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 This is for our information and not for publication.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.

(9680) C. H. C. says: Can you inform me of the philosophy of the curving of a tennis ball when struck with a "cut," and why some balls, with a forward twist, drop, and others, with a reverse twist, carry a long way without dropping? Is the cause gyroscopic action, or the result of the climbing motion of the ball against the air, or what? A. The curving of a tennis ball is probably due to the same cause as that of a base ball. The rotation of the ball is such that the air pressure is greater on the side toward which the ball rotates, pushing the ball in the opposite direction. See SCIENTIFIC AMERICAN, July 16, 1904, for a discussion of this question. This explains upward and downward motions of balls, as well as sideways motions. There is no gyroscopic action, so far as we can see.

(9681) L. S. says: Several times I observed in your valued paper that one *thousand* millions is called one *billion*. So (issue of February 18, 1905, page 146) Mr. Edgar L. Larkin says that 500,000,000x64 = thirty-two *billion*. As far as I know, it is only thirty-two *thousand* millions; or thirty-two millions = 32,000,000, while thirty-two billions = 32,000,000,000,000. Please tell me in your notes and queries who is right. A. What is a billion? In Great Britain it is a million million—1,000,000,000,000; but in America a billion is a thousand million—1,000,000,000. We of course print numbers as they are expressed in America. Both ways are right; but one should know the custom of the country in which he is, to know what is meant. The American follows the French method of notation of numbers, three figures in one period.

(9682) M. E. G. says: I would like to know how long the longest railroad and street car rails are made nowadays. A. The usual length of railroad and street car rails is 30 feet, and they are furnished this length unless otherwise specified. They may be, however, rolled longer than this when especially ordered.

(9683) D. B. says: Will steam at a pressure of 110 to 120 pounds (not superheated) set fire to woodwork? The dry house in our factory gets so hot that our thermometers fail to register, as they are only marked to 125 degrees. A. The temperature of steam at a pressure of 120 pounds per square inch is 350 degrees Fahr. This is not hot enough to set fire to wood, but is hot enough to char it, and wood should not be allowed to come closer than two inches to such steam pipes without being protected with asbestos or other suitable covering. Thermometers may be purchased which will register up to this temperature, or if desired considerably higher.

(9684) C. E. D. asks: In your reply to query 9606, you state that daylight is gone after the sun is 18 deg. vertically below the horizon. It seems to the writer that this is an error. On almost any clear night in the latter part of June, the sun's light can be traced, decreasing as the hours pass by, farther and farther north until the North Pole is passed, when it begins increasing until dawn. If this is not daylight, what is it? It is a well-known fact that the nights in summer are not so dark as in winter, and this must be because the daylight is not so fully excluded. A. You are quite right in supposing that the light seen in the sky after the sun sets is sunlight. It is reflected from the dust particles in the upper air. This is twilight, not daylight, since daylight implies the seeing of objects distinctly, while twilight implies a dim, indistinct vision. *Twi* here means *between*, that is, neither light nor darkness. The twilight zone is about 1,500 miles broad, to the east and west of the sunset line. At different times in the year a different time is required for the sun to reach an altitude of 18 deg. below the horizon. In our latitude this is more than two hours in midsummer, and the shortest possible duration of twilight in the torrid zone is one hour twelve minutes, all the year round. The writer has lived there, and seen the night fall almost as soon as the sun sets. Twilight is not reckoned upon for working in the torrid zone, as it is here in the summer. The twilight illumination of the sky swings around toward the north as the sun itself does, and in the most northern portions of the United States the twilight zone does not dip below the horizon, even at midnight. Above latitude 48 deg. twilight of morning meets evening twilight at the north. Even in Montreal or Edinburgh the evenings of summer are very long, and the streets are filled with people much later in summer than with us. But wherever on the earth the sun is 18 deg. below the horizon, it is night, and no light of the sun is to be seen above the horizon. Another fact in this connection, is that the sky is never dark. This, however, is not due to the sun, but to the stars. The Milky Way is above the horizon in summer in our latitude, and it gives a great deal of light by night, enough to make the night sky of that time brighter than when it is not a part of our night sky, as is the case in winter. Then, too, the stars which cannot be seen by the unaided eye give us much light. The stars which are not visible to the eye give more light than those which are visible. We quote Todd's "New Astronomy," p. 424, on this point: "Accepting a sixth-magnitude star as the standard, and expressing in terms of it the light of all the lucid stars registered by Argelander (a catalogue of 324,000 stars to the 9½ magnitude), they give an amount of light equivalent to 7,300 sixth-magnitude stars. But calculation proves that the telescopic stars of this extensive catalogue yield more than *three times* as much light as the lucid ones do. The stars, then, we cannot see with the naked eye, give more light than those we can, because of their vastly greater numbers." In the whole heavens the stars give about 1-80 as much light as the full moon. There is good reason for the fact that the sky is light all the night.

(9685) A. C. asks: In constructing some storage batteries I run across the term "sponge lead," which is used in the active material. I would like information as to what this sponge lead is, and how it is made. A. In the charging and forming of the plates of a storage cell, the lead oxide or the lead plates are reduced to a spongy condition, a porous condition in which the acid solution penetrates to the interior to an extent. This lead is not put into the plates, but results from the action of the charging current upon the lead oxide, which is used as a paste in the making of the plates.

(9686) F. R. Co. asks: We wish to know if it is generally considered practical to connect a motor and incandescent lighting service to one meter, and if said meter will accurately measure the current consumed by each. If a meter is calibrated for motor service, which is usually rather irregular and which requires much more power than light service, will this meter register one or two incandescent lights just as accurately as if it were originally calibrated and intended for a lighting circuit? We note that in most cases companies run two distinct services for lighting and power, and same metered on different meters. A. In general, electrical meters register independently of the use to which the current is to be put after it gets past the meter. It may be that a meter which was sensitive to a single incandescent lamp would not be as sensitive to a 100-horse-power motor, or 1,000 lamps. But other than this we do not see that motor service differs at all from lighting service. We do not expect that hay scales will also weigh diamonds or medicine. And a meter for large currents cannot be equally sensitive to small currents. Probably the reason for using different meters for light and power is that frequently companies have different rates of tariff for the two different services.

(9687) M. D. S. asks: I desire to secure the formula of the solution for making blue prints; how to apply it to the paper, and how to develop and finish it, after printed. Can you inform me of any book treating on the matter and where to procure it? A. To make solution for blue-print paper, make a solution of potassium ferricyanide, 1 ounce to 5 ounces of water; also a second solution of 1 ounce of citrate of iron and ammonia to 5 ounces of water. These two solutions will keep indefinitely in separate bottles. To prepare the paper, take equal parts of each solution and mix them. The mixture is sensitive to light, and the rest of the work must be done in a feeble light. With a swab dipped in the solution cover the paper by passing across in parallel lines, and afterward crosswise of these, so as to have an even layer of liquid all over the paper and yet not enough to flow or drip. The paper is hung by a pin in the dark to dry. It is then ready for printing. After printing in bright sunlight, the picture is developed by putting it under water. Wash thoroughly till the white parts of the picture are clear.

(9688) E. C. B. asks: To extract the square root of any number between 100 and 9,999 with close approximation: Divide the number by a multiple of 10 whose square would be the nearest number exceeding the number the square root of which is desired; carry the division to at least one decimal place. Take one-half of the sum of the quotient found, and multiple of 10 used as divisor. In event of number being less than 100, simply divide it by its nearest square root; add this divisor to quotient found, and take one-half. Above may not be new, but having never run across it, thought it might be useful. A. This method of finding an approximation to the square root of certain numbers will be a help to those who need only an approximate square root. But it would seem better to be able to find the exact root to the desired number of decimal places by the usual process. Several numbers which we have tried yielded their roots with scarcely more work than is required in finding an approximation by the method given above. We printed the process of taking the square root of a number fully worked out in answer to Query 8196, Vol. 84, No. 22, SCIENTIFIC AMERICAN, which we send for ten cents. The process is easily learned and quickly applied. There would seem to be no need of approximate processes.

(9689) G. C. K. asks: 1. Where can I buy porous cups 1¼ inches outside diameter? A. For small porous cups address the dealers in electrical supplies who advertise in our columns. They can supply the size you name if they can be had. 2. Can the field of the motor described in SCIENTIFIC AMERICAN SUPPLEMENT No. 1195 be divided so as to make four fields in place of two, and how many turns will I have to put on so as to have the same horse-power described? I want to make it so I can run some small machinery. A. There is no reason why you should not divide the field winding of the motor into four parts as you propose. The result will be the same as if the field were in two coils when the armature has completed one revolution. Nor do we see that you will gain anything by making the change. The power will be the same as in the present design. It will drive small machinery just as well as it is. 3. Could I get Chapter XIX. of "Experimental Science," on a one-quarter horse-power electric motor, without buying the entire volume? If so, what will be the charge? I mean the one-quarter horse-power electric motor which may be enlarged or reduced. A. No, we have not published the one-quarter horse-power motor you refer to in the SCIENTIFIC AMERICAN or SUPPLEMENT.

(9690) B. T. asks: Will you please inform me why a gravity battery will not run a small electric motor which will run on a single cell of dry battery? A. One gravity cell will not take the place of one dry cell. The voltage of a dry cell is 1.4, while a gravity cell is usually not above 1.07 volts. Two gravity cells must be used in place of one dry cell. They will run the motor much longer and stronger than a dry cell. A dry cell is not adapted to a motor. It being an open-circuit cell, it should have a rest after working, as it does in ringing bells. A gravity cell is a closed-circuit cell, and should be kept at work. On an open circuit it does as poorly as a dry cell does on a closed circuit. You cannot use the same cell on both closed and open circuit work.

(9691) L. B. G. asks: Will you kindly give a rule for finding the velocity that steam is capable of attaining at all pressures, when the back pressure is known, and when expanding into the atmosphere? A. The rule most commonly used for determining the velocity of steam as it escapes from an orifice is:

$$G \; A \times \frac{P1}{70}$$

Where $P1$ is the pressure per square inch in the reservoir, A is the area of the orifice, G is the flow through the orifice per second in pounds. This rule only holds good where the pressure inside the orifice is at least 1.66 times the pressure of the atmosphere into which the steam is escaping. After finding the number of pounds of steam that flows through the orifice from the above formula, you can readily find the velocity corresponding by looking up the volume of one pound of steam corresponding to the pressure in any given case in steam tables, and from this calculate the velocity of flow.

(9692) E. H. W. asks: 1. What month and day of the month was Easter Sunday, 1863? A. In the year 1863 Easter fell on April 5. 2. Easter Sunday for any given year? A. Easter Sunday is calculated by the assistance of tables which may be found in the Episcopal Book of Common Prayer. It is kept on the Sunday which falls next after the first full moon following the 21st of March, or the vernal equinox. If a full moon falls on that day, the next full moon is the Paschal moon; and if the Paschal moon falls on Sunday, the next Sunday is Easter day. The moon referred to is not the real moon, but a fictitious moon which moves uniformly in the celestial equator in exactly the same time as the real moon moves in its orbit. Any attempt to locate Easter by the motions of the real moon as given in an almanac will frequently fail. The best way is to go to the Prayer Book and get the dates, which in some books are given for a couple of centuries.

(9693) F. L. asks: Will you kindly inform me through your columns if a bullet dropped from the muzzle of a rifle would reach the ground quicker than one fired from the rifle at the same elevation with the rifle held perfectly horizontal. I think that it would not. Am I right? A. A bullet dropped from the muzzle of a gun and one shot horizontally from the gun at the same instant are both acted on by gravity in exactly the same manner. Both fall toward the earth with the same velocity and both will keep all the time in the same horizontal plane. So both will strike the earth at the same distance below at the same instant. It is on this principle that the sights of a rifle are adjusted and all cannon aimed. Were not this true it would not be possible to hit a target at all. The science of gunnery teaches how to elevate the gun so that the ball will fall as it flies just enough to hit the target after one second or any other time of flight.

(9694) C. L. W. asks: In the SCIENTIFIC AMERICAN for February 18, 1905, I read a very interesting piece on the subject "Velocity Potential of the Universe." In this the writer states that "if a hole be through the earth, passing through its center, and a stone be let fall into it, the stone will move to the opposite side and return to the starting point; and if the air could be removed, it would oscillate to and fro so long as the earth endures. It would be a pendulum." I claim that the ball would stop at the center of the earth. The basis of my claim is Newton's laws of motion and weight given in all school physics. Would not the weight of the stone at the center be zero, and if its weight were zero, would it not stop? Please tell me who is right, and if I am wrong, how about the laws of gravitation? A. Your opinion that a ball dropped into a hole through the center of the earth will stop at the earth's center is the opposite of the belief held by mathematicians upon this point. We are not able to accept your view of the case. A falling body will have its motion accelerated as long as the minutest force acts upon it to draw it downward. This will be the case until it reaches the center of the earth. It will at that moment be moving with its highest velocity, and will pass to the region where the acceleration becomes negative, and tends to reduce the velocity. The center of the earth is but a point, and the momentum of the ball acquired during its fall will carry it past the center and forward as far as it fell to acquire that momentum, that is, to the surface on the opposite side.

(9695) H. M. says: 1. About what size and length is the wire wound on an induction coil in a long-distance telephone? A. There are many kinds of induction coils in use in telephone practice. An average coil may perhaps have ½ ohm of No. 24 wire in the primary and 250 ohms of No. 35 wire in the secondary. 2. What size and length is the wire that is used in a telephone receiver? A. A receiver may be wound with 100 ohms of No. 36 wire. 3. Would not the sending distance of the wireless telegraph instruments (described in the papers herewith sent) be increased by increasing the height of the aerial wire say by kite or balloon? A. The sending distance of a wireless telegraph depends upon the height of its aerials and the spark length of its induction coil. A kite and a balloon have both been used for raising the aerial wire, but the kite drags away so obliquely on the wind that little is gained by using a kite. So also does a captive balloon. 4. Why is it that a telegraph sounder of low resistance, say 5 ohms, is not suited for a line of much length, and a sounder of 20 ohms can be worked on a line up to 15 miles in length? A. The resistance of a sounder is only a mode of stating the number of turns of wire it has in it, and therefore the magnetic force it can exert. The more turns, the farther it can work. A 20-ohm sounder can work farther than one of lower resistance, since its greater number of turns of wire can produce more magnetism by a weak current, than a sounder of low resistance can produce with a weak current. 5. We have a mutual telephone line in our neighborhood. It runs very close to W. U. T. Co.'s line for about three-quarters of a mile. It crosses over the telegraph line in two places. At certain times, usually late in the evening, the line is bothered with so much noise that persons can hardly be heard talking over the line. The line is a party line with one wire, and cannot be transposed. Do you think the noise is caused by the two lines so close together? Can it be eliminated any other way than by using metallic circuits? A. The difficulty with your telephone line is its nearness to the other line. This can only be remedied by removing it from the neigh[illegible] the disturbing line or by mak[illegible]sed metallic circuit.

(9696) G. W. C. asks: 1. What is a cycle, in connection with gas or gasoline engines? A. A "cycle" in connection with any engine refers to the series of events which takes place from any point until the engine does precisely the same thing again it was doing at the start. Thus the "cycle" of an ordinary gas engine is as follows: A charge of air and gas is admitted during a forward stroke; the admission valve closes, and it is compressed during a return stroke; it is ignited during the return stroke: it expands during a forward stroke; the burnt gases are expelled through the exhaust during a return stroke; the engine is then at the point where we started, ready to take a fresh charge of gas and air, and the "cycle" is now complete. 2. Should one say an engine with single cylinder makes one or two strokes in one revolution? A. An engine with a single cylinder makes two strokes per revolution. 3. What is a "stroke cycle"? A. A "stroke cycle" would be the series of operations that an engine goes through during a single stroke. Thus, during the forward stroke of a steam engine, steam enters the cylinder; the admission valve closes; the steam expands; the release valve opens. This is not a common term and is not one of special value, because the "cycle" is not complete. 4. Must a two-cycle engine have two cylinders? A. No.

(9697) C. S. J. asks: 1. Do two objects, for example a ball of lead 4 inches in diameter and a cork ball 4 inches in diameter (thus presenting an equal surface for the air to act upon), fall to the earth in the same space of time if dropped from the same height at the same moment, under atmospheric resistance? A. A ball of lead falls faster through the air than a ball of cork of the same size, since it has more momentum for overcoming the resistance of the air. This is easily observed. If you watch motes floating in the air, or a feather, you will see the effect of the resistance of the air to the downward motion of light bodies. They lack weight for pushing the air out of their way. 2. Would the result be changed if the cork ball be, say, 8 inches in diameter and the lead ball 1 inch in diameter? A. The result will be the same if the cork ball is made larger, for the surface presented to the air increases as the square of the radius of the ball, while the weight increases as the cube of the radius. The ability to overcome the air varies as the radius. 3. Or would it make any difference in the time of descent if the cork be, say, only 1 inch in diameter and the lead ball 8 inches in diameter if dropped from the same height at the same time, under normal conditions of the air? A. You cannot make a cork ball fall as fast as a lead ball by any proportions whatever, so long as the densities of the two are so different. Compress the cork and it will fall faster. 4. In pumping water from a well with a common suction pump, does the person pumping by means of the pump-handle raise the *water* out of the well or does he lift a column of air of the same diameter as the well tube, thus letting the atmosphere outside of the tube press the water up into, and out of the tube? A. The piston of a suction pump removes the pressure of the air from the surface of the water in the barrel of the pump. The pressure of the atmosphere in the well forces the water up into the barrel of the pump. The person pumping lifts the air in the barrel of the pump. If the area of the barrel is 5 square inches he must lift 75 pounds of air. This has no relation to the size of the well.

(9698) F. L. J. asks: 1. Are the polished parts of a bicycle nickel plated, or are they polished with an acid, as I have been told? A. The parts of a bicycle which have a silvery luster are nickel-plated. 2. Why is it that people do not receive shocks from a trolley rail? If you could touch the overhead wire, without touching the ground, would you get a shock? I have seen birds do this last, and think the reason they can do it, is that they are not in contact with the ground. Am I right or wrong? A. If by a trolley rail you mean the rail of the track upon which the car wheels run, there is no reason why a person should receive a shock from it. It is at the same potential as the earth. If one could catch a trolley wire while in the air he would receive little shock because the potential of his body would soon be the same as the wire, which is at a low voltage, only about 550 volts. No current would flow through him since he is not in a complete circuit. 3. When electric cars jump the track, I have seen the motormen place the switch iron from the rail to the trucks to complete the circuit. Is this necessary? The wheels are in good contact with the ground, and I have heard that the current returned to the station through the ground as well as the rails. A. When electric cars jump the track, it is necessary to provide a better contact than that of the dirt for the current to flow from the motor to the rails. Dry earth is not a conductor nor is pulverized earth. When the current returns through the earth to the power house it must find a better path than either of these if any considerable current is to make a swift return. A poor conductor will take a small amount of current by leakage. 4. I have asked several persons why they build roofs over their porches, and have been told, it was to keep the rain and dev ... ing on the porch. Is there a ... w part of this answer? I have learned that dew does not fall, but is moisture in the air which was condensed by contact with cold objects. How can a roof protect a person from dew? A. Most certainly there is good sense in the "dew part" of the answer to the question why piazzas have roofs. Dew forms on a body exposed to radiation, so that its temperature can fall below that of surrounding objects, that is, below that of the air. Under a roof or under a tree the heat which is radiated upward is arrested by the roof or the tree and prevented from easily escaping to the sky, with the result that the space underneath the roof or tree is warmer than in the open air. You can verify this by moving your chair out from under a roofed piazza on almost any quiet clear evening. You will find it colder than under the roof, and dew forms more quickly. Clouds act in the same manner to screen the earth, and there is rarely dew on a cloudy night.

NEW BOOKS, ETC.

MANUAL OF TERREOHMETRY. By Ethan Scheidler. South Pasadena, Cal.: Ethan Scheidler, 1905. 16mo.; pp. 44. Price, $2.

This little manual has been written as an aid to mining men, for the purpose of showing how ores may be located scientifically by electrical tests. The science of terreohmetry, as it is called, has received a large amount of study and original investigation by the author, who has incorporated in his manual the results of many lessons learned from practical experience in making mining surveys throughout this country, Canada, and Mexico. A clear description of all the necessary apparatus is given, and full directions will also be found as to the method of using the same in locating ore.

MODERN IRON FOUNDRY PRACTICE. Part II. By George R. Bale, Assoc. M. Inst. C.E. London: The Technical Publishing Company, Ltd., 1905. 12mo.; pp. 194. Price, $1.40.

This part of the work on iron foundry practice deals with Machine Molding and Molding Machines; Physical Tests of Cast Iron; Methods of Cleaning Castings; Foundry Accounting, etc. The machines illustrated and described are typical ones, and besides these descriptions the reader will find a very exhaustive account of the physical tests of cast iron which, on account of the exacting demands of the modern engineer, has now generally to be very thoroughly tested before being put into use. The book is completed with an index, and will be found most helpful to all connected with the iron industry.

HENDRICKS' COMMERCIAL REGISTER OF THE UNITED STATES. New York: Samuel E. Hendricks Company, 1905. 4to.; pp. 1,279. Price, $7.

This is the fourteenth annual edition of this valuable reference book, which forms a complete and reliable index, containing over 350,000 names, addresses, and business classifications, of the architectural, mechanical, engineering, contracting, electrical, railroad, iron, steel, mining, mill, quarrying, and kindred industries. The book also contains a full list of the manufacturers of and dealers in everything employed in the manufacture of material, machinery, and apparatus used in these great industries, from the raw material to the manufactured article, and from the producer to the consumer. The book will be found extremely valuable as a buyers' reference book, for all engaged in any way in the trades above mentioned.

PROBLEMS OF THE PANAMA CANAL. Including Climatology of the Isthmus, Physics and Hydraulics of the River Chagres, Cut at the Continental Divide, and Discussion of Plans for the Waterway. By Brig.-Gen. Henry L. Abbot, Consulting Engineer, New Panama Canal Company. New York: The Macmillan Company, 1905. 12mo.; pp. 248. Price, $1.50.

This work, which is from the pen of one of the most qualified and lucid writers on the problem of the Panama canal, appears at an exceedingly opportune time. The American public, after being treated to successive reports by expert commissions, each giving a series of recommendations differing, more or less, from the others, will welcome this book, which gives a complete but not over-elaborated statement of the various phases of the Panama canal question. Gen. Abbot was at one time a member of the celebrated Comité Technique which, at the request of the new Panama Canal Company, made an exhaustive examination of the vast amount of technical data gathered by the engineers of the company. His pen was one of the most potent influences in leading the United States government, and the American public at large, to see the superior claims of the Panama to the Nicaragua canal route, and the present work embodies much data that have been presented in the various articles written to this end during the past few years by Gen. Abbot. The work opens with a historical *resume* of the history of the canal, and then takes up the subject of the rival routes and the physical conditions existing on the isthmus. A whole chapter is devoted to the once-formidable and supposedly-insurmountable problem of the Chagres River. Then in logical sequence there follows a chapter on the ultimate disposal of rainfall in the basin above Bohio. The last chapter considers, in considerable detail, the projects for the construction of the canal. To all of those who desire something more than a superficial knowledge of this great national problem, we cordially recommend this work.

THE MECHANICAL HANDLING OF MATERIAL. By George Frederick Zimmer, A.M. Inst. of C. E. New York: D. Van Nostrand Company, 1905. 4to.; pp. 521; 550 illustrations. Price, $10.

This work forms the first complete and connected treatise on the Mechanical Handling of Material, in any language. Its author has had over twenty years' experience in the designing and installing of machinery designed to handle material in the substitution of or supplemental to hand labor, and all such machinery is described in full in the present volume. The book is divided into three main sections dealing with the Continuous Handling of Material; the Intermittent Handling of Material; Unloading and Loading Appliances; and Miscellaneous Handling Apparatus, such as automatic weighers; apparatus for coaling locomotives; coal-handling plants for gas works; power stations, boiler houses, etc.; floor and silo warehouses for grain and seeds; and high-level or cantilever cranes. Section I. deals largely with all kinds of elevators and conveyors, and Section II. with endless chain and rope haulage, ropeways, and aerial cableways. Section III. deals with the loading and unloading of vessels, cars, etc., and describes all modern machinery of this sort. The book is printed on fine paper, and is very completely illustrated with a large number of half-tones and numerous line cuts, showing details of machinery. It will no doubt be welcomed by all engineers, and will be found a most useful handbook.

FARM GRASSES OF THE UNITED STATES. By William Jasper Spillman. New York: Orange Judd Company, 1905. 12mo.; pp. 248. Price, $1.

This volume presents, in connected form, the main facts concerning grasses grown on American farms. Actual practice in grass growing has been set forth wherever information concerning this is available. The country has been divided into four regions, each of which presents a different set of problems. The problems of growing grass in the South and the semi-arid lands of the West are discussed, and full information given concerning them. The book forms a practical treatise on the grass crop, seeding and management of meadows and pastures, descriptions of the best varieties, the seed and its impurities, grasses for special conditions, etc.

BUILDING MATERIALS. Their Nature, Properties, and Manufacture. By G. A. T. Middleton. New York: William T. Comstock, 1905. 8vo.; pp. 420. Price, $4.

This book is one of the most recent and complete works on the subject of building materials which has come to our notice. It is prefaced by a geological introduction, describing the formations in which British building materials occur, and by a second introductory chapter dealing with the chemistry and physics of building material. After citing the various stones and their classification, these are all described in detail, a chapter being devoted to each. Other building material, such as lime, plaster, cement, bricks, terra cotta, artificial sand and stone, and their methods of manufacture, are described in detail and illustrated by photographic views. Several chapters are devoted to timber, the various woods and their method of seasoning and preservation being described. The main varieties of iron, their impurities, strength, and test, are also considered in detail. Steel, copper, zinc, and lead are also treated of, and the book even goes into the description of special paints, enamels, and iron and stone preservatives, giving full directions for mixing and using the same. Varnishing, polishing, enameling, and lacquering are also described in the latter portion of the work. Glass and wall and ceiling papers, besides stamped metal linings, etc., are among the sundry materials of lesser importance which will be found described. The work is a complete textbook for students and others engaged in the building trades.

THE POCKET BOOK OF REFRIGERATION AND ICE-MAKING. Edited by A. J. Wallis-Thayer, C.E. New York: The Norman W. Henley Publishing Company, 1905. 16mo.; pp. 184. Price, $1.50.

This volume contains in a handy form such formulæ, data, tables, and memoranda as are constantly required by persons engaged in the refrigeration and cold-storage industries. It is a very reliable handbook, giving full information on all subjects of refrigeration, such as Cold Storage; Ice-Making and the Storage of Ice; Insulation; the Testing and Management of Refrigerating Machinery, etc. The book has a large number of general tables and memoranda, and is completed by an index, which makes all its information readily accessible.

KNOTTING AND SPLICING ROPES AND CORDAGE. By Paul N. Hasluck. Philadelphia: David McKay, 1905. 16mo.; pp. 160. Price, 50 cents.

This small handbook, which is fully illustrated with numerous engravings and diagrams, was compiled by the author for everyday use. It consists of a comprehensive digest of information on this subject, obtained from the columns of Work. Among the different kinds of knots described are eye knots, ring knots, and fancy knots. Rope formation, shortening, and splicing are also described. One chapter is devoted to "Working Cordage," another to "Lashings and Ties for Scaffolding," and a third to "Splicing and Socketing Wire Ropes." Two of the most useful chapters are on "Simple and Useful Knots" and "Hitches and Bends." The book is provided with an index, which makes the information it contains readily available.

CEMENT AND CONCRETE. By Louis Carlton Sabin, B.S., C.E. New York: McGraw Publishing Company, 1905. 8vo.; pp. 507. Price, $5.

This volume is one of the most complete we have seen on cement and its properties and uses. It is divided into four parts, which deal respectively with the Classification and Manufacture of Cement; the Properties of Cements and Methods of Testing Them; the Preparation and Properties of Mortar and Concrete; and the Use of Mortar and Concrete. The author has produced a work which, although not going into the subject as deeply as some others, still gives all the information essential to the young engineer of to-day, to whom we heartily recommend the work as a most helpful reference book.