ning of the engine or altering its speed or direction of rotation.

PUMP.—L. K. Pulliam, Pensacola, Fla. The invention relates more particularly to that type of combined engine and pump in which there is employed a single cylinder having a piston therein, the space at one side of the piston serving as a power chamber and the space at the opposite side of the piston serving as a compression chamber.

WATER-POWER BLOWER.—J. L. Ware, Terry, Miss. The invention relates to a blower for use in connection with the forges of machine shops and other metal working plants of a similar nature. The object is to provide a combined blower and water motor having comparatively connecting parts. It may be readily taken apart and reassembled.

SAND-FEED FOR STONE-SAWING MACHINES.—J. M. Owens, Oolitic, and J. A. Rowe and E. E. Mitchell, Bedford, Ind. The invention provides a feed in which there is a tank at higher elevation than the sand box parallel therewith, there being a plurality of outlets for the tank and box, those for the box having openings therein, above which are disposed the lower terminals of the tank outlets respectively, the tank having an overflow which leads into the box, and the box also being provided with an overflow, the outlets from the tank and from the box being commanded by valves.

ATTACHMENT FOR SEWING-MACHINES.—E. J. Miller, Shamokin, Pa. More particularly the invention relates to attachments such as are adapted to be removably secured to the balance wheels of the machines, and each of which consists of a frame having a grinding rim formed of emery, carborundum, or the like, arranged thereon, and adjustable means for removably securing the frame to any ordinary balance wheel.

ATTACHMENT FOR TYPE-SETTING MACHINES.—H. A. Armstrong, New York, N. Y. The attachment is particularly useful in connection with linotype machines having movable metal pots. One object of the inventor is to provide an attachment which comprises a signal bell, a float arranged within the metal pot of the machine and controlled by the metal level therein, and mechanism operable by the member, and serving to sound the bells when the member is in a certain position owing to the falling of the metal to a predetermined level.

AUTOMATIC LOCKING-RECEPTACLE.—J. W. Carter, Turnersville, N. Y. The receptacle is especially useful as a holder for milk bottles and the like, where there is a constant danger of unauthorized removal of the bottles after they have been delivered. An object of the invention is to provide a receptacle having means for automatically locking the same when an object has been placed therein, and which necessitates the opening of the door or the like, to permit the release of a trigger to unlock the device.

MOUNTING FOR BOTTLE-WASHER BRUSHES.—A. N. Davis, New York, N. Y. The invention relates to bottle washer brushes, the more particular object being to improve the mountings of such brushes. The brushes are actuated in the usual manner, the water being caused to flow through a spindle, the interior of the bottle being effectively washed. The operation completed, the withdrawal of the cleaning device from the bottle causes the brushes to be forced toward each other for an instant, and they spring backward into normal position immediately afterward.

UNIVERSAL JOINT.—J. Elkan, New York, N. Y. The improvement pertains to the transmission of power, and its object is to provide a joint, which is simple and durable in construction and arranged to permit of running shafts at any desired angle one to the other, and of changing the angle to suit existing conditions.

MECHANICAL MOVEMENT.—W. H. Gaskill, Wilson, N. Y. The invention refers to mechanical movements, and more particularly to an automaton mechanical movement suitable for simulating the motions displayed by an animal or a man in walking. It is of peculiar value in relation to propelling vehicles, for steering the same, and for use in sporting devices and in toys.

REVERSING-GEAR.—A. N. Woods, Corvallis, Ore. The object of the invention is to provide a new and improved reversing gear for traction engines and other power vehicles, and arranged to permit convenient and quick reversing for driving the vehicle in the desired direction.

CASH REGISTER AND INDICATOR.—J. F. Parker, Kansas City, Mo. A distinctive feature in this case is a bank of keys provided for registering and indicating the nine different amounts, in cents, ending with the numeral "5" such as 15, 25, 35, etc. Machines of other classes operate two keys in order to register any of the above amounts, while in the present, the same results are accomplished by one. Another, is the means for indicating amounts so that they are exhibited from the four sides of the register making them visible from any part of the room.

Prime Movers and Their Accessories.

VALVE.—N. B. Creighton, New York, N. Y. The aim in this case is to provide a valve, simple and durable in construction, and arranged to reduce the friction of the moving parts to a minimum, to allow convenient opening and closing of the valve and to permit of interchanging the actuating parts for use on either side of the valve.

ROTARY ENGINE.—C. Ford and D. F. Helmer, Grand Rapids, Mich. While the invention relates more particularly to internal combustion engines, it relates also to improvements to steam engines, and its object is to provide a thoroughly efficient rotary engine with which the full force of the explosive or expansive effort of the explosive or expansive element that is used for driving the engine may be utilized.

ROTARY ENGINE.—G. L. Webster, Midlothian, Texas. When the parts in this engine are arranged and adjusted they engage each other at the proper time. Consequently high or low speed makes no difference in operation, the degree of speed being a question of pressure and strength of material. Any form of governor may be used. Cams for opening and closing the abutment are independently adjustable on the shaft so they may be set with great accuracy to operate.

MEANS FOR INJECTING WATER INTO THE CYLINDERS OF COMPRESSORS.—A. E. Jones, Via Volosca, Fiume, Hungary. The object of this invention is improvements in compressors for air or other gases and relates more particularly to means for automatically supplying the cylinders with injection water. It comprises more particularly a coil supplied with live steam, arranged in the water circulation jacket of the engine and opening into the cylinder.

Railways and Their Accessories.

WASTE-SUPPORTING ATTACHMENT FOR JOURNAL-BOXES.—R. A. Billingham, St. Marys, Pa. The boxes have lateral grooves in which members of the attachment may be slid, there being grooved lugs disposed at forward ends of the side members to permit of a front waste retaining member being slid into position. The latter has its upper terminal curved outwardly and is adapted to engage the lid of the box, by which it may be pressed inwardly, the upper terminals of the side waste retaining members being disposed in close proximity with the journal to prevent waste from passing around the journal under the brass. The attachment also prevents the waste from working forward and hanging out of the box.

Pertaining to Recreation.

BASE-BALL CURVER.—W. W. Winquest, Brady, Neb. The purpose of this invention is to provide a simple, serviceable and inexpensive ball curver adapted to be arranged on the fingers, and having means for engaging the cover of the ball so that a decided curve may be imparted to the latter in pitching.

GANG FISHING-HOOK.—S. R. Sutton, Naples, N. Y. The hooks are arranged in groups known as gangs. The object is to provide reliable means for loosely coupling together groups of fishing hooks in sequence, so that they will be free to turn or spin at their coupled connections. An improved swivel link forms a portion of the coupling device.

Pertaining to Vehicles.

WIND-SHIELD.—J. H. Sprague, Norwalk, Ohio. More particularly the invention relates to the construction of the frame of the shield and the method of holding the glass in place. It involves a construction of frame in which the glass is resiliently held between oppositely-disposed plates spaced apart, so that the glass will not be broken by undue pressure, yet will be securely held against movement in the frame.

WAGON-REACH.—H. Braun and G. L. Wackerow, Mellette, S. D. The invention relates to improvements in reaches for use on wagon trucks, and the object is to provide a simple, cheap and efficient means for applying the reach members to a truck. The improvement can be applied to practically all of the wagon trucks now in common use at a very small cost, and will add materially to the life of such trucks.

FIREMAN'S TRUCK.—C. Holst, New York, N. Y. In this truck two of the more important features relate to the telescoping mast having improved means for raising and lowering the sections and holding them in adjusted position; and a novel form of bridge that is mounted on a carriage the wheels of which travel vertically on the mast, the apparatus having means whereby the bridge may be raised or lowered to the desired position for the manipulation of a hose carried thereby.

Designs.

DESIGN FOR AN EMBLEM.—B. Martin, Degraff, Ohio. The design includes on a foundation or base, a horse-shoe crossed by a pennant with crossed base-ball bats between the lower ends of the bats, the whole forming an attractive design relating especially to base ball matters and including with the good luck shoe the representation of the pennant and bats and ball of the game.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

HINTS TO CORRESPONDENTS.

The full name and address must accompany all letters, or no attention will be paid thereto. This is solely for our information. *All* queries are answered by mail, and a *few* of the selected answers are afterward published in the paper. We cannot undertake to furnish information on matters of personal interest, without reasonable compensation. To answer questions which are not of general interest usually costs us from $2.00 to $3.00 each upward, and this sum should invariably be remitted in such cases. When there are questions involving building or other construction, or when calculations must be made, an estimate of the cost will be furnished upon request. We cannot give answers to examination papers, or decide wagers, nor can we undertake to solve mathematical problems of any description whatsoever. Do not use postal cards.

Queries from this vicinity not answered within fourteen days should be repeated in full. Queries from points more remote will require a longer time.

We do not make chemical analyses; but we are always pleased to give the names of minerals which are submitted to us, when it is possible for us to do so. The minerals should be sent marked distinctly with the name of the sender, and should be sent fully prepaid.

Buyers wishing to purchase any article not advertised in our columns will be supplied with the addresses of the houses manufacturing or carrying the same, as soon as possible, or if we are unable to do so, their queries can be advertised in our special classified column.

Any books on any scientific or technical subject can be furnished. We solicit requests for quotations. The Scientific American Supplements referred to are mailed for ten cents each. Book and Supplement catalogues will be sent free on request. A careful reading of these "Hints to Correspondents" will prevent any misconception as to the uses and will prevent abuses of this column.

(12014) P. H. W. asks: Kindly state why the months of the year are numbered, some with 31 days and some with 30, February with only 28? A. The arrangement of the days of our months is due to two Roman emperors, Julius and Augustus Cæsar. Julius Cæsar revised the calendar, making the common year to have 365 days, and every fourth year to have 366 days. The days of the year were distributed among the months, so that the odd months, beginning with January, had 31 days, and the even months had thirty days, excepting February, which had 29 days in common years and in leap years had 30 days. He also gave his name to the month of July. The months following were named from numerals. Augustus Cæsar followed Julius, and gave his name to the sixth month, August, and in order to get 31 days for it, so that it should be as long as July, named for Julius, he took a day from February and placed it in August. This brought three months with 31 days together. To remedy this Augustus changed September and November to 30 days and October and December to 31 days. Thus our peculiar arrangement of days in the months is because of the vanity of Augustus Cæsar.

(12015) J. P. B. asks: If a mine is from 600 feet to 800 feet deep, and when it reaches this depth it branches in different directions, say several hundred yards in each direction, and it is necessary to force air down to the workers, no matter in what position they may be, can air be forced through a large tube without any trouble to the above tube, say 3 feet or 4 feet in diameter, and air discharged through same, flowing to the 800 foot depth, and conveyed from there in other tubes to its destination? If this is the case, do they have to pump the foul air away, that is, suck it away, at the same time driving fresh air in regularly? The other point is, is the air sucked from below through a large tunnel, or pipe, instead of being discharged from a pump above to the mine below? In which manner is it done, or can it be done either way, by the drawing of the air from below or discharging it from above? In either case, is it necessary to discharge the foul air from the mine? A. There are a number of different systems of mine ventilation, some automatic and some mechanical, and two more or less opposed "schools," one of which argues, "If you get the bad air and smoke out of the mine, the fresh air can be trusted to find its way in;" and the other, "Get your fresh air to the remote places where it is most needed, and it will force the bad air out." If a mine has two shafts connected underground, one of which opens to the surface higher on a hillside than the other, sufficient natural draft will often be provided to ventilate the connecting workings. This condition is often artificially imitated by raising the "collar" of one or other of the shafts on a level, or even by partitioning a single shaft and carrying a sort of chimney higher on one side, leading wooden or metal air ducts from the workings into the bottom of the "uptake" inside, where the warm air rising creates a current assisted by the heating effect of steam pipes down the shaft, and the fresh air flows in automatically. In large mines, especially collieries, with extensive workings, however, the air is almost entirely *blown* in by powerful fans, is conducted in large ducts to the bottom of the shaft, and from there directed through the workings by means of a carefully arranged system of double doors wherever "roads" cross underground, so that there may be a continuous current from the blower all through the workings to the foot of the shaft, whence the up draft is natural. In one colliery visited by the writer, where the shaft is just over half a mile deep and workings extend for two miles from the bottom in a more or less horizontal direction, comprising over 20 miles of "road" in all, 500,000 cubic feet of air per minute is blown into the mine, over 200 horse-power being required to drive the blowers alone. There are systems (for smaller mines) by which using a single blower and pipe the current may be made either suction or inblowing, but none to our knowledge in which both mechanical exhaust of foul air and inblowing of fresh are simultaneously required.

(12016) G. L. asks: What makes the great heavenly bodies and other matter in the universe move? What is the nature of the power or original cause? A. The absolute origin of motion in the matter of the sidereal universe is not positively known any more than the origin of energy or of life, nor is there any likelihood that it ever will be with regard to any one of them. At the same time there are certain developments in progress in the universe, of each stage of which there are numberless repeated instances visible to astronomers with high-power telescopes, of which developments the results will so obviously be planetary systems with a motion similar to that of ours, that we may fairly assume the developments of our system to have been analogous if not identical. These developments commence with a nebula, an immense body of highly-heated gas, revolving inconceivably slowly but unquestionably. Movement having been originated somehow, by molecular attraction or otherwise as may be imagined, its development is comparatively easy. The heavier molecules would attract to themselves the lighter ones, as they observably do in the chemical laboratory, and these small aggregations or nuclei would continually grow by accretion of smaller masses, continually developing motion in every possible direction and resulting in collisions, which again result in increase of size and decrease of number of the individual nuclei as they join each other. Gradually the number of different motions would become less, the resultant attractions being toward the center of the whole system, and this attraction being at first opposed by gaseous expansion, and eventually tending to revolution of the nuclei around the center of the mass. This is most noticeable in the visible nebulæ, the observable form of many and the probable form of most of which is spiral, long streamers of luminous gas containing solidifying parts trailing away from them in all directions. This permits of the more rapid cooling of the gases, their condensation, solidification, all the time with increasing density and decreasing volume, resulting in their increasingly rapid motion as gravitation acts on a mass offering less and less frictional resistance to the gaseous atmosphere in which they move. When the immense eruptive tendency of a highly-heated gaseous body is taken into consideration, the tidal effect produced by the attraction of two such bodies approaching each other without collision is amply sufficient to account for the throwing off of the particles, the spiral form of the nebulæ, and, combined with the centripetal attraction, for the eventual circular or elliptic rotation of the planetary bodies. This theory, whether or not demonstrably correct, is generally considered to be at least *sufficient* to account for planetary and other universal motion.

(12017) W. S. asks: 1. Why is twilight so much longer in England than in Spain or North Africa? Is it true that the period of twilight increases as we approach the poles, and if so, what is the cause of the increase? A. Twilight lasts till the sun is about 18 deg. below the horizon in the evening at any place. The sun in the torrid zone descends vertically in setting, and the duration of twilight is least in this region of the earth. The sun traverses 18 deg. in 1 hour and 12 minutes, which consequently is the shortest duration of twilight in the torrid zone all the year. The path of the sun makes the least angle with the horizon in the northern hemisphere in the summer, and hence a longer time is required to bring the sun 18 deg. below the horizon. Twilight then lasts about 2 hours in latitude 40 deg. north. On the Arctic circle the sun at the summer solstice just touches the northern horizon, and daylight lasts through the 24 hours. There is no night. At the north pole twilight is about 2½ months, or from the middle of January to March 22, when day begins. Duration of twilight can be calculated for any latitude at the sea level by trigonometry. At high altitudes above the sea twilight is said to be of shorter duration than at lower altitudes, due probably to the clearness of the air from dust. We have seen it stated that it is not more than twenty minutes at Quito. 2. Is there any means of determining the voltage and amperage of a current after passing through a Ruhmkorff's coil? Could you give approximately an idea of the voltage and amperage of a current which has passed through a coil that yields a spark of six inches, and that is worked by seven Grove cells (ordinary size)? A. The voltage required to force an electric discharge through air has been determined for various conditions. It is found to be different between needle points from what it is between balls. It varies also with the size of the balls. Between sharp points about 20,000 volts are represented in a spark one inch long, while for six inches about 72,000 volts are required. These voltages have been determined by experiments with alternating currents. With direct currents also many tests have been made, using batteries giving enormous pressures. 3. When lamps are lighted by electricity from alternate-current dynamos, how is it that the light appears constant and does not seem to flicker? I suppose commutators cannot be used with continuous-current dynamos. In the alternate-current machine does not the current enter the lamp alternately by opposite wires? A. An alternating current is the result of an alternating electromotive force, which is conceived to start from zero and rise to its highest point of voltage, then to fall through zero to a point as far below zero as it rose above zero, after which it returns to zero, thus making a cycle of changes. The polarity of the current is reversed while the E. M. F. is below zero. The fluctuation of lamps is not visible under such a current, because the changes are more rapid than the eye can take note of. The shortest interval of time the eye can note is about a tenth of a second, while the alternating current passes through 30 to 60 cycles per second. A commutator can be used with a continuous-current dynamo whose voltage is not too high and current is low enough. The transformation of a direct to an alternating current is usually made by a rotary converter or a motor dynamo. We furnish Sloane's "Electrician's Handy Book," which discusses all such matters, for $3.50 by mail.

(12018) J. W. L. says: 1. Does a gyroscope consume the same amount of energy while rotating in either the vertical plane or horizontal plane? R. P. M. Equal, I think, owing to the fact that while rotating in the vertical plane one side of the rotating part would be moving toward the earth; that the force of gravity on that side should be decidedly below normal, while on the opposite side (which would be receding) the force of gravity should be above normal. Under these considerations would not gravity alone tend to bring the gyroscope to rest? A. The power necessary to maintain a gyroscope in motion would not seem to depend upon the angle made by the wheel with the horizon. Any excess on one-half of a revolution is made up by as great a deficiency in the other half revolution, leaving the mean value the same. 2. Is this not the reason that the moon does not rotate on its axis as viewed from the earth? A. The reason of the moon not rotating upon its axis as referred to the earth is that tides have in the past acted to bring the moon to rest with reference to the earth. See Darwin's theory of tidal evolution in Moulton's "Astronomy." This theory is now quite generally accepted by astronomers. We can send you the book for $1.75 postpaid.

(12019) J. E. W. asks: 1. If at the equator a hole 2 feet wide pierced the earth through its center, and a ball a half inch in diameter were dropped into the hole, I figure that in about nine and one-half seconds, and at a depth of about 1,440 feet the ball would impinge against the east side of the hole, because at that depth the earth would be revolving a little over one-tenth of an inch slower than at the surface; and from that point down to the center the continually decreasing speed of revolution would cause the ball to press continually against the east side. Supposing now, that there were neither air nor friction to retard the ball, would it acquire the same velocity as if it could have fallen without touching the side; and would it rise again to the opposite surface of the earth? A. The best experiments to determine the easterly deviation of falling balls, according to Prof. Young in his "College Astronomy," showed from 160 trials, a deviation of 1.12 inches in a fall of 520 feet into a mine. If a ball were dropped into a hole in the earth it would in time come against the side of the tube and roll down to the center of the earth and pass some distance beyond the center. How far no one can tell, since it depends entirely upon the degree of friction upon the sides of the hole. It could not rise as far as it had fallen, since it could not pass the center with the full velocity due to free fall. 2. If the earth were a hollow sphere inclosing a vacuum, and a rock fell from the inner side, would it not gradually assume a convolute course till it reached a point where its increasing momentum would equal the earth's decreasing attraction, and at that point begin to revolve in a circular orbit? If so, at what depth would this occur? A. If the earth were a hollow shell a rock which had become detached from its interior surface could not fall at all. A body anywhere within such a shell is equally attracted in all directions and has no weight. This is usually demonstrated in textbooks of mechanics. 3. In such a sphere a ball falling from either pole would go to the center direct and rise again to the opposite pole; but if as in the case of the earth, the poles themselves had a slight rotary motion in space, would not the ball be gradually deflected into a circular orbit? A. A ball falling along the polar axis of the earth would not be deviated at all in the time required to fall from the surface to the center of the earth, since the deviation of the pole is very slow and very small.

(12020) T. H. asks: Do any of our planets ever swing beyond the zodiac? If so, which ones, and how far beyond? A. All the major planets have their orbits wholly within the zodiac. The belt of the zodiac was originally taken to be 8 deg. on each side of the celestial equator, simply because with that width it included all the known planets and the moon. Many of the minor planets depart from the zodiac.

NEW BOOKS, ETC.

Vorlesungen über Ingenieur-Wissenschaften. Vol. II. Eisenbruckenbau. By G. C. Mehrtens. Leipzig: Wilhelm Engelmann, 1908. 800 pp.; 970 ill.

It is possible that the mathematics of bridge construction may have been more fully treated in some text book, the details of some particular bridge more fully described in a magazine article, but it is inconceivable to us that the whole subject of iron-bridge building could be more exhaustively treated in the same compass than by the present volume. Many of its pages could be used as text book for the calculation and distribution of strains and stresses in bridge members, but much more of it is as interesting to the amateur as to the engineer. We cannot imagine that any history of bridge building could commence further back and conclude more up-to-date, or include a wider range of examples from the most primitive to the most complex structures. The author begins with pictures from the Bayeux tapestry of Alexander the Great bridging the Euphrates and coins commemorating Trajan's bridge over the Danube, and includes representative work of all leading bridge builders from Vespasian and Maximian to Roebling, Baker, Brunel, and Lindenthal, leading up through twenty centuries to the last word in braced arch and cantilever construction. Mr. Mehrtens even goes outside his title and the above range of period to include all types from natural bridges in the Cordilleras, and bamboo and rattan suspension bridges in Java, from the pyramid of Cheops, the principle of which is illustrated by working drawings, and Hannibal's stone bridge at Barcelona, to the latest developments of masonry and ferro-concrete. Many forms of fastenings and details are illustrated, each new system of strain distribution involved in a bridge described is explained by diagrams, and the reader is conducted through the entire series of operations from the rolling from the ingot of members of various forms to their location in the finished structure. In glancing over the excellent illustrations one cannot help regretting that in the development of the American iron-bridge system, admirably as it was suited to meet conditions nowhere else encountered with the same limitations imposed, the artistic beauty so noticeably superior in many European bridges has had to be to some extent sacrificed to economy and efficiency.

Two Family and Twin Houses. New York: William T. Comstock, 1908. Small 4to.; 127 pages. Price, $2.

This work consists of a variety of designs contributed by leading architects in all parts of the country, showing the latest ideas in planning this class of dwellings in city, village, and suburbs, together with very complete descriptions covering all the latest improvements in sanitation.

Old Edinburgh. By Frederick W. Walkeys. Boston: L. C. Page & Co., 1908. 2 vols.; 16mo.; pp. 380-360. Price, $3.

This is an account of the ancient capital of the kingdom of Scotland, including its streets, houses, notable inhabitants, and customs in the olden times. It is beautifully illustrated with reproductions of old prints and photographs. A charming book of travel, well written and well illustrated.

Reservoirs. For Irrigation, Water Power, and Domestic Water Supply. By James Dix Schuyler. London: Chapman & Hall, 1908. Imported by John Wiley & Sons. Large 8vo.; pp. 573; 281 ill. Price, $6.

This is a second edition revised and enlarged of the original work of the author, well known to all engineers concerned in such work. The rapid development in dam construction since the original publication has necessitated the complete revision of the work in order to bring it up to date, and this having obviously been done with great care, must have involved labor equivalent to, if not indeed greater than, that of writing a new book. Much new matter has been added and some of the old describing practice obsolete or superseded by modern methods has been omitted, the most noticeable addition being that descriptive of hydraulic fill dams, a method of using natural streams for the transportation of material and for the natural solidification of dams of great height at small cost almost unknown at the time of the appearance of the author's first edition. Improvements in photography have also increased the interest of the book, especially to the layman, by the addition of over 200 new illustrations, many of striking and historic dams.

The Mechanical Appliances of the Chemical and Metallurgical Industries. By Oska Nagel, Ph.D. New York: Published by the Author, 1908. 8vo.; pp. 302; 292 ill. Price, $2.

It must be difficult to find a new field for authors and compilers nowadays, but we are unfamiliar with any other work covering exactly the ground of the present. All the machinery used in industrial chemistry and metallurgy from the generation of steam and producer gas to the conveyance and disposal of their waste and by-products, from the crushing of ores to the handling of their residues after cyaniding and filtration, from reverberatory furnaces to sublimation, is critically described and classified, including all kinds of conveying apparatus for solids, liquids, and gases, grinders, mixers, separators, purifiers, evaporators, and dryers. There is a good deal of rather obvious compilation from manufacturers' catalogues, but this in a work of this sort could hardly be avoided, and one of the author's professed objects is to save the manufacturer from the toils of the salesman and the perusal of endless half-understood descriptions by presenting the essentials of the different systems. This he successfully achieves and leavens the work with a few usefully simple formulæ for calculating drafts, etc., and rules for the selection of material and fittings.

The Elements of Physics. In Three Volumes. Volume II. Electricity and Magnetism. By Edward L. Nichols and William S. Franklin. New York: The Macmillan Company, 1908. 8vo.; pp. 303; 196 figures. Price, $1.60.

This is a college textbook, being the second volume of Nichols and Franklin's "Elements of Physics." The volume was originally published in 1896, but has since been entirely rewritten. It differs from other works on the same subject in beginning with magnetism and electro-magnetism and thence leading up to electrostatics. The latter subject is approached from the standpoint of the ballistic galvanometer.

The Physical Properties of Soils. By Arthur G. McCall. Fully illustrated with photographs and diagrams. New York: Orange Judd Company, 1909. 12mo.; pp. 100. Price, 50 cents.

This book is rather suggestive than didactic, telling nothing of the physical properties of soils but giving rules for the carrying out of systematic experiments for determining them; nor does it explain the relation to or effect in agriculture of the physical properties so discovered, the author contenting himself with referring the student to the best works extant on these subjects. As a guide to the student in the most practical methods of pursuing a study as yet little formulated while leaving him free to original research the book should prove of great value.

How to Use a Camera. By Clive Holland. London: Routledge & Sons. Imported by E. P. Dutton. 12mo.; pp. 132.; ill. Price, 50 cents.

The object of the author is to supply up-to-date practical information, useful especially to the beginner rather than a profound treatise, and this he does in a readable and entertaining manner. The advice as to the important matter of selection of the right camera is good, and whereas the artistic eye for the selection of the right subject can hardly be taught, the chapter on that subject will assist many to avoid mistakes. The hints on variation of light and the way to estimate correct exposures are good, as are especially the instructions for local improvement of negatives, by following which many a hopeless picture may be retrieved. Many formulæ are also given for developing, toning, and fixing baths, hints for finishing and for artistic applications of photography. The illustrations, apart from those intended to illustrate defects, are a little disappointing compared with the excellent amateur work nowadays seen in newspaper competitions, and the subject matter is worthy of a better style of publication, the paper being poor and conspicuously different from that of the illustration and advertising pages.

The American Apple Orchard. By F. A. Waugh. New York: Orange Judd Company, 1908. 12mo.; pp. 215; fully illustrated. Price, $1.

Although modestly described as a "sketch" this book forms a very complete treatise on American apple growing and the instruction it contains is given in a very interesting manner. Beginning with the geographical distribution of the industry and the different varieties, the author explains the desirable qualifications of soils for orchards as well as the exposures and wind protection desirable. He proceeds with the causes and effects of winter killing, the preparation of land for an orchard, selection of trees, propagation, times of planting and all the methods of working, discusses the advantages and disadvantages of cover crops, pruning, and feeding the trees, their principal diseases and the protection of them from insects, including formulæ for all the best mixtures for spraying, and concludes with harvesting, sorting, and packing apples for the market. The book makes our mouth water for the apples it describes and makes us hungry for the scent of the soil and the breezes blowing through the apple blossoms, and we should say that any intelligent farmer who has grown anything else should be well equipped for a start in commercial apple growing by its careful perusal.

Foundry Practice. By James M. Tate and Melville O. Stone, M.E. Revised third edition. New York: John Wiley & Sons, 1909. 12mo.; pp. 234; 112 ill.; cloth. Price, $2.

This work is essentially a text-book for the use of students, the work of the shop and of the class-room being carefully correlated in a manner infrequently found in books on foundry practice, which are generally adapted to the requirements of the advanced foundryman rather than to those of the beginner. In this respect the object of the authors seems to have been achieved. The first-named of the authors adds to a life-long experience as practical pattern-maker and foundryman some fifteen years of putting what he has learned in practice into the form of precept intelligible to others and has therefore an ability to explain what he knows rare in the practical operative. His associate has graduated under his instruction and made a special study of foundry chemistry and metallurgy. The result of their joint efforts is an eminently practical work, giving all the essentials and fundamental principles of foundry work, and, without going into details of special processes or machines, covers sufficiently for the student everything from the simplest green-sand molding to the latest machines for handling molds and cleaning castings, concluding with tables of alloys for foundry use. Not the least useful feature is a glossary of foundry terms, given especially to avoid waste of space in needless explanations, and a glance through which prevents any possible obscurity.

INDEX OF INVENTIONS

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