

purely theoretical formulae. This promise is of course not rigorously carried out, as we find the calculus is used throughout, while the formulae involve elementary algebraic knowledge on the part of the users. We are very glad indeed to see such a book produced, tending to remove the atmosphere of mystery from calculations.

CONTINUOUS CURRENT DYNAMOS AND MOTORS. Their theory, design, and testing, with sections on indicator diagrams, properties of saturated steam, belting calculations, etc. An elementary treatise for students. By Frank P. Cox, B.S. New York: The W. J. Johnston Company, Ltd. 1893. Pp. 271. Price \$2.

The specialization of dynamo work is illustrated in this contribution, where all the calculations are kept down to the practical ones required in constructing the machines. It will be found a most excellent contribution to the subject, and one in line with the work reviewed in the preceding notice.

PRIMER OF PHILOSOPHY. By Dr. Paul Carus. Chicago: The Open Court Publishing Company. 1893. Pp. vi, 232. Price \$1.

Philosophy in this book is treated of from the standpoint of experience. Experience by the writer is made the sole base of philosophy. The methods of philosophy are said to be derived from experience and the problems of life are to be solved by the methods of philosophy. This is the abstract of the scheme of the work.

PRACTICAL DYNAMO BUILDING, WITH DETAIL DRAWINGS AND INSTRUCTIONS FOR WINDING. By L. C. Atwood. St. Louis: Nixon-Jones Printing Company. 1893. Pp. vi, 143. No index. Price \$3.

The title of this book exactly describes its contents. It consists of a description of a number of dynamos, the details of construction of each one being given without any attempt to theorize. At the end of the book are given appendices of tables, underwriters' rules and regulations for wiring, and a chapter on how the electromagnet is produced, another on the history of electricity and the electric light, and one on the incandescent system, and a final one on the economy. The lack of an index is a bad feature.

Any of the above books may be purchased through this office. Send for new book catalogue just published. MUNN & CO., 361 Broadway, New York.

SCIENTIFIC AMERICAN BUILDING EDITION.

JANUARY, 1894.—(No. 99.)

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1. Elegant plate in colors showing a suburban dwelling at Bridgeport, Conn., recently erected for L. D. Plumb, Esq., at a cost of \$4,500 complete. Floor plans and perspective elevation. An excellent design. Mr. C. T. Beardsley, architect, Bridgeport, Conn.
2. Plate in colors showing the residence of Thomas C. Wordin, Esq., at Bridgeport, Conn. Two perspective views and floor plans. Cost \$3,600 complete. Mr. Joseph W. Northrop, architect, Bridgeport, Conn.
3. A colonial dwelling erected for Philip Lucas, Esq., at Mount Vernon, N. Y. Perspective and floor plans. An excellent design. Cost \$7,000 complete. Mr. Louis H. Lucas, architect, Mount Vernon, N. Y.
4. A cottage at Cranford, N. J., erected at a cost of \$5,000. Floor plans, perspective view, etc.
5. Engravings and floor plans of a suburban residence erected at Brookline, Mass. Mr. F. L. Rodgers, architect, Boston, Mass. A very attractive design.
6. A dwelling recently erected at Elizabeth, N. J., at a cost of \$5,500. Floor plans and perspective elevation. Mr. J. E. Baker, architect, Newark, N. J.
7. A new frame schoolhouse at Elizabeth, N. J., erected at a cost of \$16,000 complete. Elevation and floor plans. Messrs. Charlock & Howard, Elizabeth, N. J., architects.
8. A dwelling recently erected for W. E. Clow, Esq., at Buena Park, Chicago, Ill. A picturesque design. Two perspective views and floor plans. Mr. Greg Vigeant, architect, Chicago.
9. A town library of moderate cost at Colchester, England. Perspective view and plans.
10. A house at Cambridge, Mass., erected at a cost of \$6,000. Mr. J. T. Kelly, Boston, architect. Perspective and floor plans.
11. Restoration of the Pantheon at Rome. Half page engraving.
12. Miscellaneous Contents: A rival to oak.—Seaside painting.—Miscellaneous weights.—Water tanks.—Improve your property.—Cement.—Peruvian ruins.—Ornamental iron and brass work, illustrated.—Facts for builders.—The Goetz box anchors, post caps, and hangers, illustrated.—Improved gasgrate, illustrated.—Improved drawing instruments, illustrated.—Climax gas machine, illustrated.—Improved square chisel, mortiser, and borer, illustrated.—Adamant brush finish.—Patent stair gauge, illustrated.

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question. **Inquiries** not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(5666) M. T. asks: 1. What is the best way to leave boilers that have been using salt water and now are not to be used for several months? A. If there is any fresh water to be had, the boiler should be thoroughly cleaned out and washed out with freshwater, then filled with fresh water and steam got up, a few pounds pressure, and air blown out at the safety valve; the boiler pumped full of water while steam is on, allowing the safety valve to be blown enough to get rid of all air inside of the boiler; then close all valves and cocks on the boiler to keep out air. The airless water will preserve the inside of the boiler from rust. The flues and shell should be thoroughly cleaned. 2. I have two tandem compound engines, working with 100 pounds steam pressure. I would like to know if it would not be more economical to run the pressure down when I have only half load, i. e., would I not get better work from the low pressure cylinder if the high pressure were to carry the steam longer and exhaust into the receiver as a higher pressure, thereby making the low pressure piston do more work? A. You have only to set the cut-off to suit the work required; or, if the load is variable during the day or night, throttling by the steam valve is preferable. This may vary the relative work of each cylinder; but as the vacuum may be constant under the varying conditions, there can be no material loss of steam, whether less pressure is carried in the boiler or the cut-off carried back; but probably both are advisable in our uncertainty as to the present position of the cut-off. 3. Why is zinc used in boilers using salt water, and what is its action? Is it a benefit or not? Is there any substitute? A. Zinc is used for removing scale by its galvanic action, its proper connection being by copper wires with the stays at the top of the boiler. 4. If I were to run a 100 horse power engine with 100 pounds steam, and only have 25 horse power of work, would not the low pressure piston form a vacuum on the steam side, owing to the other cylinder cutting off so early with the high pressure, thus making the low work against the high pressure cylinder? A. There should be no vacuum in the low pressure cylinder until the cut-off has been reduced to one-tenth and under, and then only a partial vacuum at end of the stroke. There is no harm in this practice for a tandem compounded engine. 5. Please state at what pressures I should carry the steam to get the best results. Both the engines are working with about 26 inch vacuum. A. The most economical pressure for running a tandem compound condensing engine cannot be stated without a knowledge of its proportions; but assume that 60 pounds pressure and a proper change in the cut-off will be your best practice. 6. How much economy is there in a slow speed Corliss engine over the high speed class? A. The economy of slow or high speed is mostly in the wear of the engines and their size. For engines of 100 horse power, 100 revolutions per minute is the best speed.

(5667) J. A. asks: 1. Can I enlarge the small motor described in SUPPLEMENT, No. 641, to one-half horse power? A. You can, but it is better to follow SUPPLEMENT, No. 844. 2. How can I make the one described in No. 600 small enough for one-half horsepower? A. As the size given is a little less than a horse power, it will answer probably as it is. Or you may reduce its dimensions in the ratio of the sixth roots of 1:2. (See answer 5, below.) 3. How many storage cells will it take to run the last named motor as one-half horse power? A. Twenty-five. 4. Can I charge the same with gravity batteries? A. Yes, if you allow enough cells of gravity battery. A series of ten gravity cells will charge four storage cells, but very slowly. The series of gravity cells may be parallelized to increase the rapidity of charging. 5. If not, can you tell me where I can get directions for making one-half horse power motor? A. A very slight reduction in size (about 98:99, or $\frac{1}{50}$ the dimensions of No. 600) will be right. The size of wire and number of turns depends on the voltage to be employed. Calculate as if for a dynamo. Calculations will be found in Sloane's "Arithmetic of Electricity," \$1 by mail.

(5668) G. R. C. asks: 1. Does combustion in common air vary in rapidity in proportion to pressure; i. e., for instance, would a fire burn half as fast in a one-half vacuum or four times as fast in compressed air, at a pressure of 60 pounds per square inch, as it would at common pressure of 15 pounds per inch? A. No exact experiments have been made determining any ratio between the rate of combustion and the density of the air fed to any kind of fire. The result will vary with the combustible; but the combustion increases faster than the pressure with many combustibles; that is, within certain limits. 2. Please to inform me at what temperature or pressure hydrogen gas is liquefied. Is oxygen liquefied at same temperature? Also at temperature of 212° F., what pressure is required to liquefy CO₂? A. Hydrogen is known to have been liquefied. Oxygen has been liquefied by several chemists, among them Picot, Cailletet and Hautefeuille, Wroblewsky, Olszewski, and Dewar. Olszewski determined the boiling point, which is close to that at which it begins to liquefy, 294½° F. below zero. The liquid oxygen has, at this temperature, a maximum density of 1.137. Wroblewsky cooled it to 392° F. below zero, without solidification. At 212° F. carbon dioxide cannot exist in the liquid form. Andrews discovered, some thirty years ago, that what is called the "critical point" of carbon dioxide is as low as 87° F. At this point it begins to gasify gradually, under any pressure, and at a few degrees higher passes wholly into a transition state, independent of pressure. For valuable articles on the liquefaction of gases, we refer you to our SUPPLEMENT, Nos. 489, 896, 878, 932; also SCIENTIFIC AMERICAN, No. 2, vol. 67, and No. 11, vol. 68.

(5669) S. A. D. asks: 1. Should the shutter in a detective camera be in a certain place, or will it give good results in the rear of the lens inside of the box? A. A shutter placed between the lenses is supposed to be in the best position; but practically it makes no difference whether it is placed in front or behind. 2. Is it necessary to have the aperture in the shutter the size of the lens, or would it work the same if it were as large as the largest stop in taking instantaneous exposures? A. It is advisable to have the aperture in shutter fully as large as the lens opening, in order to obtain the advantage of all the illumination.

(5670) C. E. P. says: The inclosed piece of wood I broke from a common split basket that was used for holding clothespins, the same being frequently set in the yard during the summer season on wash day. Will you kindly explain whether it is larva or excrement, and from what kind of an insect? Reply by Prof. C. V. Riley.—The flattened, ovoid objects attached to a bit of wood broken from a split basket, the one overlapping the other, are the eggs of one of the common katydids. This is the angular-winged katydid (*Microcentrus retinervis*), which is found throughout the South and West. It feeds upon the foliage of various plants, but is not abundant enough to be specially injurious. These eggs have been variously referred to different insects by older authors, and their true nature is fully set forth in an illustrated article in the "Sixth Report on the Insects of Missouri." The first notes of this katydid are heard about the middle of July, and are made by the male, the wing covers being partially opened by a strong jerk and the noise produced by the gradual closing of the same. The song consists of a series of from 25 to 30 rasps, as of a stiff quill drawn across a coarse file, and strongly recalls the slow turning of a child's rattle, ending by a strong jerk of the same. The female responds by a single sharp chirp or techik. The young katydid issues from the egg in early summer, but leaves little evidence of hatching, as it issues from the side and the two parts of the shell contract again. There frequently issues instead a characteristic little parasite (*Antigaster mirabilis*, Walsh), which gnaws a smooth round hole, about the size of a large pin-head, through the shell.

(5671) J. L. says: I have two large mirrors which are spotted; i. e., the quicksilver is coming off in spots. Is it caused by roaches or what? Have you a receipt of any kind that I can use on them to advantage? A. Remove the silvering from the glass around the scratch, so that the clear space will be about a quarter of an inch wide. Thoroughly clean the clear space with a clean cloth and alcohol. Near the edge of a broken piece of looking glass mark out a piece of silvering a little larger than the clear space on the mirror to be repaired. Now place a very minute drop of mercury on the center of the patch and allow it to remain for a few minutes, clear away the silvering around the patch, and slide the latter from the glass. Place it over the clear spot on the mirror, and gently press it down with a tuft of cotton. This is a difficult operation, and we would advise a little practice before trying it on a large mirror.

(5672) N. A. C. asks: What is the proper and quickest way to tell whether a glass fruit jar is airtight? A. At the time of putting up fruit in glass jars the jars should be turned neck down while hot, when if not tight air bubbles will be seen rising among the fruit through the sirup as they cool. After fruit has been put away in glass jars any leakage of air will create mould on top or cause the sirup to ferment.

(5673) A. W. S. asks for a good recipe for belt glue; something that does not require more than

four hours to dry and will hold after it is dry. What is "Buffalo frozen glue"? A. For a good, quick-setting glue for belts, select the best amber-colored glue that can be found and test its toughness by breaking the pieces, which, if of good quality, will bend and spring back, and finally break with a splintered edge. Make up the glue in the usual way by soaking cold and then heating. For a pint of thick glue prepare an infusion of gall nuts (strong) and add half a gill, hot, to the pint of hot glue just before using. Use quickly, with good wooden clamps to press the belt laps close. The tannic acid properties of the gall nuts make the glue elastic and tough. The "Buffalo frozen glue" is made by freezing the glue gelatine as soon as sliced, causing it to become spongy in drying.

(5674) R. J. L. asks: How can canvas or duck used for wagon covers and for belts be treated so that it will not be beaten or torn by mice or rats, and at the same time leaving the canvas uninjured? A. Soak or wet the canvas and belts with a strong solution of alum in water and dry; or, if the color is no object, wet the goods with a decoction of wormwood or aloes.

(5675) G. W. S. asks: What will remove stains on cotton cloth produced by a toning solution? The solution is that sold by dealers, which had been used until yellow. A. First try boiling the cloth in an ordinary clothes boiler for half an hour, then set out in the sun to dry and bleach. If this does not succeed, moisten the cloth with warm water until it is thoroughly softened; then try rubbing the stain with a dilute solution of nitric acid, one-half an ounce, mixed with twenty ounces of water, rinsing the cloth in warm water after each application.

(5676) G. D. C. writes: I wish to light a small sleeping room a half hour each night in week with an Edison six candle power lamp, incandescent. How may I make primary and storage batteries with quart and pint cells, which I have at hand? What number of each and how arranged for lighting above lamp; also how connected? A. You will need twelve volts and one and a half amperes. A six cell plunge battery, such as described in SUPPLEMENT 792, connected in series will answer. Be careful never to leave the plates immersed except when using. Storage batteries are described in several of our SUPPLEMENTS, but we do not advise you to try to make one yourself.

(5677) S. G. M. writes: I have a one horse power motor of 500 volts running in my shop. The power is furnished me by the street railway company. I would like to burn some incandescent lamps in my place, the electricity for these to be furnished by batteries; storage batteries I suppose to be the most preferable kind. Could I charge those batteries from that motor while it is running and driving my machines? How many batteries would it require for four, eight, or twelve lights to burn at an average one to two hours a day? What voltage would those lights require? How much more power does the motor require in order to charge the batteries and run my machines? Understand, while I have a one horse power motor, I hardly use over one-half horse power when running, or rather don't need more than that. What other batteries can you recommend, outside of the storage system, to burn four or eight incandescent lights? Will they last (the batteries)? Can you advise me how to arrange the batteries for said purpose? A. If your motor uses only 1½ amperes of current, you will have slow work charging a storage battery. For twelve 16 candle power lamps of 24 volts each, allow 13 cells of storage battery. If you run them two hours, the battery at the rate of 1½ amperes will require thirty-two hours to be charged again up to the starting point. If you run them only one hour, half the given number of hours will be spent in the charging. The charging will absorb about 30 volts, representing, at 1½ amperes, one-fifteenth horse power. The batteries will last a long time, with careful usage. We do not advise the use of primary batteries. Arrange batteries in series. Consult our advertising columns for addresses of electric supply firms.

(5678) B. B. W. asks: 1. What is the voltage of a single storage battery cell? A. Two volts on the discharge. Two and a quarter volts are required to charge it. 2. How many cells will it take to run fifteen 16 candle power 110 volt lamps for ten hours? A. Fifty-six. 3. How many amperes of current will that amount of cells require to run said amount of lamps, and how large will they require to be? A. 675 amperes, requiring rather more than one foot area of positive plate. 4. Have you a book on storage batteries for good practical use in lighting? A. We can supply Salomon's "Electric Light Installations and Management of Accumulators," price \$2; Reynier's "Voltaic Accumulator," price \$3 mailed. The first named is exceedingly practical.

(5679) R. M. P. asks: 1. Can you advise me, at earliest convenience, the object of evaporating oil to burn the gas, in lieu of burning from a wick, in the "gas-generating" devices being introduced in stoves, etc.? A. More rapid combustion, with greater freedom from smoke, is obtained. 2. Is anything gained in increasing the temperature of the gas before ignition? A. This is a gain in intensifying the heat, and if waste heat is employed, an absolute gain may be reached. 3. Is anything gained by increasing the temperature of the air (that joins the gas) before it reaches the gas for combustion? A. The same applies, but in a much greater degree. Air, however, is hard to heat, as it is very diathermic. We recommend as authorities on heat the following books, which we can supply by mail at prices given: "Thermo-Dynamics, Heat Motors, and Refrigerating Machines," by De Volson Wood, price \$4; "The Principles of Thermo-Dynamics," by Rontgen, price \$5; Peabody's "Thermo-Dynamics of the Steam Engine," price \$5 mailed.

(5680) E. R. A. asks: 1. What sizes, lengths, and weights of insulated wire (copper and German silver) will be necessary to produce following resistances: 1 ohm, 9 ohms, 40 ohms, and 150 ohms? The wire is for tangent galvanometer described in "Experimental Science." A. Consult a table on resistances of wire. These are given for copper wire, and you may multiply the given resistances by 13:1 to get the resistance of corresponding sizes of German silver wire. Only an approximation can thus be obtained. See Sloane's "Arithmetic of Electricity," page 128, \$1 by mail. 2. What weight and length of No. 40 insulated copper wire