an uncommon spider and is widely distributed throughout the United States. Its beautiful regular orb webs are to be found in woods and fields, and very frequently also about dwellings and outhouses, from which latter habit it doubtless received its specific name. It establishes itself in sheltered angles of barns or porches, and if the presence of the web is no objection to the housekeeper, this spider will be of considerable service in reducing thenumber of house flies, for which it has a special fondness.

(5331) J. L. says: I have a twenty-five foot hull. Would you kindly recommend to me through your query column the safest and cheapest motor (no steam) that can be used for same? A. A gasoline or petroleum explosive engine is probably the cheapest and as safe as proper care and attention can make a motive power for a boat. Electric power is no doubt the safest, but has not yet arrived at a practical condition for general use. The storage electrical system is in use, but charging is not always convenient. The combined live battery and storage system is under improvement, but as yet rather a burden in a boat, from its bulk.

(5332) C. B. writes: I have found upon my tomato vines during August a green worm, about 1½ or 2 inches long and ¼ to ⅛ inch in diameter. All over the body of this worm are little white substances, apparently eggs, sticking out straight, each one about ⅛ inch long, and as thick as a hairpin wire or a trifle thicker. Each worm carries about thirty or forty of these. Will your entomologist kindly inform as to this phenomenon? Of course the worm doesn't stick these foreign bodies all over himself. What insect does it, and why? Reply by Professor Riley.—Your correspondent has observed a rather common phenomenon at this season of the year. The large green worm which he describes is one of the Sphingid caterpillars, and the minute white egg-like bodies projecting from it are the cocoons of a small black four-winged parasite (*Microgaster* sp.) A single parent fly deposits in the partially grown Sphingid larva a very great number of eggs, usually extending into the hundreds, which ultimately hatch into minute grub-like larvæ and which subsist on the fatty matter of the host larva, avoiding the vitalorgans. On reaching full growth, or having attained a length of about ¼ inch or less, they pierce the skin of the host larva and, remaining attached in the puncture at the posterior extremity, construct a beautiful silken cocoon which, on account of the immense numbers and close regular disposition over the back and sides of the larva, always excites the greatest curiosity when observed for the first time. Each of these cocoons, in a week or so, will disclose a small black fly, exactly similar to the one which was the author of the original parasitism. The females of these, after mating, will seek other larvæ, in accordance with their parasitic instincts. There may be several broods of these parasites in a single season, the later ones wintering over.

(5333) J. N. writes: I am making two carbon batteries, using ¾ inch carbons. I would like to know if I bored holes in the top of these carbons and filled them with hot lead, if that would make a perfect contact, so that I could solder or put set screws into it? Also the strongest carbon battery, in volts and amperes. A. You will do better if you cast your lead in a collar or cap shape around the top of the carbons. If the carbons are copper plated, tin the upper part of the copper with solder to insure contact. A battery can have any amperage. It depends on its size, nature of solution, etc. Practically 1·5 to 2 volts is the limit of E. M. F. for primray carbon batteries.

(5334) A. B. R. asks: Which of the following metals will be the most durable and have the least frictional resistance when used together, *i. e.*, one metal used in a bearing and the other in a revolving shaft: mild steel, wrought, cast and malleable cast iron, copper, brass? A. Mild steel journals running in brass boxes are considered the most durable in service and run with least friction. Wrought and malleablecast iron and cast iron, running in brass boxes, are next in order, as enumerated. Copper is not desirable as a journal box, from the difficulty of casting and fitting, although it is a good anti-friction metal.

(5335) R. H. asks: 1. Describe method of making a small electric furnace for heating soldering iron, using the Edison current. A. Use a heavy platinum coil within a chamber of non-conducing material. The coil should surround the iron. 2. Of what material is the magnet in a Thompson reflecting galvanometer made of? Would a piece of watch spring do, or would it be better to have two astatic needles? How should the needle be magnetized? A. Watch spring is excellent. For details, see our SUPPLEMENT, No. 628. 3. Is the arc light introduced into the Edison current without any resistance? A. Resistance is generally used. 4. Is the arc light used on other systems the same as the Edison, and can they be transposed? A. No.

(5336) E. L. S. asks: 1. How is a galvanic battery made, using sodium as one pole? What is the other pole composed of, that is, the bath? The electromotive force? Is it an open circuit battery? A. A sodium battery is provided with a porous cell filled with sodium amalgam. In one form the amalgam is a paste composed of 1 part of sodium and 50 of mercury. In two otherformsitis a liquidcomposed respectively of sodium 1 part, mercury 100 parts; sodium 1 part, mercury 200 parts. The electro-motive force of the sodium battery is about2½ volts. The other elements of the battery consist of carbon, and the electrolyte is dilute sulphuric acid. There are other combinations also. 2. How can I remove scars by electricity? A. In regard to removing scars by electricity, you should consult a competent surgeon.

(5337) J. E. B. asks for: 1. The U. S. government rule for safety valves. A. For boilers having flat or stayed surfaces, 30 square inches for every 500 feet of effective heating surface; for cylindrical boilers orcylindrical flued, 24 square inches. 2. In designing a field magnet, which is proper to use, ampere turns or ampere feet? A. Alwaysworkby ampere turns. 3. I have about 4 pounds of No. 31 cotton-covered copper wire. I wish to make a volt meter with a reading as high as 110 volts E. M. F. Would it be possible to use this wire to make a good spark coil? A. Your wire is rather too large for a volt meter, and rather fine for a spark coil. Bottone's "Electrical Instrument Making for Amateurs," 50 cents by mail, describes various electrical instruments. 4. Which is proper, ampere or amphere? A. Ampere. 5. For other definitions asked for consult the "Century Dictionary."

(5338) F. W. A. asks: 1. What horse power is one of the Edison motors, such as used in the phonograph, motor to run at about 1,500 revolutions per minute, and using a large plunge battery, such as described on page 401, "Experimental Science"? A. The power is very low, perhaps one one-hundredth horse power. 2. What is the length of time the above battery will run, giving full power, before being exhausted? A. One or two days. 3. If two of the Edison phonograph motors were coupled together, would the plunge battery above furnish power enough to run one of the Barnes 13 inch by 69 inch lathes and do work within the capacity of what a man could do on same lathe? A. No.

(5339) J. H. M. A. G. writes: I wish to light a three candle power lamp, requiring six volts, about. Will you please tell me: 1. Will three cells of storage battery be enough? A. Yes. 2. How many square inches of plate surface, including both + and −, should each cell have? A. Allow one square foot of positive plate. 3. The cells are to be made as nearly alike as can be. Will charging each cell separately for the same time with the same battery make them nearly enough alike to use together in series? It is far better to charge in series. You can, however, charge separately. 4. Will it be best to use resistance box and volt meter, so as to always obtain the same voltage through the lamp? A. This is not necessary. The batteries will be near enough. 5. With eight hours charge, how long will the storage cells run lamp? A. Fully charged, the batteries should give ten hours' current.

(5340) C. D. asks: 1. Why could not the armature and field magnets in the simple electric motor described in the SCIENTIFIC AMERICAN of March 17, 1888, be wound with No. 28 wire? A. Any sized wire could be used. The size is a matter of calculation, and depends on the E. M. F. and current to be employed. 2. Would it not increase the resistance so as to need more battery? A. It would, if wound singly, increase the resistance, and would require higher E. M. F. or more cells of battery; but such cells could be much smaller in such case.

(5341) G. D. C. writes: 1. If thirty dry batteries were put on a circuit with a simpleelectric motor as described in "Experimental Science," on page 498, the motor being about double the size of the one described, would it run it to its full power? If not, how many would it take? I want them to run it about three-fourths of an hour ata time. No other battery can be substituted in this case. A. Probably 200 dry cells would be required, and it is doubtful if they would run it for the time mentioned. 2. In making this motor twice the size of the other one, must I use the same size wire for the fields and armature? If not, what size must I use? A. This is all a matter of calculation. See preceding answer.

(5342) W. H. asks how to prevent barrels containing indigo extract from exploding. A. To prevent fermentation, salicylic acid or mercuric chloride might be used. By barreling the extract at a boiling temperature and closing the barrel while hot, fermentation should be prevented.

(5343) F. S. asks for a good zinc solution for plating on copper, and also the necessary acids for dipping. A. A "Watt's" solution is made by dissolving pure metallic zinc powder, by the aid of a strong current, in a strong solution of cyanide of potassium, with ammonia added. The proportions given are as follows: 200 ounces cyanide of potassium, 20 gallons of water, and 80 ounces, by measure, of strong aqua ammonia. A good dipping acid is formed of sulphuric acid 4 pounds, nitric acid 2 pounds, water 4 pounds. The fumes from the solution should not be inhaled. You will find further particulars in Watt's "Electro-Deposition of Metals," price by mail $3.

(5344) O. A. W. asks how to make nitrobenzene. A. Treat benzene with a mixture of 2 volumes strong sulphuric acid and 1 volume strongest nitric acid. Drop the benzene slowly into the mixture and filter through dry salt, after separation and washing.

(5345) J. S. M. asks: Can 20 to 30 tons of ice be put up in one ice house and keep satisfactory? About what would be the percentage of loss in one season? How large an ice house will be required, and how should it be constructed? A. Ice in quantities of 20 and 30 tons can be stored to advantage, and with a loss of no more than 10 per cent, when packed with ordinary care. Thirty tons will occupy a space of 10 × 10 × 10 feet, or 1,000 cubic feet, with 8 inches all around the inside and 3 feet at the top for packing, which may be hay or sawdust. A peak roof, ventilated, and, if possible, the ice house shaded from the sun. See SCI. AM. SUPPLEMENT, No. 59, for construction of ice houses and cold storage rooms; 10c., mailed.

(5346) R. A. S. says: A says that if brakes are applied to a car with force enough to cause wheels to stop turning and slide on rail, all power to stop train is absorbed. B claims that if brakes are not applied quite so strong, but as strong as possible without causing wheels to slide on rail, more force is exerted to stop train. Who is right? A. B is right. A skidding wheel does not hold to the track as well as a rolling wheel with the brake on nearly to the limit of the rolling traction.

(5347) F. W. L.—The ordinary newspaper pictures are produced by making a print from a negative of the same size which the newspaper print is to be. This print must be made on plain silvered paper; an artist then draws exactly the lines which appear in the picture, with waterproof indigo ink; the print is treated to a bath of bichloride of mercury dissolved in water or alcohol; this fades away the photograph, leaving only the black ink lines. The drawing is then touched up if necessary and photo-engraved like any other line drawing. The print must not be toned.

(5348) E. McC. writes: We have a woolen mill driven by small turbine, 50 feet head; mill was formerly driven by a 30 foot overshot, and think we did as much work then as now with the increased head. The turbine is liable to breakage, is delicate and so high speeded. Why would not a water motor made on principle of chain and buckets—something similar to elevators in a flour mill—with water thrown on top, or pitch back, answer every purpose without the objections of an overshot, as weight is the principle? Have you ever known such, and results? How does the Pelton wheel compare with other wheels in economy and efficiency? A. Probably your turbine is too small and does not use all the water that the overshot wheel used. If of proper size and kind, it should give you much more power with the same quantity of water and head. With 50 feet head you should realize 80 per cent of the gross value of the water fall. The chain and bucket system is of less value than an overshot wheel and has proved, so far, nothing better than a rattle trap. The Pelton wheel has proved itself one of the most efficient motors for high heads, and equal to 85 per cent of the gross water power. It is a marvel of simplicity and power.

(5349) J. B. asks: 1. Who was the inventor of piano; in what year? There is one in Louisville, Ky., made in 1776. A. The first instrument known by the name of "piano" was constructed in 1726, by Christofor. Instruments of the nature of pianos were made in 1668 and in 1521. 2. Last winter I was working at the car works in this town at night. I went into the engine room one night and sat down on the platform on which the dynamo was set, and magnetized my watch; is there anything that will save it from being thrown away? A. You can have your watch demagnetized by almost any jeweler, or you can demagnetize it yourself by suspending it on a twisted string, allowing the watch to revolve, approaching the dynamo closely while it is still revolving, and receding from the dynamo before it ceases to revolve.

(5350) L. M. asks: 1. Please inform me through your valuable paper if the amount of heat concentrated by a double convex lens depends on the distance of focus or its diameter. If the latter, is it directly proportional to its diameter? A. The heat-gathering capacity depends on the diameter of the lens. 2. Have you any SUPPLEMENTS treating on the Wimshurst's electric machine described in "Experimental Science," by George M. Hopkins? If so, please state the number. A. You will find a number of descriptions of modifications of the Wimshurst machine in the SUPPLEMENT. Consult Nos. 548, 648, 534, and 647.

(5351) C. K. T. writes: 1. From whom can I purchase inclosed wire in quantities of two or three pounds? Please state nearest place to me. A. Address any of our advertisers who deal in scientific and electric apparatus. 2. Does the lightning which one frequently sees on warm evenings give any audible report? If not, why? A. The subject of thunder is obscure, whether as regards its presence or absence at the time of a lightning discharge. Hot-weather lightning is often produced at distant places, too far off for the thunder to be heard. 3. Please mention number of SUPPLEMENT to SCIENTIFIC AMERICAN which contains directions for making a simple electric motor. A. No. 641.

(5352) L. W. writes: I desire to construct an electric battery for general experimenting that will give a strong and lasting current, and will not be too expensive to keep in order. How should I proceed to make a one-gallon battery of this kind? Also how many cells would be required, of one gallon each, to furnish electricity for a sixteen candle power incandescent lamp? A. We advise you not to try primary battery lighting. The bichromate batteries are the best. Many varieties have been described in our SUPPLEMENT and in the SCIENTIFIC AMERICAN. Two cells to the c. p. with a 30 ohm lamp may be allowed. Our SUPPLEMENT, No. 792, gives a powerful plunge battery. We also refer you to Nos. 157, 158, and 159 for other batteries.

(5353) P. C. asks: 1. Can I successfully light a photographic dark room by electricity, employing batteries? A. Yes; but it will be expensive and troublesome. 2. If so, what is the best battery to get? A. Use a Bunsen or Fuller bichromate mercury battery. 3. What candle power lamp would it require to produce the same amount of light as a kerosene lamp employing a B wick? A. A six c. p. lamp should suffice. 4. What would be the cost of the above plant with only one light, supposing a six c. p. lamp sufficient? A. Fifteen or twenty dollars.

(5354) R. M. P. asks: 1. What size wheel and how much power can I get from an undershot water wheel, 2 feet head, and race 14 feet wide by 3 feet deep and 1,000 feet long? A. The total gross power that can be obtained from the size race stated will probably be, with a water velocity of 4 feet per second, 168 cubic feet per second falling 2 feet, 38 horse power. Of this an undershot wheel 14 feet wide, 12 feet diameter will realize about 40 per cent, or 15 horsepower. A properly arranged Leffel turbine should realize 80 per cent, or 30 horse power. 2. Can you tell me the name of the firm or company that make a succession of undershot water wheels to develop power, that is, 2, 3, or 4 wheels working in the same flume? I was told they are made at Kansas City, Mo. A. We do not know of the firm that proposes to develop extravagant power from water wheels; 80 per cent of the total power is the largest known output with any known combination of water wheels for low heads. 3. How many pounds pressure is carried on small gas machines for house use? Gas to be made from gasoline. Also have you any papers on the manufacture of gas machine to light houses with? A. The gasoline vapor and air gas machines are used with from ½ inch to ¾ inch water pressure. Address Gilbert & Barker Manufacturing Co., Springfield, Mass., for their circular descriptive of their gas machines.

Replies to Enquiries.

The following replies relate to enquiries published in the SCIENTIFIC AMERICAN, and to the numbers therein given.

(5262) In issue of August 12 under Notes and Queries (No. 5262) J. B. asks is there any way to harden steel castings? I have a process of tempering cast steel or cast iron all the way through, and will be pleased to be placed in communication with him.—L. B. BROWN, 67 Jackson Avenue, Bradford, Pa.

(5278) F. K. J.—Replying to inquiry (5278) F. K. J., August 19, 1893, would suggest filling rusted pipes with a strong solution of caustic potash or preferably caustic soda of say 36° B. Solution should remain in pipes for several days.—S. C. STRUNZ.

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