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The practical treatise of the late Prof. C. A. Smith on the above subject is to be published in book form by the *American Engineer* of Chicago, under a contract of the publishers with the author.

A BIBLIOGRAPHY OF ELECTRICITY AND MAGNETISM, 1860 to 1883. Compiled by G. May, with Index. Trubner & Co., London.

This little volume gives a full list of works on electricity and magnetism issued within the period during which these subjects have become of such general interest. The titles are given in the languages in which the different works are written. By far the greater number of the works noted are in German, after which come French, English, Italian, etc.

THE CINCHONA BARKS PHARMACOGNOSTICALLY CONSIDERED. By Friedrich A. Fluckiger, Ph.D. Translated by Frederick B. Power, Ph.D. F. Blakiston, Son & Co., Philadelphia. Price, \$1.50.

This monograph is based upon the treatment of the same subject in the "Pharmakognosie" of the author, who is a professor in the University of Strassburg, although the details have been amplified, and the latest information is given touching the natural and chemical history of this most important remedy.



HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

When renewed request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from \$1 to \$5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at the office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) G. W. B. asks: What is the ratio between powder and ball in a rifle, or in other words what weight of powder will give the best results with a given weight of ball? A. The relative weight of powder to ball varies very much in practice; from one-seventh to one-half the weight of the ball in powder has given good results. The quality of powder, form of ball or bullet, kind of arm, proportional length of barrel, rifled or smooth bore—all are elements in the proportion. With the Harper's Ferry rifles (U. S.), 70 grains U. S. rifle powder to a 500 grain bullet at 300 yards gave the greatest

penetration, while in some of the later rifles at target practice the charge reaches to nearly one-half the weight of the bullet. There is a U. S. regulation charge of 75 grains powder for a 218 grain bullet. The cartridges for sporting rifles as practiced here are charged from one-third to one-half the weight of the ball; for pistols, one-sixth to one-quarter weight of ball.

(2) A. McD. G. asks: 1. I want to light a room 18 x 20 three hours a day by electric light; can I obtain sufficient electricity to do it by means of a battery? A. Yes. 2. How many and what size cells would be necessary, and please describe the form of them? I want the details so that I can make them, as also directions for making and using the points. A. Use 25 cells of Bunsen battery. You will find full particulars, which will enable you to make this and other batteries, in SUPPLEMENTS 157, 158, and 159. Better purchase your carbon pencils. They are inexpensive, but would give you a great deal of trouble were you to try to make them. The same advice would apply in regard to an electric lamp. 3. Could I use this battery during the day to operate a telegraph line of one-quarter of a mile? A. You could use it in that way, but a gravity battery would answer better. It would require not more than two cells to work your telegraph.

(3) H. C. T. writes: I have some small iron articles that I wish to japan. Should be glad to have you give directions in the SCIENTIFIC AMERICAN. A. For japanning small iron goods, the japan may be put on with a brush, generally two coats. If the goods are of a kind that will bear dipping, you may then the japan with a little turpentine. You will have to make a few experiments to find just how much to thin the particular kind of japan that you are using. The goods should be heated upon a plate of iron over the oven stove to a little above the temperature of boiling water, then dipped into the japan quickly and out, either with a hook or on small wires, then drained for a moment and hung in the oven. The oven should be raised to a temperature of 250° Fahr. Great caution should be used with an oven heated by a stove. Nothing but the pipe or such part of the stove as will not communicate fire to the vapor of the japan should be exposed in the chamber. The air that feeds the fire should not under any circumstances be taken from the drying chamber. A steam coil is the best if you can use steam at 60 pounds pressure, as that pressure is necessary to produce the desired temperature.

(4) C. L. asks at how early a date cast iron stoves came into use. A. Have no information in regard to iron stoves earlier than the middle of the eighteenth century. The Hollanders made stoves at a very early date of tile. A search among early illustrations of household goods might be of advantage to you.

(5) F. R. R. S. asks: 1. How can I remove coal oil from a carpet without destroying the colors, the spot not a very large one? A. Coal oil is soluble in ether, naphtha, chloroform, etc., so that by proper manipulation with these reagents the spots can be removed. No light, however, must be brought near them, as they easily catch fire.

(6) F. H. P. asks: 1. Is or was clover seed of any kind ever used for coloring purposes? A. No. At least not in our day. 2. Are or were dried apples ever used for coloring? A. No. Not that we know of.

(7) R. S. B. says: I am a constant reader of your valuable paper. Would consider it a favor if you would give me a receipt in detail for making Babbitt metal. Also what is necessary to harden it when too soft? A. Melt in a crucible 8 parts copper by weight; add 90 parts tin and 2 parts antimony. Proportions are varied for different purposes. Harden with antimony.

(8) M. D. asks: 1. Will not Swedish iron boiler tubes one-sixteenth of an inch thick, two inches in diameter, stand 120 pounds to the square inch pressure applied inside of tube? A. Yes, if the tube is one inch long; no, if it is six feet long. 2. Will not copper tubes be better made same size and thickness? A. No. 3. What is the mineral sent? A. The mineral is massive quartz not commercially valuable.

(9) W. H. says: I would be glad if you would inform me in your Notes and Queries what the composition is that is used to whiten the belts of the militia? A. Pipe clay.

(10) J. H. L. asks: Can you inform me how to obtain a hard, smooth, glossy black surface on wooden panels for art decorating purposes? A. Dissolve gum shellac in alcohol and add enough powdered ivory black or drop ivory to give it the consistency to apply with a brush. Put on three or more coats, rub down with rottenstone and a woolen cloth when dry, and varnish with thin coach varnish.

(11) A. V. asks: 1. If a dynamo would give 100 candle power, what candle power would double the size give? A. It should give at least 400. 2. What is the candle power of a Bunsen cell? A. The amount of light a Bunsen cell can produce depends upon its size and upon the kind of lamp used. In any case a single cell would produce very little light—not equal to one candle.

(12) W. M. B. asks: 1. What can I mix with varnish to cause it to dry immediately after being applied to smooth wood surface, that will retain a bright, lively appearance and will not crack or peel off? A. There is nothing you can use that will accomplish your purpose. Driers are added during the process of making the varnish, so that it is best for you to purchase a quick drying varnish. 2. I have some cheap silver looking ornaments that turn dark when exposed to the air. What can I cover or coat them with to exclude the air, and retain their bright silver appearance? A. Cover them with a "silver lacquer," which can be purchased of the ordinary paint supply houses.

(13) H. S. asks how to dye and fix the aniline colors so that they will not rub off? A. Albumen will be found a satisfactory fixing agent.

(14) R. H. H. writes: In one of your SUPPLEMENTS you mention using mercury flasks in making small steam boilers. 1. What are the dimensions of the flasks? A. Five in. diameter by twelve in. length. 2. Where can they be obtained, and what is the cost of them? A. From druggists and instrument makers. 3. How many would be required for an engine 4 1/2 inch

cylinder, 4 inch stroke, running 250 to 300 revolutions per minute? A. From 65 to 70. 4. How many pounds steam pressure will they stand, or what pressure will it be safe to carry? A. Safe to carry 130 to 150 pounds. We suppose they will stand 600 to 800 pounds; we cannot, however, say that they are tested to that pressure.

(15) F. C. S. asks: What the so-called diamond ink used for writing or etching upon glass is composed of? A. The preparation is said to be made from ammonium fluoride dissolved in water and mixed with three times its weight of barium sulphate.

(16) W. H. McA. asks: 1. How is citric acid extracted from lemons? A. The juice of lemons is allowed to ferment, and chalk added to form calcium citrate. This salt when treated with sulphuric acid decomposes, giving rise to calcium sulphate, a white insoluble powder, and citric acid, which is in solution. The latter is then evaporated and the citric acid purified by crystallization. 2. Is there much of a demand for it? A. It is in good demand, and regularly sold by wholesale drug houses. 3. How much is it quoted at per pound? A. Forty-eight to forty-nine cents.

(17) P. P. H. asks: 1. How to polish, smooth, and brighten wooden (pitch pine) floors? A. This information is given on page 312 of the SCIENTIFIC AMERICAN for November 17, 1883. 2. How to stain rattan chairs to imitate mahogany and ebony? A. Wash the rattan with a concentrated aqueous solution of iron acetate, having a strength of 14° B. Repeat this until a desirable shade is produced. Then give a coat of quick drying varnish, such as can be made by dissolving black wax in spirits of wine. 3. How to regild much used gilt frames (without using the varnish and gold powder)? A. We fail to understand how it is possible to regild frames unless the size or varnish be employed with gold leaf or powder. 4. How to fix looking glasses where the quicksilver is partly gone, and with black spots? A. See SCIENTIFIC AMERICAN for Nov. 10, 1883, answer to query No. 23, for this information.

(18) L. D. B. asks for some simple chemical or other means for analyzing common drinking water to ascertain the different ingredients, and also for iron and lead? A. A simple test for water is to place it in a clear bottle, and first examine if it be colorless, and thus free from organic matter. Then taste it, and if no peculiar flavor is discernible let it stand a day or two; then heat or boil, and if no odor is present, the water is in all probability pure.—*Weiss's Test for Sewage Contamination*: Fill a clean pint bottle three-fourths full of water, dissolve a teaspoonful of loaf or granulated sugar, cork the bottle, and place it in a warm place for two days. If the water becomes cloudy or muddy, it is unfit for domestic use. If it remains perfectly clear, it is probably safe to use. If the water is sufficiently concentrated, it will give a blue precipitate with potassium ferrocyanide when iron is present, and a black precipitate with hydrogen sulphide if lead is present. It would be unwise to attempt these tests without some previous knowledge of chemistry.

(19) O. B. W. writes: 1. I wish to build a marine engine suitable for a small launch. Will you please tell me what is the most economical rate to drive propeller? Would 250 revolutions per minute be too high speed? A. Two hundred and fifty revolutions not too fast. 2. I do not understand how to get the size of ports. The steam pressure in boiler will be about sixty pounds per square inch. What should be the size of steam ports, and what pressure should there be in cylinder? The diameter of cylinder and stroke of piston is four inches, and the number of revolutions of engine per minute, say two hundred and fifty. A. Steam ports 3 x 3 1/2 in.; exhaust, 3 x 3 1/2 in. 3. What size boat would the above engine drive at about seven or eight miles an hour, the boiler pressure being sixty pounds? A. Boat about 26 ft. long and 4 1/2 ft. beam by 2 ft. 9 in. deep. Your boiler should have not less than 110 ft. heating surface.

(20) J. C. D. asks in what respect is a coal burning locomotive constructed differently from an ordinary wood burner, and also what change would be necessary to make in changing from wood to coal, as a fire under a common horizontal fire or tubular boiler? A. There is a difference in fitting the furnace for bituminous or for anthracite coal. For coal the furnace has much less depth and larger grate area than for wood. Anthracite coal furnaces have generally more grate area than for bituminous. Generally all that is required is to reduce the depth of the furnace and fit suitable grate bars. Furnace for anthracite coal, about 24 in. or 26 in. deep.

(21) R. R. asks: What is the minimum power required to operate an air pump cylinder 5 1/2 in. diameter and 8 in. stroke, forcing air into a reservoir until it contains 100 lb. to the sq. in. The engine or power used to have same number of revolutions as air pump, with 75 lb. steam to the sq. in. A. We cannot estimate the power, as you do not give the number of strokes per minute. The pressure upon the steam piston must be at least equal to the maximum pressure of the air pump piston, if both have the same stroke; the total pressure on the air pump piston at 100 lb. per sq. in. will be 2,376 lb.; and as the pressure per sq. in. is but 75 lb., the diameter of its piston must be say, 6 1/2 in.; add to this 33 percent for friction of engine and pump, will give a cylinder 7 1/4 in. diameter.

(22) J. M. B. asks: Why the notches on a scale beam or steelyard weigh say uniformly 1 pound on the platform, no matter whether the piece be near the fulcrum or at the end of the beam; the notches on beam are of equal distances. Why should not the balancing power increase, the greater the distance it is placed from the fulcrum? A. Because the power of a lever is as the ratio of its two arms.

(23) S. B. G. asks: 1. What is meant by each of the following chronological cycles. They are used in the almanacs, but are not generally understood: 1. Golden number, 2. A. The Golden number is the year of the lunar cycle of 19 solar years; after which the new and full moon fall upon the same day that they did 19 years before. The number of the year in the cycle is called the *Golden number*, because it is supposed that it was inscribed in letters of gold in the Greek temples. The cycle is supposed to commence with the year in which the new moon falls on the 1st of January. This happened in the year preceding the commence-

ment of our era; hence to find the number of any year in the lunar cycle, or *Golden number* of that year, add one to the date and divide by nineteen; the quotient is the number of cycles elapsed, and the remainder is the *Golden number*. If there is no remainder, the *Golden number* is the last, or nineteen. 2. *Epact*, 3. A. The *Epact* is the moon's age at the end of the year, or the number of days by which the last new moon has preceded the beginning of the year, and is used in ecclesiastical computations. It is computed from the difference between the number of days in the solar and lunar year, which is 11, and its yearly multiples divided by 30; whence if a new moon fall on the 1st of January, the moon will be 11 days old on the 1st day of the following year. The *Epact* for that year will be 11, the next year 22, and the third year 33—30 = 3, and so on—subtracting 30 whenever the added 11 becomes 30 or more. 3. *Solar cycle*, 17? A. The *Solar cycle* is a period of time after which the same days of the week recur on the same days of the year. Its duration is obtained by multiplying the days of the week by the leap year period—7 x 4 = 28 years. Its number for a given year is found by adding 9 to the date and dividing by 28; the quotient is the number of cycles elapsed, and the remainder is the year of the cycle. Should there be no remainder the cyclical number is 28, or the last of the cycle. 4. *Dominical letters*, F, E? A. The *Dominical* or Sunday letter in the ecclesiastical calendar is denoted by the first 7 letters of the alphabet. A commencing with the first day of the year, the letter falling upon the first Sunday is the *Dominical letter* for the year. They recur every 28 years upon the same day of the year. 5. *Roman indiction*, 12? A. The *Roman indiction* is a period of 15 years, not astronomical like the other cycles, but entirely arbitrary. It is supposed to have been introduced by Constantine the Great about the year 312 A.D., and had reference to certain judicial acts that took place under the Greek emperors. Its number is found by adding three to the date and dividing the sum by 15; the remainder is the year of indiction.

(24) W. O. D. asks: 1. What is meant by caliber 12 or caliber 14 in speaking of shot guns? From what standard is the caliber of a gun calculated? A. The caliber of shot guns is designated by the number of round balls to a pound. Thus 12 is 0.73 of an inch in diameter, No. 14 is 0.69 inch, etc. Rifles and pistols are designated by their diameter in hundredths of an inch. Thus 40 caliber is 0.40 of an inch diameter. 2. From what standard is a wire or saw gauge calculated? What is meant by saying a saw is gauge 10 or 12 or 14? A. The saw gauge standard is the *Stubbs gauge*, which is also a wire gauge; it is sometimes called the *Birmingham gauge*. No. 10 is 0.134 of an inch; No. 12 is 0.109 of an inch; No. 14 is 0.083 of an inch.

(25) J. C. asks us if the following, which appeared in a Chicago paper, is correct: How many cubic feet are in a stick of square timber 1 foot square at one end and tapering to a point at the other, and 100 feet long? The answer was 25 feet. Orton & Saddle's calculator gives the rule for finding the solid contents of squared or four-sided timber as follows: "Multiply the breadth in the middle by the depth in the middle, and that product by the length for solidity." A note says: "If the tree taper regularly from one end to the other, half the sum of the breadth of the two ends will be the breadth in the middle, and half the sum of the depth of the two ends will be the depth of the middle." In this case the breadth and depth of one end would be 0. Following the rule, the breadth and depth at the middle would be 6 inches, and the example would be 6 times 6, equals 36 inches, multiplied by 100 feet equals 3,600, divided by 144, equals 25 cubic feet. A. We believe this answer to be incorrect. Haswell's rule for computing the volume of a pyramid is, multiply area of base by perpendicular height and take one-third of product. This will give us a cubic contents of 33 1/3 feet.

(26) F. S. asks for a good recipe for making up citrate of magnesia, such as is sold by druggists? A. The following receipt will make a quantity sufficient to fill 112 bottles. Take of:

Magnesium carbonate	4 oz.
Citric acid	8 oz.
Sugar	12 oz.
Water	9 pints.

Flavor with essence of lemon, then dissolve and filter. Fill the bottles at once and add to each 30 grains of potassium hydrogen carbonate, and cork securely. The bottles must not be filled up higher than the shoulder.

(27) B. A. asks: 1. Is there any varnish or wash for water color drawings to give them a glaze or shiny appearance? If so, please inform me where it may be had or how to make it? A. A varnish that is sometimes used consists of:

Dextrine	2 parts.
Alcohol	1/2 "
Water	2 "

Previously, however, prepare the drawing by coating with 2 or 3 coats of thin starch or rice boiled and strained through a cloth. 2. Do you know of any cement or adhesive substance that will glue broken pieces of meerschaum together? A. Try a little white of egg, thickened with finely powdered quicklime or by a mixture of newly baked and finely powdered plaster of Paris mixed with the least quantity of water.

(28) J. D. McC. asks if liquid albumen will remain pure or sweet by being securely sealed and protected from the air? A. Yes; if protected from air, it will remain sweet, but it is almost impossible to securely protect in anything so that air will not have access to it.

(29) E. S. B. asks how carbolate of iodine is made. I have looked in all the books on chemistry that I know of, and cannot find anything about it. A. Carbolate of iodine is not a chemical compound, but a preparation much used for catarrhal affections. It is prepared by moistening chopped lint in a bottle with equal parts of spirits of ammonia, tincture of iodine, and carbolic acid.

(30) D. H. asks: What is cyanogen of ammonia? I came across it in reading the other day where it was used in connection with the hardening of steel. but on my applying to a druggist he did not know what it was. A. Cyanogen of ammonia is the term applied to the grouping of the atoms of cyanogen, hydrogen,