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 This is for our information and not for publication.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.

(9648) L. K. asks: Will you kindly tell me through your valuable paper which way the compass points south of the equator—to the north or to the south pole? A. In both hemispheres the magnetic needle points to both poles, except for the declination of the needle. That the north end of a needle should point to the north pole necessitates that at the same instant the south end should point toward the south pole. Along the line of no magnetic declination this is actually the case. The needle points to true north and true south.

(9649) F. B. B. asks: Would you please answer through your columns why any change in the number of magnetic lines of force passing through the spaces inclosed by a coil of wire produces a current of electricity in that wire? A. The reason why a change in the magnetic condition of a space produces a current of electricity in a conductor in the same space, is to be found in the theory of the ether of space. The ether is subject to stresses which produce various effects in vibrations, vortices, and currents. To the vortices are attributed the magnetizing power of the ether; to the difference of potential set up in various ways is due the flow of electricity. A change of magnetic condition has been found to be an occasion of a flow from a point of higher to one of lower potential. This is an electric current. If there is a wire there, it will usually take the wire in its path, otherwise it goes through anything it can break through, as in the case of a stroke of lightning. A change in the magnetic lines of force produces a similar effect in a small way in our apparatus, and thus we have a current of electricity whenever the number of lines of force inclosed by a coil of wire are changed.

(9650) L. A. T. asks: Will genuine amber burn? A. Amber burns with a pale yellow flame, with a good deal of black smoke, evolving an agreeable odor, and leaving a black mass of carbon behind. As it is about 79 per cent carbon, and 10.5 per cent each of hydrogen and oxygen, it is evident that it must be combustible. We should infer the same fact from its origin. Amber is a fossil gum, partly soluble in alcohol and ether; since it frequently contains insects, it must have been a viscid liquid when these were entrapped to their destruction. Imitation amber may be made with the insects in place as in the genuine article, although in the genuine amber the insects are usually of extinct species. 2. Is there any imitation of amber that can be electrified, so that it will pick up bits of paper as amber will? A. Since most gums and resins can be electrified by rubbing, it is probable that imitations of amber may be electrified. 3. Kindly give me an infallible test by which the genuine article can be identified. A. Amber contains nearly 90 per cent of a resin which resists all solvents, called succinite, and 2½ to 6 per cent of succinic acid. There are also two other resins soluble in alcohol and ether, besides an oil. The determination of these by analysis will determine the substance to be amber.

(9651) N. H. asks: Will you kindly answer in Notes and Queries column the following: A doctor uses an X-ray machine when examining patients, and claims to be able to see sore spots and small ulcers on lining of stomach and hepatized spots on lungs, also sores on other internal organs. I have looked through two different X-ray machines, but could only see the bones and flesh. The bones cast a dark shadow, while the flesh cast a lighter shadow. I could not distinguish one organ from another. Which is right? A. We would beg to refer you to the note in the Scientific American of March 11, 1905, page 208, for a partial answer to your inquiry as to the possibility of distinguishing diseased conditions in the interior organs of the body by means of X-rays. We have seen the proof of the correctness of this means of diagnosis, and have the skiagraphs of such conditions in our possession. The lungs, stomach, kidneys, bladder, and liver are susceptible to this mode of examination. Whether the physician you have in mind is sufficiently experienced with these rays to use them for this purpose we do not know. It is certain that a large experience is necessary. We have many times tried to have persons see things on the fluorescent screen which were perfectly plain to us, but which they could not distinguish at all.

(9652) C. K. asks: 1. Is there any method of calibrating volt and ampere meters without the aid of another volt or ammeter? Would the following method answer? Place two 220-volt lamps in series on a 220-volt light circuit, causing a 110-volt drop in each lamp. Connect the voltmeters in shunt with one of the lamps, and add or take off enough resistance from the meter to make it read 110. Place four lamps in series, and shunt the meter with one of them to get 55 volts. A. You can determine several points on the scale of a voltmeter in the manner you describe by the use of lamps in a rough way, but the voltage of the circuit and the voltage of the lamps are neither of them to be relied upon to any great degree of accuracy. If one cannot do better, this way is better than nothing; but in a great city it should be possible to graduate a scale by comparison with that of a reliable instrument. Standard lamps can be had from certain parties which test and guarantee them to be of the rated voltage. 2. Have you any publications that deal with practical measuring instruments? A. We can furnish you Reed's "American Meter Practice" for $2. It is a recent and reliable work on this subject.

(9653) J. W. asks: 1. How is bicycle riding explained? By what laws does a man balance himself? A. A bicycle maintains its upright position upon the same principle that a pendulum maintains its plane of oscillation, or a rotating wheel maintains its plane of rotation. This is most clearly illustrated in the Foucault pendulum and the gyroscope. As long as the bicycle is moving, it will not fall over. 2. Scientists claim to find the shape of the earth by the pendulum. This would all be very well if the density of the earth were the same in all of its parts, but as that is very improbable, it seems to me that the results of these measurements are also very improbable. Is there any way of correcting these results? A. The time of vibration of a pendulum depends upon the intensity of gravity in the place where it is hung and swung. The variation in density of the earth is not great, and the mean density is known to sufficient accuracy. It is not probable that the results of pendulum measurements are greatly in error, or in error at all beyond the variations assigned as the limits of the determination. We have no better way to determine the form of the earth than by the pendulum, and measurements of meridians. 3. In looking over several cyclopedias for the article Parallax, I find that astronomers do not make any allowance for the motion through space of the solar system and of the star whose distance is to be measured. Do they really make any allowance for these motions? These motions certainly influence the parallax. A. The proper motions of some stars are known, and can be allowed for when these stars are observed. This is so little that it cannot affect the parallax to a sensible amount. The nearest star is 4 1-3 light years distant from us. The sun is 8 minutes and 19 seconds from us in terms of the velocity of light. The annual parallax of the nearest star is 75-100 of a second of arc; its distance is 25,000,000,000,000 miles. The variation of its parallax due to the motion of the sun in a year through space is not appreciable. 4. We are bothered here with alkali water. Is there any way of making such water drinkable? A. Without an accurate chemical analysis of your water, it is impossible for us to express any opinion. The question of the purification of drinking water is always a somewhat difficult one, and it seldom happens that impure water can be much improved without considerable trouble and expense. In case you have not tried it, however, we would suggest your boiling the water for a period of about twenty minutes. With some waters this will cause a sediment to form, which when allowed to settle, removes many of the impurities with it.

(9654) J. D. asks: Can you give me in your query department of your paper, data for a small jump-spark coil, such as is used on gasoline motor cycles to explode mixture? Using four dry batteries for the primary excitation. Writer has several pounds of No. 36 B. & S. silk-covered copper wire. Can this be used on secondary? A. A strong and reliable spark can be made for gas ignition with a coil of the following proportions: core length 7 inches, diameter ¾ inch, made of No. 20 iron wire, B. & S. gage. Primary of three layers of No. 14 copper magnet wire, cotton covered. Secondary 1 pound No. 36 silk-covered wire. Condenser of forty sheets of tinfoil, 4 x 6 inches. The insulation of the secondary should be very carefully attended to. Failure here will cause a loss of the whole. The details of the work are given with great fullness in Norrie's "Induction Coils," which we can send you for $1.

(9655) H. J. B. writes: In reading of the applications of electricity in the treatment of disease, I find a statement which seems a little at variance with some others that I have noted. For instance: One, after connecting forty large Columbian dry cells in series (each one giving about 15 amperes), says he was surprised to find an output of 1,600 milliamperes. Now, when the inspector of the telephone comes around, he applies an ampere meter, and from three small cells shows an amperage of 6 or 8 amperes. If I understand the term, a milliampere is 1-1,000 = 0.001 of one ampere. What becomes of all the rest of the electricity, and why do they measure one set of cells with the fractional meter, and the other set with the full measure? As I am a constant reader of your paper, I shall be pleased if you will give me a little more light on this matter. I am thoroughly conversant with the fact that we can seldom take out all that we put into the dish; some will stick to the sides, and there are various ways of loss. But it seems that in this case there must be something that I am a little behind in, and thus I refer to you. In a certain catalogue, I find a description of the Laclede cell or battery, saying "Connected with a faradic coil with milliamperemeter in circuit, it ran the coil 300 hours, giving a 70-milliampere current; on short circuit it gives one ampere; its voltage will average 1.5." A. You are correct in saying that a milliampere is a thousandth of an ampere. Thus 1,660 milliamperes are one and six-tenths amperes. It would be quite as well to express it in that way. But physicians are in the habit of using milliamperemeters, and so fall easily into thinking in the smaller unit. As to the output of cells: The large current can only be realized on short circuit, that is, with no external resistance, and even then a number of cells in series will not give a very large current, or number of amperes. In the case you cite, forty cells in series gave only 1.6 ampere, when one alone will give 15 amperes. The current is cut down to a tenth of the full current of one cell. This is because of the increased resistance in series. Increasing the number of cells in series does not give more current unless there is a large external resistance. With a small external resistance it is better to put the cells in multiple for larger current in amperes. As no data for the various resistances are given in your citations, we cannot present any numerical solution for the different cases, but doubtless this could be done with a full knowledge of the conditions.

(9656) H. J. F. asks: Will you please tell me if a piece of paper 8 inches x 8 inches can be cut so that it will cover a surface containing 65 square inches? Explain if it can be done. A. A piece of paper 8 inches x 8 inches contains exactly 64 square inches of area. By cutting it you cannot make the area any greater. Therefore, by no conceivable means can it be made to cover a surface containing 65 square inches.

(9657) J. G. P. says: 1. I want to put a slide-valve engine about 900 feet from the boilers. The lead pipe to engine is 3 inches. Should this lead pipe be larger? If so, should it be larger all the way, and how much larger should it be? With high-pressure boilers, should the engine have a receiver or separator? A. It will be considerably cheaper to use a 3-inch pipe all the way from the boilers to the engine than to use a larger size; and although there will be a considerable drop probably in pressure between the boiler and the steam chest of the engine, we do not think that this would cause sufficient annoyance to warrant the additional expense of the larger pipe, unless it is desired to have the engine develop the maximum power that it is capable of generating. In the latter case, a 4-inch pipe would be better. A steam separator of liberal size should be placed in the steam pipe close to the engine, but a receiver is not necessary. 2. In putting a crankpin in a large engine, is shrinking the best method? If so, how hot should the disk be heated? How is the best method to heat? Will it hurt the disk, or is there any danger if it gets hot around the main shaft? Could you crack the disk in shrinking the pin in? Should it cool itself, or should there be anything used to cool it? A. Hydraulic pressure is the best means of securing a crankpin in a large engine. If this is not available, the next best plan is to have the crankpin slightly tapered, and then force it into the disk by means of a large nut. It is possible to do this work satisfactorily by shrinkage, but there is some danger of warping the disk slightly by unequal expansion of different parts of the disk. If this method is used, very great care should be taken to heat the disk slowly and uniformly, heating a considerable area on all sides of the crankpin up to a high temperature, but one, of course, very much below a red heat. Care should also be taken to have the cooling as slow and uniform as possible.

(9658) A. L. T. asks: Will you be so kind as to inform me if it is possible or impossible to make a so-called permanent magnet out of a pure soft iron, i.e., a magnet, for example, similar to the steel horseshoe magnets as now made? Can a permanent magnet be made out of any iron? I do not refer to the residual magnetism remaining in the field magnets of a dynamo when not in motion. A. Any iron or steel which has once been magnetized does not again lose all its magnetism, except by heating it red hot. Its magnetism is then destroyed. Good soft iron, cast or wrought, will, however, retain but little magnetism after the magnetizing force is removed. The retentivity to which you allude is the same property in steel as in iron. The field magnets of a dynamo, when of iron, retain little; when of steel, retain more magnetism. A hard steel retains so much that it is called a permanent magnet. It, however, does not retain full magnetic saturation, but loses considerable magnetism very soon after the magnetizing force is removed from it. It is strongest just after it is magnetized. From the above it will be seen that a magnet cannot be made of iron which deserves to be called a permanent magnet.

NEW BOOKS, ETC.

Practical Sanitation. By George Reid, M.D., Ph.D. With an Appendix by Herbert Manley, M. A. Cantab., M.B., Ph.D. Philadelphia: J. B. Lippincott Company, 1904. 8vo.; pp. 351; numerous diagrams. Price $2.

That this handbook on practical sanitation, for sanitary inspectors and others interested in the subject, is of value is shown by the fact that it has reached its eleventh edition. The author is an expert on the subject, and has gone into it in great detail. Among the subjects treated are Water Supply, Drinking Water, Pollution of Water; Ventilation and Warming; Sewerage and Drainage; Sanitary and Insanitary Works and Appliances; Details of Plumbers' Work; Sewage and Refuse Disposal; House Construction; Infection and Disinfection; and Food. The addition of the Acts of Parliament relating to public health in England and Wales is useful as an example of the highest form of sanitary legislation.

Telephone Development. By Vinton A. Sears. Boston: Barta Press, 1905. 8vo.; pp. 121.

The object of this pamphlet, which is now published for the second time, is to encourage the development of the telephone by showing conclusively that better service and lower rates are already being enjoyed under competition. That such service and rates are being furnished to-day on a large scale by telephone companies independent of those operating under the Bell patents, and in successful competition with the latter, besides making attractive earnings at rates which the Bell companies have declared prohibitive, is demonstrated to the satisfaction of all. One of the most interesting facts brought out is that the most important improvements and the most modern high-class apparatus are to-day controlled by independent companies. Telephone conditions in various cities throughout the country, the investigation of the telephone trust, telephone securities and finance, etc., are thoroughly discussed. A map showing the independent telephone toll lines in New York, New Jersey, and Pennsylvania is one of the useful features of this pamphlet.

Calcareous Cements: Their Nature, Manufacture, and Uses, with Some Observations on Cement Testing. By Gilbert R. Redgrave, A.I.C.E., and Charles Spackman, F.C.S. Philadelphia: J. B. Lippincott Company, 1905. 8vo.; pp. 310; 63 illustrations. Price, $2.75.

As the cement industry has been completely changed, and the processes of manufacture used in it have undergone a great revolution in the past ten years, due to the introduction of the rotary-kiln tube mill, as well as other important inventions, the authors of this work, in preparing the second and revised edition, have had to alter it considerably. All the latest processes used in cement manufacture, both here and abroad, are illustrated and described; and all the theories of cement reactions that have been advanced by English and foreign experimenters are given in a chapter on the Analysis of Cement Mixtures. All information of value regarding the cement and concrete industry will be found in this book, which we heartily recommend to all interested in the subject.

An Outline of the Theory of Organic Evolution. With a Description of Some of the Phenomena Which it Explains. By Maynard M. Metcalf, Ph.D. New York: The Macmillan Company, 1904. 8vo.; pp. 204; numerous illustrations. Price, $2.50.

In this book, which is the outcome of a series of lectures given by the author before the students at the Woman's College of Baltimore, the author sets forth briefly the theory of evolution and describes some of the phenomena which it explains, after which he discusses the relation of mankind to evolution. The book serves as an introduction to this great theory, and gives a comprehensive outline of it, together with sufficient illustration to tempt the reader to seek fuller knowledge of the many interesting phenomena relating to it. Although organic evolution seems to be satisfactorily established, there is far from a satisfactory knowledge of the factors which are at work to produce it, and especially are we ignorant of the manner of their operation. The author avoids discussing the more doubtful questions, but merely gives an outline of the apparently well-established facts as to the theory and some of its important corollaries. In the three cases where there is a general difference of opinion upon a fundamental point, namely, regarding the degree of efficiency of natural selection, inheritance of the effects of use and disuse, and evolution and sexual selection, Mr. Metcalf has given the divergent opinions and what seems to him the safest conclusion. The third point mentioned he has illustrated abundantly with pictures, showing some of the phenomena about the explanation of which there is so much difference of opinion. Color in animals is the subdivision of his work to which the author has given the most attention, his reason being that these phenomena might be readily observed by any person in any locality. The first section of the book deals with the theory of evolution, and the second section with the phenomena explained by the theory. The book is illus-