heat to counteract radiation; but by expansion to atmospheric pressure in a coil without receiving heat, pressure and temperature will both fall and temperature of the exhaust will be 212 deg. F. By superheating or adding heat in the coil, any desired temperature, even far above that of the boiler, may be had in the exhaust and far above the temperature due to the pressure in the pipe of the coil. The general principles of the use of superheated steam are discussed and illustrated in SCIENTIFIC AMERICAN SUPPLEMENT Nos. 1068 and 1069. We think that the articles on superheated steam in SCIENTIFIC AMERICAN No. 24, vol. 74, also SUPPLEMENT Nos. 1387 and 1408, would also be of interest to you; price 10 cents each mailed.

(9377) S. T. Co. writes: We note in a recent issue that you advise the use of alcohol to remove ink spots from typewriter keys. Allow us to state from experience that this is not effective, because as celluloid keys are referred to, the alcohol (particularly if wood alcohol) will dissolve the celluloid and ruin the appearance of the keys. Javelle water is the best substance to use.

NEW BOOKS, ETC.

THE FACTORY MANAGER AND ACCOUNTANT. Some Examples of the Latest American Factory Practice. Collected and Arranged by Horace Lucian Arnold. New York: The Engineering Magazine. 1903. 8vo. Pp. 431. Price $5.

The author deals with this subject in an admirable manner, and the forms or blanks which are illustrated would certainly tend to give the manager of any large plant most valuable points. The book is made up of several complete factory systems, both the costing and commercial blanks being accurately reproduced, each one having the actual size in inches given, together with its color and the material on which it is printed. The reader is thus enabled to reproduce any form and apply it in his own practice, and he may also trace its action and effects in relation to the entire accounting of the factory, and can compare his own practice with that of other managers, cost-keepers, or accountants. It is certainly to the credit of the various companies represented that they have allowed their forms to be reproduced. It is an excellent book.

SCHUTZ DER EISENBAHNEN GEGEN SCHNEEVERWEHUNGEN UND LAWINEN. Von E. Schubert. With 103 illustrations and an atlas of 38 plates. Leipzig: Wilhelm Engelmann. 1903. 8vo. Pp. 62. Price $1.25.

This monograph forms part of Schubert and Fink's "Handbook of Engineering Sciences," in which it appeared as the twelfth chapter under the title "Means for Securing the Safety of Railway Traffic." Beginning with the discussion of snowstorms, the author treats of snowdrifts and their effect upon railways. As a protection against snowdrifts he recommends various constructions, which consist either in modifications of the roadbed itself, or in cutting off the wind. A similar treatment is accorded to the subject of snow avalanches. One of the most striking parts of the book is an excellent series of illustrations, which clearly show how snowdrifts and avalanches originate, and how their course may be checked by walls, dams, fences, and the like.

FIRE AND EXPLOSION RISKS. By Dr. Von Schwartz. Translated from the German edition by Charles T. C. Salter. Philadelphia: J. B. Lippincott Company. 1904. 8vo. Pp. 357. Price, $5.

This work forms a complete handbook for fire insurance officials, members of the fire department, lawyers, factory inspectors and owners; in fact, anyone interested in fire risks and dangers and their prevention.

The book is divided into eleven parts, which treat of such subjects as the following: Fires and explosions of a general character; fireproofing; dangers caused by sources of light and heat, gases, agricultural products, various industrial materials, lighting and lighting materials; dangers in various establishments, such as drug stores, breweries, soap and sugar works, and the like; and danger from petroleum, oils, ethers, and other liquids, as well as from metals, oxides, acids, and salts. In completion of the general thoroughness with which the subject is treated, the book contains an appendix of eight tables giving the boiling, flashing, and fusing points of various liquids and substances, the working temperatures permissible in the various trades, together with an explanation of some of the principal processes and their risks, and dangerous substances that are liable to ignite and explode spontaneously, with their reactions. As a reference work for those having to do with fires and fire risks, the value of this volume is unquestionable.

ELEMENTS OF THEORETICAL MECHANICS. By Alexander Ziwet. New York: The Macmillan Company. 1904. 8vo. Pp. 494. Price, $5.

This work is a revised edition of "An Elementary Treatise on Theoretical Mechanics," which was published by Prof. Ziwet ten years ago. It contains practically the whole course in theoretical mechanics as taught at the University of Michigan; but, on account of the time limit of the course and the mathematical capabilities of the usual second-year student, the subject matter is confined largely to problems in one and two dimensions. Thus, although such problems as the motion of a rigid body around a fixed point had to be omitted, rectilinear motion and rotation about fixed axis have been more thoroughly treated than heretofore, and some illustrations of plane motion have been given. Fundamental subjects, such as simple and compound harmonic motion, motion under central forces, and the theory of moments of inertia, are treated very thoroughly. The book is theoretical in character, though numerous practical illustrations of the theories discussed are given. It is intended for use chiefly as a textbook, and the author's expressed desire is that it may tend to stimulate the study of theoretical mechanics in engineering schools.

ANTHRACITE COAL COMMUNITIES. By Peter Roberts, PhD. New York: The Macmillan Company. 1904. 8vo. Pp. 387. Price, $3.50.

This new work on the anthracite coal fields by Mr. Roberts will be welcomed by all who are familiar with his previous volume on "The Anthracite Coal Industry," published in 1901. While the facts relative to the economic life of the people of these regions were given in the former work, little or nothing was said concerning the social and moral life. In the present volume this is thoroughly dealt with; and the author, besides having a personal acquaintance with the people he describes, has had the benefit of much valuable testimony given before the Coal Strike Commission a year ago. The home life, different ways of living, the intellectual and religious life, the schools, the saloons, and the political system of these hard-working people are graphically and interestingly portrayed, while some 25 illustrations from photographs give one a good idea of the appearance of the people and of their homes.

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