different mining laws of the States. Even from the point of view of its advertisements only, the work will have definite value for mining engineers and capitalists.

HOW TO KNOW THE WILD FLOWERS: A GUIDE TO THE NAMES, HAUNTS, AND HABITS OF OUR COMMON WILD FLOWERS. By Mrs. William Starr Dana. Illustrated by Marion Satterlee. New York: Charles Scribner's Sons. 1893. Pp. xv, 298. Price $1.50.

This is not a botany, but is designed to have a place in the family where the botany with its technical description and its tedious Latin names would lie neglected in the corner. There is no ignorance so profound and startling as the ignorance shown by even intelligent and educated people about the commonest plants and flowers about them. This work is intended as a guide and aid to such, and not only would the reader learn to have, as the authoress says, a "bowing acquaintance" with old neighbors, but would with little effort be able to call them by name. The work possesses literary merit, and when the description seems to the authoress to wax a little dry, it is redeemed by some happy quotation or by some song of summertide. The accuracy and precision of the description is not sacrificed, however, and the scientific treatment is preserved throughout. There are separate indices for the Latin, the technical, and the common English names of the various flowers. The plants may be readily identified by the illustrations which are very carefully executed and are quite numerous, there being 104 plates, most of which were sketched directly from nature. The book is handy in form and may be easily carried in a stroll through the woods.

MANUAL OF IRRIGATION ENGINEERING. By Herbert M. Wilson, C.E. First edition. New York: John Wiley & Sons. 1893. Pp. xx, 351. Price $4.

Irrigation is every year acquiring increased importance in the Western States. It will yet modify enormous areas of our Western Territories, and may even bring about climatic changes. This work is therefore particularly timely and represents what has been a long felt want. It is written thoroughly up to date and does not confine itself to the smaller features of irrigation, but treats of the great dams of the world as well as of the irrigating conduit. Numerous illustrations of structures and many diagrams are interspersed throughout the text, so that the whole subject is thoroughly covered and illustrated. The measurement of water is treated very interestingly, including the current water meters, the miner's inch, etc. We cordially recommend the book to our readers.

☞ 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.

### APRIL, 1893, NUMBER.—(No. 90.)

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The Scientific American Architects and Builders Edition is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming, practically, a large and splendid MAGAZINE OF ARCHITECTURE, richly adorned with elegant plates in colors and with fine engravings, illustrating the most interesting examples of Modern Architectural Construction and allied subjects.

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## Business and Personal.

*The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue*

## Notes & Queries

HINTS TO CORRESPONDENTS.

**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.

**Special Written Information** on matters of personal rather than general interest cannot be expected without remuneration.

**Scientific American Supplements** referred to may be had at the office. Price 10 cents each.

**Books** referred to promptly supplied on receipt of price.

**Minerals** sent for examination should be distinctly marked or labeled.

(4828) J. P. asks: What solution should be used in a Smee's cell in order to get the most strength from the cell? A. The solution used in the Smee battery is sulphuric acid 1 part, water 9 parts. The zincs must be well amalgamated and the platinized silver or carbon should be in good condition to insure perfect depolarization.

(4829) H. B. asks: Can you let me know anything concerning metal plating with Russian white metal for knives and forks? That is, the metal is melted. A. The Russian white metal is probably only a name given to Banca tin, with possibly a small admixture of bismuth to make it flow easy. It is being extensively advertised in the West. The work done with it is excellent. The directions are sold.

(4830) P. F. M. says: As your paper is one of our "standard text books" in our High School, will you please answer in your "Notes and Queries:" 1. If water at 39° Fah. were perfectly confined, could it be frozen in any temperature; i. e. could it not expand? A. Water when confined at the temperature of greatest density, 39°, upon being cooled below the freezing point, produces an immense pressure, and begins to freeze at a few degrees below 32°. The increasing pressure from the expansion of the ice so retards the freezing of the remaining water that a temperature below zero may be reached before it is all frozen. 2. Will you please give rule for finding horse power of ordinary locomotive, with cylinders 17 x 24 and 5 foot drivers, steam pressure in boiler 130, and speed 15 miles per hour? 30 miles? A. The actual horse power of a locomotive is so variable that any computation

depends entirely upon the cut-off, and the cut-off is governed by the actual pull required of the engine. Assuming a heavy train at 15 miles per hour and a mean piston pressure of 50 pounds per square inch, the piston speed will be approximately $\frac{15 \text{ m.} \times 5{,}280 \text{ feet}}{60}$ = 1,320 feet wheel speed per minute and $\frac{1{,}320}{15' \text{ (circumference of wheel)}}$ = 88 revolutions per minute. As a revolution is equal to twice the stroke, then 88 × 4 feet = 352 feet piston speed per minute. The area of the cylinders is 2 × 226 square inches = 452 square inches × 50 pounds mean pressure × 352 feet piston speed per minute = $\frac{7{,}955{,}200}{33{,}000}$ = 241 horse power. The possibilities of such an engine are about 400 horse power. The increase in power of the engine is not proportional to the increase in speed, and for 30 miles may be no more than 300 horse power. 3. Why are the wheels of a locomotive larger near the flange? And how can it pass a curve when the wheels are worn half an inch smaller next to the flange? A. The taper tread on driving wheels is to partially compensate by difference in circumference made by the wheel flanges hugging the outer rail on curves, the wheels slipping to make up for the loss of compensation by taper. Wheels that are grooved run hard on curves, as well also on straight tracks.

(4831) G. J. L. writes: To settle a dispute will you kindly state what scientific astronomers suppose or figure the temperature of the boundless space of the firmament outside of the influence of suns and worlds? If it were possible to have such a thermometer, what would it register if placed in the opposite direction from the sun, as far away from the earth as the sun, where the sun's rays would not be affected by friction of atmosphere whatever? A. The temperature of interplanetary and stellar space is supposed not to be lower than absolute zero, or 461° Fah. below zero Fah., or 493° below freezing temperature.

(4832) L. A. L. writes: Last fall I dug a well here for domestic use. I struck water at 26 feet, in a gravel bed, immediately below a stratum of blue clay. We have used the water all winter and always considered it good (though hard) until a week or so ago, when it developed a peculiar mineral taste, having a lot of reddish sediment in it. I inclose a sample of this latter, which I took from less than a gallon of the water. I would like to know what is the reason of it, and also if it is safe to use the water? A. The sample appears to be oxide of iron and clay. Probably it is harmless, but not pleasant to drink. We recommend putting a drive pipe in the bottom of the well and connecting directly with a pump to draw water from a deeper and possibly more satisfactory stratum.

(4833) L. S. F. asks the fastest way to find how many gallons a cistern or tank can hold, and if it is better to pump water into a tank through the bottom. I can use the pipes to lead the water off or where we need it; but I think it is much harder on the pumps when the tank is half full. A. If tank is round, square the diameter in feet and decimals. Multiply the product by .07854. Multiply last product by the height in feet, for cubic feet. Multiply the cubic feet by 7½ for gallons. You can pump into bottom of the tank or the distributing pipe without loss of power.

(4834) L. W. B. asks if copper is more difficult to heat by hammering than soft iron. A. Copper develops less heat than wrought iron by hammering or compression. Its specific heat is considerably less than that of wrought iron. It also parts with its heat faster than iron.

(4835) B. asks: Would the atmospheric pressure on a piece of gold leaf be greater than on a spherical piece of gold which displaces the same amount of air? A. The pressure is as the surface exposed to atmospheric pressure. The total pressure would be much greater on the gold leaf.

(4836) G. S. N. asks how the induction coil in a Blake transmitter for a telephone is wound, amount of wire, etc. A. The induction coil in the Blake transmitter consists of a bundle of soft iron wires, No. 20, inserted in a thin spool, about 2¼ inches long, with two layers of No. 20 wire on the spool and ten layers of No. 36 wire wound in the primary wire, an intervening layer of writing paper being tightly wrapped on the primary before winding the secondary. The direction of the winding in either case is immaterial.

(4837) G. D. C. asks: 1. Will the gravity or Crowfoot battery run the simple electric motor in Experimental Science? If so, how many cells will it take to get enough power to run a sewing machine or other light machinery? A. The gravity battery, owing to its resistance, is not suitable for running an electric motor. 2. What size wire should I use to make one half the size of the one described? I have completed the one man power, now I want a smaller one. A. If you intend to make a smaller motor, one-half the size linear, No. 20 wire will be about right.

(4838) J. N. F. asks: How many strokes per minute can an air compressor, similar to the one used by the Westinghouse Air Brake Company, be driven and work successfully? Or, in other words, how many cubic inches of air will valves of similar size and capacity receive and deliver per minute? A. The Westinghouse air brake can safely make 250 single strokes per minute, and will deliver air at nearly their full capacity, the valves being equal to their pumping capacity. We cannot name the cubic inches.

(4839) F. & T. ask how many storage batteries it would take to run eight lights (incandescent) for five or eight hours, provided the cells were about 12 × 7¾ x 5? A. The number of storage batteries required to run your lights depends upon the resistance of the lamps. For eight 20 volt lamps you will need 11 cells; for eight 30 volt lamps you will require 16 cells; for eight 50 volt lamps you will require 26 cells; but these cells will run about 20 such lamps.

(4840) J. W. D. writes: I am winding some field magnets with two wires in parallel, and I wish to determine their resistance when so connected. The two wires are of different sizes. One is No. 22 double cotton-covered and the other is No. 21 bare. I do not know how much of each yet, so I would be greatly obliged if you could give me some general rule for finding the resistance. I should also like to know the comparative re-

sistance of the fields and armature in shunt and series wound dynamos. A. It is bad practice to wind the field magnet with wire of two sizes. No. 22 wire runs 60 feet 6 inches to the ohm, while No. 21 is 76 feet 4 inches to the ohm. In a shunt wound machine the resistance of the field magnet should be about fourteen times that of the armature, while in a series wound machine the resistance should be as small as possible consistent with the proper excitement of the field magnet.

(4841) B. J. E. says: If oil put in the cylinder of an engine would pass through the exhaust pipe (into a well into which the suction pipe runs) and be drawn into the boiler with the water, would the oil ignite or cause boiler explosion if taken up? Or would it take a long time before enough oil to get into the boiler, as the boiler pipe, of course, is at the bottom of the well? A. The oil from the exhaust pipe in the well might do no harm for a while; but its gradual accumulation would cause it to come within the range of the suction pipe and to the boiler. In the boiler it will tend to gather the dirt and loose scale, forming masses that agglomerate and finally lodge on the fire sheet, cause it to be overheated, bulge, and if not discovered in time may cause a disaster. Many a boiler has made a large bill of expense from this cause alone. The oil will not ignite in the boiler; the danger is from lodging over the fire and allowing the boiler plate to be heated red hot and to bulge.

(4842) P. B. asks: 1. How many volts does it take to run the small electric motor described and illustrated in No. 641 of the SCIENTIFIC AMERICAN SUPPLEMENT? A. Two volts. 2. Of what resistance is the field magnet and of what resistance is the armature? A. The resistance has not been measured. We think, however, that the entire resistance of the machine is not more than three or four ohms.

(4843) E. E. J. says: I am desirous to know which is the hardest to bend, a solid bar, say 2 inches in diameter and 6 feet long, or a hollow bar of the same dimensions having a 1 inch hole in the center. What is their difference, both in strength and price of manufacture? A. The solid bar is the hardest to bend, i. e., it will bear the greatest load, and costs less than a hollow bar, which by your dimensions would have to be a double extra strong pipe, which costs twice as much as a solid bar of the same size. On the other hand, the same weight of metal as a tube is harder to bend, or will bear more weight than a solid bar, both of the same length.

(4844) C. H. S. says: Will you please give me a rule, through Notes and Queries, for finding the remaining bearings of a survey when the interior angles, length of sides, and the bearing of one side are given? A. Plot the survey on paper with the side having the given bearing for the base, and draw the meridian at the proper angle with the side given. Use the difference of the given course and the meridian for adjusting the several angles of the plot. Make the necessary changes as the angles carry the lines across the cardinal points of the compass. Then retrace the angles and bearing the reverse way to prove the work. See Gillespie's Surveying, by Staley, a complete guide to the survey and plotting of land. $3.50, maile .

(4845) W. H. P. writes: I have a storage battery which, after charging for about twenty hours with large dynamo, it will only run about two hours. It looks to me as though it runs down while not in use, as it gives a large spark when freshly charged. The negative plates look all right, but the positive plates look empty. If so, how can I refill them? Is there any article on making and repairing storage batteries in the SCIENTIFIC AMERICAN? If so, what number? A. Possibly your storage battery is short-circuited, or it may be that you are using it on machines having too little resistance. We think you have destroyed your storage battery by subjecting it to the action of too much current. Better send the battery to the makers for refilling. We hardly think you will be able to refill the plates yourself. You will find many references to articles on storage batteries in our new SUPPLEMENT catalogue, which is mailed to any address without charge.

(4846) A. L. E. writes: In your issue of March 4, 1893, page 134, C. L. Wolley describes a storage cell. What is the use of the red lead paste? How are the connections made with dynamo or primary cells when charging it? How long should the connection between dynamo and storage cell be kept up? When charged, how long will it be before it is necessary to charge it again? Can you give a description of a small dynamo, one say that would run from 10 to 20 incandescent lamps? A. Red lead paste is used on storage battery plates to facilitate the forming of the oxide, the red lead being more easily converted into lead peroxide than the metallic lead. The two poles of the battery are connected with the binding posts of the dynamo for charging, and the battery should always be connected up in the same manner. It requires from five to seven hours to charge a storage battery. We cannot, within these limits, give you full information in regard to the construction and use of storage batteries and dynamos. We refer you to our SUPPLEMENT catalogue.

(4847) C. P. P.—1. Please give me a list of all the metals, as I am unable to find a complete list, including the later discoveries. A. A list of metals will soon be published in the SCIENTIFIC AMERICAN. 2. What is the fastest railroad time ever made? When and where was it made? A. The fastest railroad time is claimed at the rate of 80 to 90 miles per hour on the Central Railroad of New Jersey, between Bound Brook and New York. See SCIENTIFIC AMERICAN, October 24 and November 21, 1891, for particulars of fast railway time.

(4848) H. G. M. writes: I am designing an automatic plug for electric light circuits. The plan requires a substance of great resistance, which will expand greatly when hot. Now what I want to know is, what will this substance have to be to heat and expand quite a little with about 4 amperes and 110 volts? A. We know of no substance better adapted for your purpose than brass. Compound bars of brass and steel are often used for thermostatic bars. Possibly such a bar would be better than one of brass only. Neither the brass bar nor the compound bar would have great resistance.

(4849) L. P. writes: I have built my house from plans made by you, and am more than pleased with it. Since then a number of lightning rod agents have been around to try to sell me their rods.