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 This is for our information and not for publication.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.

(9733) J. F. S. asks: Will you kindly explain how it is that makers of dry batteries rate their cells in amperes? Thus, they claim that a cell will show 14 or 16 amperes. I always supposed that an ammeter simply showed the *rate* at which current flows. This being the case, the reading on the ammeter would be dependent on the voltage and the resistance in circuit. Would it not be better practice to test cells with a voltmeter? A. You are correct in supposing that the amount of current registered on an ammeter connected in a circuit is dependent upon the voltage and resistance. In testing dry batteries, however, it is customary to short circuit each cell for an instant through an ammeter to see what is the maximum rate at which it will discharge. When new, this gives an indication of the capacity of the battery, and, as a cell becomes run down, the rate at which it will discharge when momentarily short-circuited decreases. When this falls to 5 amperes the cell is about used up for anything but very light, intermittent work. Cells in this condition will sometimes still spark a gasoline engine if the vibrator is properly adjusted to suit the weak current they will supply. The voltage also falls off slightly as a dry cell becomes run down, but this indication is not as definite as the amperes in the cell will show, while with a storage cell the voltage taken when the cell is discharging is a good criterion of the amount of charge still in the cell. A dry cell shows 1.5 volts when new and anywhere from 1 to 1.25 or possibly more when run down. A storage cell shows 2.1 or 2 volts under discharge when full, about 1.9 when half discharged, and 1.8 or 1.75 when fully discharged. It will, however, immediately return to 2 volts when on open circuit. In short-circuiting dry cells through an ammeter, but one cell at a time should be tested and care should be taken to have large enough wire to carry the current easily. The wires to the meter should be as short as possible and all connections should be well made. A whole battery of 4 or 6 cells can be short-circuited at once, but this gives an average discharge only and does not indicate the condition of each separate cell.

(9734) G. O. asks: Will you kindly state in your Notes and Queries if the dynamo described in the SUPPLEMENT No. 600, by George Hopkins, can be made into a 110-volt and 5-ampere machine, the size and amount of wire? A. The dynamo of SUPPLEMENT No. 600 can be rewound for 110 volts. We have published the mode of doing this in Answers to Queries: 9553, vol. 92, No. 11; 8316, vol. 85, No. 7; 8250, vol. 85, No. 1. We send these papers for ten cents each. The general rule for making such a change in the design of a machine is to double the number of turns on the armature and rewind the field with twice the number of turns, using wire of half the sectional area.

(9735) T. G. asks: I refer to your Notes and Queries column March 25, page 248 (No. 9565). You say: "Since the tank weighs 10 pounds an addition of 73 1-3 pounds in the tank will sink it." I suppose you did not intend to say will sink it to the *bottom* of the water? Would not the tank be kept swimming in submerged position at a certain distance under the surface of the water for the reason that the tank is closed air-tight and no water can enter the tank, and for the reason that 1 1-3 cubic feet of water at the surface of the water do not weigh as much as at the depth or bottom of the water, because for example the water at the bottom of the ocean is more compressed than at the surface and consequently 1 1-3 cubic feet of water weighs more and more the closer to the bottom of the ocean it is? For this reason the air-tight tank displacing 83 1-3 pounds of water at the surface of the water would not sink to the bottom, but be kept swimming in submerged position at a certain distance under the surface of the water. Would it be possible to put just enough weight in such a tank to make it stay in a submerged position say 4 or 5 inches under the surface of the water? A. We have treated the question of a submerged body many times in the query column, and would refer you to Queries 8307, 8440, 8935, 8959, 9500, in which different phases of the matter are discussed. But we have always said a body which will sink at all in water will go to the bottom. The reason is that water is less compressible than any metal or other substance which may sink in water. The references we have given above furnish you the figures of compressibility of water, etc. Water is not much denser at the bottom of the ocean than at its surface. Now, your question involves a somewhat different point. The container in this case is filled with water which is compressed as it descends in exactly the same degree as is the water in which it is sinking. There remains only the compression of the container. If, then, the box will sink at all the container will be compressed more than the water in which it is sinking and the whole will go to the bottom, if it sinks at all. It is not possible as a practical matter to make anything float just under the surface of water. We have tried to do this many times. The slightest change of buoyancy will bring such a body to the surface. The fatal point in this question is that the tank is to be filled with air and not with water; and air is readily compressible under all conditions. Hence, as the tank sank it would always grow smaller by compression and displace less water. Hence it would sink faster as it went deeper. There is no chance that the tank in the case proposed could ever rest except at the bottom of the water.

(9736) W. I. H. asks: 1. What is the heat conductivity of carbon such as the pencils used in arc lamps? What order does it have in the scale of conductors? A. The conductivity of carbon for heat is 0.000405, when copper is 1.0405 on the same scale. This is less than all the metals, stones, and many minerals, and more than most woods, wool, and animal substances generally. 2. What is its fusing point, or does it only fuse in the electric arc? A. Carbon has not been melted, though under sufficient pressure there seems to be no reason why it may not be melted. It turns or seems to turn directly into a vapor upon heating it sufficiently. It vaporizes in the electric arc at a temperature between 5,000 and 7,000 deg. F. The electric arc is the only source of heat hot enough to vaporize carbon. 3. What is its specific gravity? A. The specific gravity of carbon in the form of graphite is from 1.9 to 2.3. The porosity of electric light carbons would probably cause them to appear lighter than this. 4. How is it manufactured and of what is it composed? A. Carbon is manufactured from wood as charcoal; from coal in retorts as graphite. Carbon is carbon. It is an element, and so far as man is able to affect it, it is not made from any other substance, nor changed into any other substance. 5. What holds it together, that is, is it plastic when molded or molded under great pressure? A. Cohesion holds the particles of a lump of coal or other piece of carbon together. It is not plastic in its ordinary states. In the electric light carbons the particles are bound together by some sticky material, and the rod is then burned in a furnace. 6. Is it what would be considered an expensive product? Please give some idea of cost in molded shapes and in bulk. A. Carbon is not an expensive article. You know probably what a ton of coal or a cord of wood is worth at your place. In buying either you are buying carbon. 7. Could scraps of it be pulverized and again molded into shape? A. Pulverized gas carbon, or graphite, is molded, as we have said above. 8. Can you supply us with the addresses of firms making articles of carbon? A. The Dixon Crucible Company, Jersey City, N. J., make crucibles, lead pencils, and many other articles of graphite. All dealers in electrical goods have electric-light carbons, battery plates, and motor brushes for sale. They also may have granular carbon for use in the telephone transmitter. Jewelers deal in diamonds, which are crystallized carbon. 9. All authorities do not agree upon the melting point of gold. Please tell the melting point both in Fahrenheit and Centigrade. A. The melting point of gold ranges from 1,035 to 1,250 deg. C.; 1,080 deg. may be taken as an average value. This is from 1,900 to 2,250 deg. F.

(9737) L. F. S. asks: I believe that astronomers consider the planet Mars to be an old planet on account of there being very little water on it. Then, if this is the case, is the water gradually getting less on this world of ours, and if so, by what means, as when evaporation takes place on the ocean, this moisture falls again in rain. Does some moisture get carried into space? A. A vast amount of water exists in the rocks and other solids of the earth in a fixed form, and in the formation of rock, which is still going on, water disappears from the liquid state. This is not, however, the mode in which geologists believe the earth will grow old and die, but rather by becoming cold. As the earth cools the water can sink deeper below the surface. At present it is driven back as steam. The oceans can all go down below the solid surface into the porous solids of the depths of the earth and freeze there, or freeze on the surface in their beds, for that matter. It is not probable that water as water is carried out into space from the earth.

(9738) C. M. G. writes: Please give the solution and answer to the following problem in the SCIENTIFIC AMERICAN, also the rule to solve this class of problems: A siphon pipe 4 inches in diameter is laid in a small mountain stream to convey the water downstream (for a certain purpose) for a distance of 250 feet. A dam 5 feet high impounds the water, and the flow keeps the water stationary one foot from the top of the dam. In the 250 feet the pipe falls 4 feet, thus leaving the outlet of the siphon 8 feet below the surface of the water impounded. The distance from surface of the water to the paxe is one foot, altitude 4,500 feet. What is the pressure per square inch at the intake end of the siphon? A. We would say that if the water in the siphon were not flowing, the pressure at any point in the system could be readily found. It would be zero pounds above the pressure of the atmosphere at any point on a level with the surface of the water at the intake. For any point below the surface of the water, the pressure above that of the atmosphere would be equal to the distance below the level of the surface in feet multiplied by 0.433 in pounds per square inch. For any point in the siphon above the water line at the intake, the pressure would be less than the pressure of the atmosphere by an amount equal to the height of the point in question above the level of the intake in feet multiplied by 0.433, this result, as before, being in pounds per square inch. If the water is flowing through the siphon at a uniform velocity, the problem becomes very much more complicated, as the friction of the water in the pipe varies with the character of the pipe, its diameter and the velocity of flow. This makes accurate calculations very difficult. The pressure at any point in the system, however, would always be equal to the pressure found by the above rule, on the supposition that the water was at rest, minus the loss in pressure due to friction between the intake and the point in question, minus $0.433 \times \frac{v^2}{64.4}$ where v equals the velocity of the water in feet per second.

(9739) W. W. S. asks: Will you please explain why an incandescent light filament in circuit on an alternating current of about 125 volts swings back and forth when an ordinary horseshoe magnet is held with the north and south pole in a horizontal plane, while if these poles are held with their centers in a vertical one, no vibrations result? A. The vibration of the filament of an incandescent lamp under the influence of a magnet is due to the effort of the filament to turn in the magnetic field and place itself in the proper plane of rest with reference to the field of force of the magnet. The filament is a flexible conductor carrying a current of electricity and tends to rotate until the lines of its field are parallel and in the same direction with those of the magnet. In this respect it is just like a suspended coil of wire in Ampere's experiments, which may be found in any good text book. The filament may be ruptured if too strong a magnet is brought near it.

(9740) A. L. asks: Kindly oblige me by answering the following questions: 1. What is best material to make a magnet of? 2. What is the best means of making a magnet? 3. Does the north pole of a magnet repel the north pole of another magnet in practice the same as in theory—I mean on a large scale? A. Permanent magnets are made of steel, the best steel to be found. Tool steel is often used. Manganese steel is preferred by some; chrome steel, or tungsten steel also may used. Heat the bar to a cherry red, or if it is long, the ends of the bar, and plunge it endwise into water. It will then be glass hard. Draw the bar across the poles of a strong magnet, either another permanent magnet or, better, an electro-magnet. Do this ten to twenty times, pulling it off in the same direction from one pole, and then reverse the bar and pull the other end from the other pole in the same way. There is a repulsion between similar, and an attraction between opposite poles of two magnets. If the magnets be strong this will also be strong.

(9741) A. G. L. asks: What is the capacity of the condenser used in a Ruhmkorff coil with 2-inch spark? Is it possible to connect two condensers in multiple so as to make one of double capacity? How many volts would it take to run a 2-inch Ruhmkorff coil to its full capacity? Is there any possible way to find out how many vibrations a second an interrupter can make? A. A condenser for an induction coil giving a spark 2 inches long should contain about 15 square feet of tin foil. It is well to make the condenser so that it can be separated and the parts capable of being used separately, so that it may be adjusted to the strength of the battery. A condenser may have its capacity altered by dividing it into halves or any other fractional parts. Any number of condensers may be connected in multiple, and a greater capacity be secured. Three to six cells will be required for a 2-inch induction coil, according to the kind and condition of the cells. The number of vibrations of an interrupter may be approximately determined by the note given by it.

(9742) W. C. W. asks: 1. What metal or substance transfers electricity most quickly and easily by induction? A. There would not seem to be any considerable difference in the metals in the transfer of electrical induction, but electricity is not transferred by induction. 2. When we touch an electrical eel, what kind of electricity does he shock us with or project upon the person? A. Electricity is positive and negative, and a shock is always due to both. A shock is given by an electrical charge. This may be either of positive or negative electricity, and the shock is due to the sudden combination of an equal quantity of each. In a charge of electricity, the electromotive force may rise very high and the charge become very intense. The old name for this condition was static electricity, a name which has disappeared from the recent books. This is the condition of the electrical eel. These matters are well and fully treated in the new book just issued, "The Electrician's Handy Book," price $3.50.

NEW BOOKS, ETC.

THE REVELATIONS OF NATURE. By Leonidas Guillemet. San Francisco, 1905. Published by the author. 16mo; 258 pp. Price, $2.

This book contains a philosophic essay in three parts which treat of perpetual motion; forces of matter and celestial mechanism; and life and spirit, the infinite, and immortality. The author does not claim to be a man of science, although science undoubtedly has attracted him greatly and caused him to delve in and speculate upon some of the mysteries of nature which have been heretofore variously explained, or for which no suitable explanation has been found. Mr. Guillemet claims to have solved the problem of perpetual motion by means of liquid air. After stating that "all the cold imparted to a gas by abstraction from a liquified gas represents new energy," he goes on to say: "The question is to provide a machine that saves it and continues indefinitely to make more. That is easy enough when one way to do it is known." By his discovery (which is the subject of an application for a patent) the author has found out that the refrigeration and liquefaction of air will generate energy instead of spending it. The source of energy available to draw upon is the difference between the temperature of solid air and that of the atmosphere, he claims.

While people well informed on the subject in question may not agree with the author in some of his deductions, nevertheless they will find his book an interesting, clearly written little volume containing fresh ideas and speculations not only on perpetual motion, but also on the workings of nature in various directions and the operation of the universe as well.

PROPERTIES OF STEEL SECTIONS. By John C. Sample, C.E., M. Arch. New York: McGraw Publishing Company, 1905. 8vo.; pp. 121. Price, $3.

This is a reference book for structural engineers and architects. It includes many tables of moments of inertia, and radii of gyration of built sections, etc., besides examples of sections selected from monumental structures, unit stresses, safe loads for columns, plate-girder design, design in timber, and the like. The book consists chiefly of carefully calculated tables, which will save the designer much preliminary figuring in all standard designing. Only sufficient text to explain the application of the tables is included in the work. On account of its practical character, it should be a great help to all structural engineers and designers.

HYDRAULIC POWER ENGINEERING. By G. Croydon Marks. New York: D. Van Nostrand Company, 1905. 8vo.; pp. 388. Price $3.50.

This volume, which is a successor to a smaller book on Hydraulic Machinery published some four years ago by the author, is a practical manual on the concentration and transmission of power by hydraulic machinery. The author first gives an outline discussion and description of the main points and principles to be noted by engineers in designing or constructing apparatus for the utilization of water and the transmission of power. Subsequently, the author has given examples of special hydraulic machinery for various purposes. The second edition of the work contains examples of the latest developments in hydraulic pressing and lifting machines, these examples being illustrated by diagrams of typical valves, and machines for this purpose. Some forty illustrations have been added in the present edition, making a total of 240 in all. The book is divided into eight parts dealing with the Principles of Hydraulics; Hydraulic Pressures, Materials, and Test Loads; Joints; Valves; Pumps; Lifting Machinery; and Hydraulic Presses and Motors. Besides the table showing the water pressure in pounds per square inch for every foot in height up to 270 feet, the appendix contains a table giving the diameters, areas and displacements of pumps, and some thirteen other tables of use to hydraulic engineers are dispersed throughout the text. Besides diagrams of machinery the book contains a number of halftone photographs of hydraulic lifts, bridges, docks, cranes, etc.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending August 15, 1905

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Acid into stearic acid, converting oleic, A. de Hemptinne 797,112
Adding and printing machine, C. Wales.... 797,082
Addressing machine attachment, E. D. Belknap 797,092
Advertising curtain device, F. C. Chapman 797,097