Notes and 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 This is for our information and not for publication.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.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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.

(8877) A. J. R. writes: I have a small machine requiring about ¼ horse power to operate, and which we run continuously, and am desirous of getting some economical power to operate and run it, and write to ask if there is anything on the market more economical and satisfactory than the gasoline engine, and would it be possible to so arrange gears as to run the machine by clockwork, or weight or spring? A. There is no power in a small way so good or so cheap to run as a gasoline motor. You should have for your work one of a half horse power. Weights or springs have to be wound up, and only give out power for a very short time, and not all that is put into them in winding. They have been tried for useful work, and have been given up as only suitable for clocks, small fans, and for turning images and goods in show windows.

(8878) H. H. asks: Will you please tell me how much air compressed to 100 pounds pressure will expand when released? The quantity of air released to reduce pressure one pound. A. The air released from 100 pounds pressure will expand 4¼ times its volume. The quantity released to reduce the pressure one pound must be 0.068 of the volume of the air holder.

(8879) W. V. H. writes: Inclosed you will find drawing describing at the bottom what it will do. Please explain why the motor reverses when wire is connected at A. A. When one cell is used in your Porter motor as shown in your diagram, the motor runs as a series motor. When you connect the second cell, the armature or the field, as you may look at it, is reversed, and the direction of the rotation of the armature is reversed. To reverse the current in both field and armature does not reverse a motor: to reverse one of these alone does reverse the motor.

(8880) F. A. H. writes: I am producing, in an induction coil, alternate currents in the secondary by employing, instead of the usual contact breaker, the change from highest to lowest resistance in the primary, just as is done in the telephone with the transmitter in series with the primary of the coil. I learned from you some time since that these secondary currents could be made pulsating direct by the use of a condenser. This has been argued against by others whom I have since been in connection with. Will you kindly advise me just how to accomplish the desired results, either with the contact breaker or, for instance, the transmitter, should it be possible? A. With a condenser attached to an induction coil, the spark at the break of the circuit in the vibrator is made much longer than the spark at the making of the circuit through the primary. Hence if the spark terminals are drawn apart so far that no spark passes on the closing of the primary circuit, only the spark at the break can pass, and that will always be in one direction. The secondary current becomes a pulsatory unidirectional current. When the spark terminals are near enough to each other, the secondary current passes both at the make and at the break of the primary circuit, and an alternating pulsatory current is produced in the secondary winding.

(8881) C. D. S. writes: We have a pancake griddle using charcoal which is not a success. I would like to convert it into an electrical one. The size is 2 feet 5 inches by 1 foot 3¾ inches. How much and size of steel wire would be required to raise it to the right heat at 110 volts pressure? A. We do not advise you to attempt the winding of an electrical griddle. The danger of fire is too great. Special asbestos insulation is required by the underwriters for such articles, and you would find it far cheaper in the end to purchase an article made to conform to the requirements of the insurance companies. We do not know the temperature of a griddle nor do we know the allowance to be made for radiation in such a large surface exposed to the air. Much practical experience in designing cooking utensils is needed to answer your question. You will probably need to use from 5 amperes to 15 amperes at the various heats. You would then require 22 ohms of wire so arranged as to be cut out by a switch to 7 1-3 ohms. You can obtain griddles of all sizes from the American Electric Heating Corporation, 1137 Monadnock Block, Chicago, Ill.

(8882) O. F. asks: Will two coils of insulated copper wire attract one another when an electrical current is passed through them in the proper directions? What is the maximum of attraction obtainable expressed relatively to the weight of the coils? A. A coil of wire carrying a direct electric current is an electromagnet, and two such coils will attract each other as two electromagnets will do. The attraction depends upon distance, mode of winding, amount of iron on the cores, etc. To determine the attraction of the coils you would use you should make and try them. You cannot use the alternating current in an electromagnet.

(8883) A. G. P. asks: For a magnet with cores 1¼ x 5-16 inch what size wire should I use to get the strongest magnetism when wound the multiple-wire method? Will a magnet wound this way be as strong as one wound the regular way? About what is number of pounds pull on the tailpiece of a guitar when the instrument is in tune? A. There is no need to wind a small bar of iron by a multiple wire to obtain its magnetic saturation. Use any convenient number of wire from 20 to 24 and wind the spool to a depth of ¼ to 1-3 inch. Then two to four cells of battery will make it lift its full load. The theoretical lifting power would be 15 pounds which it is not probable you can reach. We are not able to give the pull upon the tailpiece of a guitar. If you have a spring balance, you can easily measure it by taking each string separately and tuning it to its note with one end attached to the hook of the balance. Get the strain in pounds for each string, and add the separate pulls together. You can do the same thing by using weights or stones instead of a balance and weighing them. The exercise of your ingenuity will enable you to do your own investigating, and be of more benefit to you than if we could tell you directly.

(8884) I. C. R. asks: What will make silk waterproof and stiff at the same time? A. After the silk has been soaked in glue and dried, it should be digested for several hours in a solution of alum: this will make the glue insoluble, and therefore waterproof. Or the glue may be rendered insoluble by digesting the treated silk in a weak solution of formaldehyde. Casein can be used in place of the glue: after drying the treated silk, the casein can also be rendered insoluble by formaldehyde.

(8885) H. K. asks: How can I connect 12 3½-volt lamps, consuming between 50 and 60 amperes each, on a 108-volt alternating current? Lamps are a trifle over 1 candle power. A. You cannot connect 12 3½-volt lamps economically to a circuit with 108 volts in it. The twelve lamps have 42 volts in series. You can connect them in series to a resistance, or inductance coil, and thus light them. You should apply to the company furnishing the current for the connection, and they will fit you out with the proper apparatus. Such low-voltage lamps are made for battery use, and ought not to be put on a high-voltage circuit.

(8886) D. H. F. asks: What percentage of shrinkage is there in the casting of brass? That is, how much larger should the pattern be to give the proper dimensions? A. The shrinkage allowance on patterns for casting brass should be 3-16 of an inch per foot in length or diameter.

(8887) F. S. P. asks: Can you furnish me with a recipe giving full directions for making Flemish oak finish? A. The wood is smoothly surfaced, and a solution of copperas containing one ounce in two quarts of water is brushed over. Follow this with an oil stain mixed with sienna or umber and drop black to color desired. Finish by waxing the wood one or more coats to get the desired effect, leaving the grain rubbed off smooth and open.

(8888) C. J. S. asks: Can you tell me how to make an electro-magnet to be used on 100-volt alternating current? A. An electromagnet cannot be used upon an alternating current. They are employed with a direct current. The alternating current flows first in one direction and then in the opposite direction through the circuit, so that the poles of the magnet are reversed at each alternation. Such an arrangement is not serviceable.

(8889) S. G. asks: What is used in the mantle of the Welsbach which gives to it its brilliancy, and in what manner is it applied; and also what change or action is it, chemically or physically, that causes the mantle to glow so brilliantly? A. The Welsbach mantle is made in the following manner: A net is woven out of thread, and this is then thoroughly impregnated with a solution of the mixed nitrates of thorium and cerium, in the proportions of 99 per cent of the former to 1 per cent of the latter. It is put on the market in this shape. Now, when a match is touched to it, the thread burns away, and the nitrates are decomposed to the respective oxides, and there remains therefore a coherent web of these oxides having just the shape and structure of the original net. Primarily, the luminosity is caused by the high temperature, just as is the case with the ordinary lime light, the heat rays of the flame being raised to light rays. Just why a mixture of thoria and ceria, containing one per cent of the latter, gives the maximum intensity of illumination, has not been definitely proven, though various theories have been advanced. Measurements with a thermo-element show that in the same zone of the Bunsen flame, this mixture will attain a higher temperature than either thoria or ceria or any other earth, if alone; while this does not explain why it attains a higher temperature, it does explain why there is greater luminosity.

(8890) D. McK. asks: How much does a bushel of vermilion red weigh? How much does a bushel of yellow ocher weigh? What is the specific gravity of red lead? What is the specific gravity of white lead? Do vermilion red and red ocher mean the same thing? A. Ocher is very variable in character and weight: a Winchester bushel will weigh from 125 pounds to 170 pounds. As Venetian red is also equally variable, its weight will also vary, but runs somewhat higher than ocher. The specific gravity of red lead is about 9: of white lead, about 6.5. Venetian red is made by burning ocher; the term red ocher is rather unusual, but it would probably be the same as Venetian red.

(8891) C. T. J. asks: 1. What is the equivalent of one H. P. in man power: i. e., about how much man power equals one H. P.? A. For constant work a horse power is equal to the work of 8 men. 2. What is the reason that two *platinum* strips are always placed in the acidulated water to be decomposed by an electric current? Why couldn't two strips of any other metal that is a conductor of electricity be used? A. Platinum is employed as electrodes in decomposing water because it is not attacked chemically by either the oxygen or hydrogen of the water when they appear upon it as nascent gases. It is the cheapest metal, if not the only one, of which this is true. Hydrogen can be collected by the use of carbon electrodes; but the oxygen combines with the carbon to form carbon dioxide, which can be collected if desired. Oxygen cannot be collected from carbon. 3. Could a small electric motor, say ¼ or ½ H. P., to be run on a 110-volt, 5½ or 6 ampere, alternating current, incandescent lighting circuit, be started and stopped by means of a switch only, or would a rheostat also be necessary as with the larger sized motors on circuits of higher voltages? A. A small electric motor is usually provided with the proper coils for starting and running at two or three speeds in the machine itself. The switch then has three or four points, and is fastened to the frame of the motor. It is more convenient to place these in a separate place in a large motor. 4. Would you please state the difference between the induction coil used in connection with the X-rays and telephony, and the inductance coil used in wireless telegraphy? A. An induction coil has two windings, the primary and the secondary. A current in the primary induces another current in the secondary, of a different voltage and current strength in amperes. Such are Ruhmkorff coils and transformers generally. An inductance coil has a single winding, usually without iron, to act as a restraint upon the rush of the current through the circuit. This it does by the counter electromotive force produced in the coil by its self-induction. Its effect is produced not merely by its resistance in ohms, but also by the impedance due to the reactance of the turns of the coil upon the current. 5. About what would be the voltage and the amperage of a Wimshurst frictional electric machine having its two circular discs of glass 16 inches in diameter (each), the glass being 1-16 inch thick? (Machine gives a spark 1½ to 2 inches long.) A. The voltage corresponding to a given length of spark cannot be stated in exact figures. It depends upon a number of factors: whether plates or balls are employed as terminals, and their size in each case; also upon both temperature and pressure of the atmosphere. A good discussion of this is to be found in Thompson's "Elementary Lessons." About 28,000 volts are usually given as the pressure needed to force a spark through one inch of dry air. 6. About what would be the voltage and the amperage of a No. 4 Laclede sal ammoniac cell? What would it be, and how is it calculated, for a battery of three such cells in series, in multiple? A. The Laclede cell has about 1.4 volts on open circuit, as do all the various forms of sal ammoniac cells. On closed circuit it quickly falls to 1 volt or less, if the current is as great as two-tenths of an ampere. Upon opening the circuit they recover quite well, since they have so large an area of carbon. Three cells in series will have three times the voltage of one: in multiple they will have the same voltage as one cell. The amperes cannot be given since they depend upon the resistance of the external, as well as upon the internal resistance of the cells. 7. I have read that some damage might be done to a storage battery by overcharging, but that there is always more or less damage done by over-discharging. Could you please explain how this (over-discharging) damages the battery, and is there any way in which to prevent it by simply observing the lead plates or the sulphuric acid and water in which the plates are immersed, in a simple home-made cell not equipped with measuring instruments? A. Over-discharging injures a storage battery by converting too much of the active material. It reduces a battery to too feeble a condition. It may even be carried so far that it is scarcely possible to charge the cell properly again. See Treadwell's "Storage Battery" for more instruction upon these matters. No storage battery should be run for work without having the proper instruments for indicating its condition.

(8892) G. J. V. asks what are the ingredients used in the manufacture of lava insulators; also enamel on the backs of resistance plates. A. The enamels used on insulators are the same as are used on dishes. There are many formulas. A good one is: Take quartz, 100 pounds, calcined and ground; borax glass, ground, 50 pounds. Mix, fuse in a crucible, and let cool slowly. Powder 40 pounds of this glass, and mix with 5 pounds of white potter's clay. Grind the mixture to a fine paste in water. Apply to a clean surface, and let it stand in a warm dry place to dry. After this, it is burned in an oven. A glaze can be put upon this by using a powder of white glass 125 pounds, borax 25 pounds, carbonate of soda, fused and powdered, moistened and dried, 20 pounds. To 45 pounds of this add 1 pound soda. Mix thoroughly and dry. Then reduce to a fine powder. Dust the surface of the enamel while still moist with this powder, and then bake. Several coatings of the glaze may be put on, one after another. The lavas are made of fine clays baked as porcelain is treated. For many receipts for doing this see "Cyclopedia of Receipts."

(8893) O. C. S. writes: A friend of mine claims that the wheels of a railroad car slip sideways only when rounding a curve. I claim that they also have what I shall call, for want of a better expression, a rotary slip; that on a slow-moving train the outer wheels slip, while on a faster train the inside wheels slip. What are the facts in the case. A. The wheel flanges of railway cars bear against the outer rail when rounding a curve by their momentum, and against the inner rail when strongly pulled by the locomotive. The inner and outer wheels both slip, the inner one forward and the outer one backward, according to the conditions of running on a curve. The centrifugal force at high speed throws the greater weight on the outer wheels, when the inner wheels slip forward.

(8894) C. E. H. asks: If we take a Bunsen burner using good fuel gas, capable of 700 heat units per cubic foot, and burn this with a naked flame, the heat resulting from each cubic foot of gas consumed would be diffused into the surrounding atmosphere, and would raise the temperature as high as 800 units. Now, if we take the same burner and surround it with a sheet metal tube after the manner of an ordinary gas radiator, and in addition to the tube place two or three metal deflector plates at a convenient distance above the flame, so as to have as much radiating surface as possible, we find under these conditions the temperature of the surrounding atmosphere is raised very much higher than it would with the naked flame, although we are using the same burner and producing approximately the same number of heat units per cubic foot of gas. How do you explain this increased efficiency for heating? A. Your difficulty with the difference in the heating power of gas when burned with an open flame or with a radiator is easy of explanation. When the open flame is used, the heat is carried up to the ceiling in a strong current of air, and the upper part of the room is much hotter than the lower part. The heat is lost, since we do not live up there. A radiator does just what its name implies—stops the rising of the heat. The heat of the flame is communicated to the metal of the radiator, and this acts as the real heater. It sends out the heat, down and all around with equal facility. You can test this with a thermometer, and see how the air below the radiator is heated. With the open flame the space below the flame is cold, by reason of the draft of cold air drawn in to feed the flame. Radiant heat travels down as easily as it rises. Convection currents of air always rise, and carry the heat up with them.

(8895) G. H. B. says: I have just commenced to nickel-plate, and am plating for a large stove firm: they have all one can do. I have turned out some fine work, but some of the nickel will peel off. As I am a beginner, I have used nickel salts and single salts for the exposed parts. I was told to plate the pieces in nitrate of copper first, to make the nickel adhere better. I tried it, but did not get any copper plate on. Please tell me the best way to get the best results of platings. A. The peeling off from some of the work is probably due either to imperfect cleaning of the object or by using too strong a current. The failure with the copper was due to the use of the nitrate of copper, with which it is practically impossible to do any plating. Copper sulphate, copper acetate, or copper carbonate, together with sufficient potassium cyanide to make the double salt, is the proper material to use. See "SCIENTIFIC AMERICAN Cyclopedia of Receipts," article on "Electro-metallurgy."

(8896) H. M. H. asks if hard woods can be used in the manufacture of wood pulp. How fine wood is ground for the pulp? To what process is the wood submitted after being ground, and in what shape is the pulp put for the market? A. Hard woods are not used; spruce and the other pines give the best pulp; linden and aspen give a whiter pulp, but of inferior quality. After grinding, the mass is beaten to complete the disintegration and hard woody masses are separated. The pulp is then collected in endless screens and pressed between rolls.

(8897) A. F. S. asks: Does not liquid oxygen as produced by liquid air become opaque to magnetism, that is, is it slightly attracted by a magnet? A. Oxygen was discovered to be a magnetic substance by Faraday in 1849, by noting that it was attracted to a magnet pole just as iron is, though to a lesser degree. Becquerel was the first to call attention to the subject in recent times. In 1892 Dewar, having produced liquid oxygen in large quantity, renewed the matter and showed that liquid oxygen has about one-thousandth of the magnetic moment of iron. Liquid oxygen is shown in a tube swinging to the pole of a magnet, in Sloane's "Liquid Air," page 337, but the language used in the text describing the experiment is not correct. It should read: "Oxygen was discovered to be *magnetic* by Faraday." The fact is just the opposite of the statement of the book.

(8898) R. R. J. asks what voltage is required to jump a spark gap of ¼ inch, and if the voltage is in direct proportion to the width of spark gap. Also, how to determine the number of oscillations and wave length wireless telegraph system as mentioned in SUPPLEMENT, No. 1383, Siemens & Halske system or any system. A. The voltage necessary to force a spark through ¼ inch of air varies greatly with the shape of the terminals, as points, balls or plates; and with the pressure, moisture, and temperature of the air. Thus a spark 1-5 inch long was produced between balls 1-10 inch in diameter by 16,200 volts; and between balls 1 inch in diameter by 18,900 volts pressure. The subject is quite fully treated in Thompson's "Elementary Lessons." The methods of measuring lengths of electrical waves will be found in papers given before the American Institute of Electrical Engineers. Prof. Pupin has presented several papers upon these topics, which we cannot abstract in a letter.

(8899) S. M. G. inquires whether a jump spark coil can be made by single windings instead of primary and secondary windings. If so, what size wire and how heavy insulation is best for a current of 5 to 8 volts pressure? A. A coil can be made for gas lighting and similar small uses with one winding; but a jump spark of sufficient length to make a sure ignition in a gas engine should be an induction coil with primary and secondary windings. A spark coil with one winding may be made with a core 10 inches long, covered with paper. The winding should be of cotton-covered magnet wire, say No. 14, of which 300 feet or thereabout may be wound on. The spark is given at the breaking of the circuit, and is due to self-induction. Each layer may be separated from the adjacent layers by brown paper, not very thick. No very definite rules are required, as there is a great difference to be noted among these coils. The battery may vary, and as it runs down, more cells may be attached.

(8900) A. B. C. asks for a formula for oxidizing linseed oil without litharge; want to have oil very heavy and bright, and entirely free from fat. A. Keep the oil at a temperature of somewhat over 130 deg. C., while a current of air is passed through or over it; then increase the temperature until the oil begins to effervesce from evolution of products of combustion. By continued boiling the oil becomes very thick and may be drawn out into elastic threads, which are very sticky, but do not produce a greasy stain in paper.

(8901) R. F. D. asks: In the Planté type of cell, how many square inches of positive plate surface are reckoned for one ampere-hour? By Planté type I understand that metallic leaden plates are immersed in the electrolyte, which I suppose is correct. A. The Planté type of secondary cell is defined by Foster in his "Electrical Pocket Book" to be "constructed of lead plates so designed as to present a large surface area to the action of the electrolyte, the active material being formed on the plates, either electrically by charging and discharging, commonly called forming, or chemically." The same authority gives a formula for calculating the theoretical capacity of a cell per pound of active material. This is the better way of expressing it, since to base the capacity upon the surface will not take the thickness into account. The *practical* results given are: For lead peroxide and the same weight of spongy lead per ampere hour: 0.53 ounce for a ten-hour rate of discharge; 0.62 ounce for a five-hour rate of discharge; 0.70 ounce for a three-hour rate of discharge; 1.00 ounce for a one-hour rate of discharge. These numbers are for plates of ordinary thickness and an electrolyte of the density of 1.200.

(8902) P. S. B. wants to know the composition and the method of manufacture, of carborundum. A. The mixture from which carborundum is produced consists primarily of coke and sand, to which is added a small amount of salt to facilitate fusion, and a small amount of sawdust, which evolves gases upon heating, and these gases tend to keep the mass more porous and thus facilitate the escape of the carbon monoxide gases later produced. This mixture is packed between the two carbon poles carrying the current, there being, however, a central core of coke placed directly between the carbon poles, providing thus a conductor for the current and so overcoming the difficulty of starting up, and also keeping the internal resistance more uniform by breaking up the arc into numerous small arcs. Carborundum is a silicide of carbon; the formula is CSi.

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Display mechanism, curtain, A. M. Davy	722,568
Display rack, C. E. Brackbill	722,279
Distance meter or range finder, J. P. Sorensen	722,435
Dividers, H. C. Adamson	722,551
Door, electrically operating, J. Chambers, Jr.	722,446
Double claw or grip device, H. Sheeler	722,257
Dough cutter or slicer, E. P. Messner	722,452
Dough dividing machine, F. H. Van Heuten	722,545
Draft equalizer, P. Yeager	722,347
Dredging machine, W. W. Lea	722,595
Dress shield, D. Basch	722,395
Drill. See Grain and fertilizer drill.	
Driving mechanism, W. Scott	722,388
Driving wheel, traction motor, E. Boniecki	722,278
Drop curtain, mirror, H. M. Williams	722,342
Duplicating machine, H. C. Gammeter	722,404
Dye and making same, yellow sulfur, Ris & Mylius	722,630
Dynamos, automatic regulator for constant current, F. B. O'Hanlon	722,533
Egg carrier, H. S. Jenne	722,512
Electric controller, F. A. Merrick	722,527
Electric current controller, J. J. Murphy	722,453
Electric furnace, A. A. Shade	722,411

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