RECENTLY PATENTED INVENTIONS.

The Inventions described in this Department were Patented through the Scientific American Patent Agency.

Electrical Devices.

ELECTROSONATOR.—R. SAKAMOTO, Tokyo, Japan. The device relates to sound transmitters for transmitting sound into the human body to an internal organ. The sound is produced by a vibrator operated from an electromagnet. In use the examiner who listens through a stethoscope applied to the body near the sound-producer may determine the exact position, form, and motion of the internal organ of the body, as well as accurately determine any dislocation, enlargement, or diseased condition.

Of Interest to Farmers.

PROCESS FOR EXTRACTING HONEY.—L. W. AVANT, Atascosa, Texas. By means of this invention the honey may be extracted from beehives without opening the hive or materially disturbing the bees, and without robbing the hive of the wax of which the cells are made. The advantage of this is that it relieves the bees of the labor of gathering the wax, thus economizing time and allowing the bees to devote their undivided energy to the gathering of honey.

Of General Interest.

WATERPROOF FUSE CAP.—T. M. DANIELS, Valdez, Alaska. This cap is adapted to be attached readily to the end of the fuse in a watertight manner. Its design is such as to prevent the occurrence of "miss-fires" or "miss-holes" in blasting, which are largely due to the fact that the explosive in the cartridge becomes wet.

MATTRESS.—F. A. KAISER, Scranton, Pa. As usually made it is difficult to fill the edge of a mattress uniformly throughout its length with the stuffing or filling material so that the "roll edge" is uniform. In the present invention a separate strip of felt, cotton batting, or the like, is provided, which is placed along the inner surface of the covering and through a portion of this strip, after the roll edge is formed complete, the main body of the stuffing or filling material may be inserted in the ordinary manner.

LOCK FOR BAG FRAMES.—L. B. PRAHAR, New York. The special object of this invention is to provide a lock in which the thumb piece of the latch is formed integral with the body of the latch, and extends through an opening in the side of the casing. The casing is so formed that the thumb piece may be readily removed to a position parallel to the bag frame, but further movement is prevented by engagement of the thumb piece with the casing.

MOTH BALL HOLDER.—G. THOMPSON, New York, N. Y. This moth ball holder is adapted to be attached to the frame of an upright piano in a position above the action, and without interfering therewith. The holder will retain the ball until all is evaporated, thus not only serving to protect the felt of the action from the moths, but to prevent particles of the moth ball from dropping into the case.

SPOOL CASE.—C. J. ALFRED, New York, N. Y. This case is adapted to be applied to a work basket and is so arranged as to permit the free withdrawal of the thread, but it will frictionally bind the same and prevent its unwinding except when intentionally pulled out. The device is provided with a cover which grips the thread and severs it at the points desired.

FAN.—E. GOOSCH, New York, N. Y. The fan is of the rotatable type for hand use. The leaf of the fan is mounted on a spindle which may be rotated by reciprocating a thumb piece which projects from one side of the fan handle. The object of the invention is to enable a person to fan himself with little exertion.

CIRCULAR BACK FOR CAMERAS.—E. L. HALL, New York, N. Y. The purpose of this invention is to provide a circular back adaptable to almost any type of camera by means of which a plate holder may quickly and readily be shifted from one position to another without removing it from the apparatus.

STEVEDORE RIG.—J. KNUPPEL, New York, N. Y. The object of this invention is to enable the cargo to be not only lifted out of the hold of the vessel, but swung sideways on to the dock by the mere action of hauling on the hoister line. This object is attained by a peculiarly rigged gaff along which the hoister line runs and by means of which the hoister acts first to lift the cargo out of the hold, and then to swing the gaff and its load sidewise over the dock.

Household Utilities.

CONNECTION FOR WATER RECEPTACLES.—E. F. COOK, Freeport, N. Y. This invention is particularly adapted to provide a connection suitable for laundry tubs which will furnish suitable valves independent of each other for directing hot or cold water or both, through a single outlet into the tub.

WINDOW LOCK.—C. C. HIGGINS, Woodmere, N. Y. The invention relates to window locks, providing a type of lock in which there are two bolts, one for each sash, but in which these bolts are independent of each other for some purposes, and yet work in unison for other purposes.

WINDOW-BLIND GUIDE AND STOP.—W. W. BRUCE, Baltimore, Md. In raising and lowering window shades that are wound on a spring-actuated roller, it often occurs that the shade slips out of the hand and flies up, wedging the stick in the bottom hem between the roller and the window frame so that it causes a good deal of trouble to release it. The present invention obviates these difficulties by providing guiding means and a stop for the shade.

Machines and Mechanical Devices.

MILK PURIFIER AND HOMOGENIZING MACHINE.—H. H. STÜSSY, Sioux City, Iowa. The invention relates to machines of the class in which milk is passed centrifugally through purifying and homogenizing media, and in which the impurities and the homogenized milk are separately discharged from the machine. In the present invention the milk is conducted through straining media and then through an irregularly-shaped conduit which causes the globules of butter fat to be broken up and disseminated throughout the milk.

CANNON PINION.—W. F. JOST, Pocatello, Idaho. The invention relates to horology and has for its object to provide a cannon pinion securely locked to the center arbor to prevent lifting and throwing it out of gear with the minute wheel, to provide true and even friction, to carry the hands safely when the watch is running, and not to interfere with the motion of the balance wheel when setting. The arrangement allows of placing or removing the cannon pinion to and from the arbor without springing the latter or breaking the jewels.

CONTROLLING MECHANISM.—H. MEYER, New York, N. Y. The invention is adapted for use on self-playing pianos. It provides a mechanism arranged to control independently the tempo, action, expression, the damper, and the hammer rail in a very simple and efficient manner.

BLACKING MACHINE.—E. E. TALIAFERRO, Colorado Springs, Colo. In this bootblacking machine a set of brushes are provided which travel around the foot form on which the shoe is placed, so as to efficiently polish all parts of the shoe. Means are provided for withdrawing the brushes to permit of placing the shoe in position. The mechanism automatically stops after completing the cycle of operations.

LATHE ATTACHMENT.—A. E. WHITING, Weston, W. Va. The invention relates to boring engine cylinders and the like and its object is to provide an improved lathe attachment designed for quickly and accurately centering the work to bring the latter in axial alinement with the lathe.

MACHINE FOR UNRAVELING TEXTILE FABRICS.—P. F. VOGEL, Clinton, Tenn. The object of this invention is to provide an inexpensive mechanism to be used in combination with loopers which join together edges of knit goods. It serves to unravel the selvage edges of such goods and to wind the unraveled yarn upon a reel.

UNIVERSAL INDICATOR.—H. P. BOETTCHER, Jersey City, N. J. This indicator is more especially designed for tool makers' and machinists' use, operating, when applied to the work, to accurately and automatically show to what extent, if any, the work is out of true.

UNIVERSAL ELEVATING AND LOWERING DEVICE.—E. G. GEBAUER, Santa Fe, New Mexico Ty. The construction provided by this invention operates to maintain a cable in a constant position as it coils or uncoils from a drum. The drum is arranged to travel to and fro as it rotates, the reversing of the travel being accomplished automatically.

Prime Movers and Their Accessories.

STEAM SERVICE CONTROLLING AND RECORDING APPARATUS.—G. M. HILGER, Chicago, Ill. This invention provides an apparatus intended for use in connection with steam service plants by means of which to automatically reduce steam pressure to the desired degree, and to record the differences in pressure and the volumes of steam delivered, whereby to admit of convenient computation of the horse-power and other conditions concerned with the steam service.

EXPLOSION ENGINE.—A. W. COTTRELL and M. A. MOORE, Douglas, Ariz. Ty. In this explosion engine there are three explosion chambers and four feed valves, causing twelve explosions at every revolution. The chambers being long permit the exploded gases to expand to atmospheric pressure before leaving the engine thus giving more power from a given amount of fuel, reducing the noise of the exhaust, and acting as a cooling agent to the engine.

Railways and Their Accessories.

SAFETY APPARATUS FOR RAILWAYS.—A. BONOM, New York, N. Y. By providing trip devices which are placed at intervals along the track, and controlling mechanism operable by these trips on trains going in either direction, Mr. Bonom furnishes a safety apparatus which operates effectively to prevent two trains from meeting when going in opposite directions on the same track. The mechanism also prevents rear-end collisions.

JOURNAL BOX.—W. A. HUFF, Newark, N. J. The object of this invention is to provide a journal box of simple construction having improved means for lubricating the wearing surfaces and for preventing a waste of oil from the box by working along the journal. The construction tends to keep the oil in a clean condition. Provision is made for the automatic deposit of solid particles which may accumulate in the oil.

Vehicles and Their Accessories.

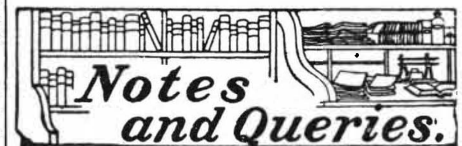
PNEUMATIC TIRE.—H. W. DOVER, Holyrood, St. James, Northampton, England. The invention relates particularly to means for securing pneumatic tires in position and its principal object is to pr vide a construction which will so hold the tire that the effect of the internal pressure will be to cause the tire to become more securely fixed in position instead of tending to become detached by increase of its diameter as heretofore.

COMBINED VEHICLE JACK AND WRENCH.—D. C. LASSITER, Shelmerdine, N. C. The invention relates to that class of jacks which support a wheel when it is removed from the spindle, in order that lubricant may be placed on the spindle. The object of the present invention is to provide a simple and convenient device for facilitating the handling of the wheels of the vehicle while lubricating the spindles.

Designs.

CASING FOR SODA-WATER FOUNTAINS.—C. F. POWERS, Coosada Station, Alabama. This patent presents a casing for soda water fountains including a body portion surmounted by a number of jars in two series, the larger jars being arranged in rear of the others, and the smaller jars appearing in a row across the front of the casing and above the body portion, all of the jars being similar in appearance and having each an ornamental cover.

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.



Full hints to correspondents were printed at the head of this column in the issue of August 8th, or will be sent by mail on request.

(10921) C. L. H. asks: Can you tell me if any one makes an electric arc that could be used as a blowpipe? I wish to use it to melt small amounts of platinum. A. It is not difficult to arrange an electric arc blowpipe for melting metals or soldering. We should use the current which passes through the carbons for the magnet. Put the magnet of a few turns of wire in series with the carbons. Adjust the number of turns of wire and the distance of the magnet from the arc to produce the blowing power required. The apparatus is so simple that no special instruction is required for setting it up or operating it.

(10922) F. B. W. asks: Can you explain the phenomenon of the Aurora Borealis? A. We cannot explain the theory of the Aurora Borealis. The most we can do is to state the view held by the best scholars concerning it. To begin with, highly heated metals or carbon send out numerous minute particles with high velocities. These particles are called corpuscles, or electrons. They are known to carry charges of negative electricity, and to move with a very high velocity. It is reasonable to regard the sun and other stars at their enormous temperatures as sources of such particles, which move in mighty streams through the celestial spaces. When such particles strike a rarefied gas they render it luminous, as is seen in vacuum tubes. Such luminosity is associated with the discharge from the negative electrode of these tubes and has a name —"cathode rays." In the upper air these corpuscles from the sun may well be considered to produce luminous effects, such as the auroral light. Arrhenius first suggested this theory of the aurora, but it is now quite generally adopted. Duncan's "New Knowledge," price $2, page 238, gives it in some detail. It is also to be found in Thomson's "Conduction of Electricity through Gases," price $4.

(10923) E. E. asks: How is the focus of a concave lens determined? Is it the radius of a circle, or half the radius of the curvature? Please inform me as to both plano and double concave. A. All foci of concave lenses are virtual. For a biconcave lens of glass, whose index of refraction is 1.5, with the same radius of curvature on each face, the principal focal length is equal to the radius of curvature. For a plano-concave lens of the same glass, the principal focal length is equal to twice the radius of curvature. In these respects the concave and convex lenses agree, excepting that the focal length of concave lenses is negative. The formula for determining focal length of concave lenses is $\frac{1}{f} = \frac{1}{p} - \frac{1}{p'}$.

(10924) W. E. F. asks: What would be the apparatus necessary to charge a storage battery from a trolley wire of an electric railway, and what size battery for 5 horse-power motor to run say 10 hours; and about what would the outfit cost, and how long would it take to charge it? A. You will require half as many storage cells to run your motor as the volts taken by the motor, since each cell will give 2 volts. To obtain the number of amperes you will need, divide 746 by the voltage of the motor. This gives the amperes for one horse-power hour. Multiply this by 5 and by 10, and you will have the ampere hours required for 5 horse-power for 10 hours.

(10925) C. C. McC. asks: Do you publish a work on the construction of voltmeters and ammeters that would enable one to construct one for use on an isolated plant? A. SUPPLEMENT No. 1215, price ten cents, will give information for the construction of a voltmeter and ammeter which may answer your purpose.

(10926) W. H. G. asks: 1. Please give acid used in pole indicator and ground detector and state what size and kind of wire is used. A. Make a solution of alcohol, 10 cubic centimeters, phenolphthalein, 1 gramme. Add to this distilled water, 110 cubic centimeters. Make a second solution of sodium sulphate, 20 grammes, in 100 cubic centimeters of water. Soak blotting paper in the first solution, and drain off the superfluous liquid. Then soak the paper in the second solution and dry the paper. To test the poles of an open circuit, moisten a strip of the paper, and place the ends of the wires about two inches apart upon it. A red spot will appear around the end of the negative wire. 2. Is there any way in which a bipolar dynamo can be made to give a steady current and not an alternating current? I cannot run a Ruhmkorff coil because of this, and would like to know if there is any instrument or battery that I can connect in circuit to stop this alternation? A. A dynamo gives a direct or continuous current when its armature is provided with a commutator. The same machine gives an alternating current when its armature is fitted with rings connected to the windings. Either form of dynamo will work a Ruhmkorff coil equally well. If the alternating current is to be used, screw down the vibrator so that it will not vibrate. 3. Do I understand that in the system of wireless telegraphy explained in SCIENTIFIC AMERICAN of January 4, 1902, there is no Ruhmkorff coil used in the transmitting part, but just the batteries connected to the earth? A. Yes; but Hertzian waves are not used in this system. 4. What are inductance coils, and please give an idea of how made? What is a choke coil and how made? A. An inductance or a choking coil is a coil to reduce the current by its induction upon the current as it passes through it. A second current is set up in the inductance coil, which flows in the opposite direction to the main current and thus chokes it off, so to speak. 5. Please give number of SUPPLEMENT, if you have same, that has plans and working drawings for constructing small gasoline motor. A. See SUPPLEMENTS Nos. 715 and 716, for construction of gas engines, 23 figures, 10 cents by mail. Also a book on "Gas Engine Construction," by Parsell and Weed, $2.50 by mail.

(10927) D. A. H. asks: Have scientists generally accepted the theory that the electric current does not flow through a wire, but follows the space around it? A. An electric current flowing with unvarying intensity flows through the material of the wire, flows in the wire, and also sets up a magnetic field around the wire. In this field a magnet is attracted by the lines of magnetic force. When an electric current flows with a varying intensity, either increasing or diminishing in intensity, as, for instance, starting with a sudden rush and as suddenly dying out, then electric waves are thrown off into the space around the wire, it may be with great force, so that they are sent many miles. It is these waves which are used in wireless telegraphy. They are not in the wire. The wire is but a core or center around which the waves whirl with tremendous energy. We are but beginning to learn their power and value, and have not yet harnessed them and broken them into our use and service. 2. Referring to the article entitled "Humidity and Heating Systems" in your SCIENTIFIC AMERICAN, why is it that the humidity of the air in the house heated by artificial means is so much less than that outside? Does the air lose any of its moisture by being drawn into the house and heated? A. The humidity spoken of is not the amount of moisture in the air, but the percentage of moisture as compared with the total amount of moisture which the air could hold at that temperature. Air saturated with moisture is said to have 100 per cent of humidity. The whole name is relative humidity, which expresses the meaning better. It is the moisture relatively to complete saturation. Now, the capacity of the air to hold moisture varies greatly with the temperature. In a summer morning fog may lie thick over the earth, because the air was saturated with moisture, and the excess of water appeared as fog. The sun rises, warms the air and the fog disappears. Why? Not because there is any less moisture in the air than earlier, for the dew and fog will come again at nightfall and last till morning probably; but because at the higher temperature of midday the air can carry more water in the condition of invisible vapor than it could at the lower temperature of the early morning. Now apply this principle to the heated room. The air inside the room is warmer than the air out of doors; and though it may contain the same number of grains of water vapor to the cubic foot, that amount of water vapor will not bring the relative humidity of the room as high as it will the out-of-door air, because it will take more water to produce the same per cent of humidity in warm than in cold air. The warm air has a greater capacity for water vapor than cold air has. It is for this reason that we should have a water pan in the hot-air box of the furnace and add water vapor to the heated air before it enters the room.

(10928) H. L. P. asks: Will you kindly publish in your query column a list of all the different kinds of ether waves, their rate of vibration per second, and their wave lengths, and do they all travel at the rate of 186,000 miles per second? A. The ether waves concerning which you inquire are the vehicle by which the radiations pass from the sun to the earth. These radiations become heat, light, or electro-magnetism, and other forces perhaps, when they strike upon organs which can appropriate them as such. That which strikes the eye becomes light, that which affects other nerves of sensation gives us the sensation of heat. You will find much about these matters in Thompson's "Light, Visible and Invisible." So far as we know, all these waves pass through space with the same velocity, about 186,000 miles per second. We can send you the book named for $2.

(10929) E. S. asks: Can you tell me what material, fluid, solid, or otherwise, will retain its heat the longest, or where can I get a table of materials that are the best non-conductors of heat, and also what material or composition which when heated will retain its heat the longest, fluid, solid, or otherwise? A. We are not able to say what material will retain its heat the longest, but Kent in his "Mechanical Engineer's Pocket Book," which we will send for $5, gives a table of many materials with figures for each. In this table the radiating power of lampblack is taken as 100. On this scale polished iron is about 25, and polished silver and gold are only 3; so that of the materials which Kent names, polished silver and gold retain their heat the longest. All substances give off their heat much faster when rough than when polished. All liquids and gases are good non-conductors of heat. So too are numerous solids, such as asbestos, all woods, and many solids. It would not be possible to select one and say it is the best non-conductor of heat. Kent gives several tables on this point. The retention of heat and the conduction of heat are two totally different matters, and materials will be classified very differently in relation to the two qualities.

(10930) H. M. asks: 1. Could not the core of an induction coil be made longer and the secondary coil be placed beside the primary coil and not over it, and thus save considerable length of wire, and also number of turns of wire in secondary? A. Induction coils have been made with almost every possible relation of the various parts, with the result that it is a general agreement of experimenters that the usual mode of arranging is the best. The secondary coil is sometimes placed by the side of the primary in the transforming of alternating currents for lighting, but then the core is especially designed to save the lines of force. In coils for giving sparks the core should not be unnecessarily long, since the object is to secure as sudden a demagnetization of the core as possible. You would better conform to the proportions of coils as given in the best books. Take Norrie's "Induction Coils" for a guide. We can furnish it for $1. 2. Do the outer coils of the secondary add as much strength to the coil as do the turns of wire wound nearest the core? A. The outer turns of secondary wire have not the same value in producing current as do the turns near the primary. The mode of securing a small-sized secondary is to use the finest possible wire. No. 36 to 40 is employed. 3. How is the magnetic resistance of a piece of iron calculated? If I know the ampere turns how may I know the strength of the magnet? A. The magnetic resistance, or reluctance, as it is called, is equal to the length of the circuit divided by the product of the permeability by the area of cross section of the iron. The tractive power of a magnet in pounds is found by the formula,

$$\text{Pounds} = \frac{TC \cdot M \cdot \sqrt{A}}{2661\ L}$$

in which TC is the ampere turns, M is the permeability. A is the area of cross section of poles, and L is the mean length of magnetic circuit. 4. What voltage will a five-bar telephone generator furnish? A. The ordinary telephone generator will give from 65 to 75 volts. What a five-bar generator gives we are not able to say. 5. Why is it that a generator requires more power to turn its armature when delivering heavy current than when on open circuit? A. The generator requires more power to drive its armature when it is delivering current because it is then doing work. An engine running free does not require much power, but when heavy machinery is connected to it, it requires much steam to drive it. 6. Can you give me the formula for constructing a tangent galvanometer so that certain degrees deflection will equal certain value of current? A. A deflection of a certain number of degrees always represents the same current in a given tangent galvanometer. You do not require any special formula to determine the current for any deflection. Use the ordinary formula for the tangent galvanometer, and substitute the natural tangents for tangent a in the formula. Calculate the corresponding current in each case. Form a table of these currents for each angle, and keep it for reference. You will then save the trouble and labor of making the calculation for each reading; we mail you a copy of our SUPPLEMENT Catalogue, in which you will find mention of articles on the construction of galvanometers.

(10931) E. S. asks: Will you kindly give me the scientific reason for the hour before dawn being the darkest and coldest, particularly the former? A. We do not know any scientific reason for the belief among people that the hour before dawn is the coldest and darkest. The popular proverb is, "It is always darkest just before dawn," which we always understood to refer to the mental attitude of a man who is hard pressed and finds help. The coldest hour of the night is found to be from 3 to 4 A. M. The darkest hour is when the sun is furthest below the horizon, or midnight. We do not see any other scientific conclusion. All daylight is gone from the atmosphere after the sun is 18 deg. vertically below the horizon, the time which marks the end of twilight of evening and the beginning of the morning twilight. Between these two times it is deep night and there is no reason why one of the hours should be darker than another.

(10932) W. A. P. asks: I am building a 12-inch spark coil according to Allsop directions. What test can I make to find if I have a good or perfect condenser? If I put 250 volts 1 lamp in series across the foil ends I get no trace of leakage or short circuit, but 110 alternating lamp series does not light the lamp, but there is a big leakage—so much that it cannot be held in the hand. I refer to using the condenser only, as the coil has not yet been built. I have 20 sections secondary built on the primary and receive only ⅝-inch spark with or without condenser, the maximum number being 96 sections. Does this appear right? A. The leakage of a condenser is found by charging it and discharging it immediately, then charging it and leaving it for say 15 minutes and discharging it again. The ratio of the discharge gives the leakage. There is no way of finding the leakage without proper instruments to measure with. We do not see any proof of leakage in what you write, though what you say is not clear. If you mean that a direct current of 220 volts shows no leakage, while with an alternating current 110 volts gives effects across the condenser, we reply that an alternating current does not charge a condenser at all. A condenser is not used on a coil when the alternating current is used with it. Without instruments or means of measuring the condenser you should make sure of each sheet of the paper, make the condenser as well as possible and rely upon the thoroughness of your work.

(10933) A. L. R. asks: 1. In running levels for a waterway of considerable length, like the Panama Canal, is not the rotundity of the earth an important factor that must be considered? A. In running levels for waterways of considerable length the line which is actually run is substantially a circle whose center is the center of the earth. The sights taken by the instrument between successive settings are so short that the curvature of the earth does not appreciably affect them, and at each new setting of the instrument the line of the level is parallel to the circumference of the earth at that point. 2. If it were possible to stretch a wire, perfectly taut, across a lake ten miles in width, so that it is perfectly level and absolutely without sag, would it not be necessary that the shore end of the wire be anchored at an elevation of not less than 16 2-3 feet above the water to prevent the immersion of the wire at the center of the lake? A. If it were possible to pass a perfectly straight line across a lake ten miles in width, the anchors must be elevated not less than 16 2-3 feet above the water to prevent the line from going below the level of the water at the center. 3. An extensive and perfectly level plain is traversed by a range of mountains; to pierce which, for a railroad, requires a tunnel ten miles in length. If such a tunnel is excavated with a floor perfectly level, as indicated by the surveyors' level or by "tees" placed at both ends and the center, assuming the possibility of sighting that distance, would not the center of the tunnel be lower than either end or than the plain outside, and would not the water in the tunnel drain toward the center? Would the specific gravity of an object placed in the center of the tunnel be affected by the superincumbent weight of the mountain mass? A. If the tunnel which you mention were to pierce a range of mountains ten miles long, it would not go in a straight line with the mountain, but be an arc of a circle whose center was the center of the earth, or else, as a matter of good engineering practice, it would be enough higher in the center, than indicated in the above statement, to allow drainage in both directions. If such a tunnel were excavated with a surveyor's level stationed at the point where the range of mountains left the level plain on one side, it would come out on the other side of the mountain range 65 feet above the plain. If the tunnel were excavated in an exact straight line from the plain of one side to the plain on the other, at the entrance of the tunnel on either side there would be a down grade of 65 feet in ten miles, or 6½ feet to the mile. The tunnel would be level in the center, and would be at that point 16 2-3 feet below the surface of the plain. The specific gravity of an object placed at the center of the tunnel would be slightly less than outside on the plain, because of the influence of the mountain.

(10934) W. B. asks: 1. A chicken gains about twice in weight for the first twenty-four hours after hatching. What do they live on, as they do not eat anything? A. It is true that chicks can go for several days without food, as there is sufficient of the egg left in the stomach to supply nutriment. They will eat on the first day, however, if food is provided. Chicks almost double in size the first day, owing to the organs being relieved from the compression of the eggshell, and as the down on the chick dries, it fluffs out and adds to the apparent size. It may be that in individual instances they double weight, but it is far from true as a general rule. We have known cases where the reverse was true. Where too much moisture has been kept in the incubator, the egg does not dry down enough, and the chicks hatch in a swollen, puffy condition. During the first day the surplus water in them evaporates, so that they shrink, and weigh less than when they were hatched. It may be true, too, that when there has been too little moisture in the incubator, and the eggs have been dried down too much, the chick will absorb moisture after being hatched and so increase in weight. Where the chick has been hatched under a hen, or where the conditions of moisture have been kept just right in the incubator, there will be very little, if any, change in weight during the first day. 2. A hard-boiled egg weighs quite a bit more than a raw egg. Where does it get the extra weight? A. The shell of an egg is very porous, and moisture and air also pass through it without difficulty. Hence in boiling water is absorbed by the egg, and this increases the weight of the egg. 3. Why docs sap run up the tree? A. Sap is carried up a tree by osmotic pressure and capillarity, chiefly. The evaporation from the leaves tends to assist the flow during the season when the leaves are on the trees. These matters are explained in textbooks of physics.

(10935) H. H. A. asks: Kindly answer the following question: Does the date change between points on opposite sides of the 180 deg. meridian, or is it merely nautical reckoning that recognizes the date line? A. The date changes at any place when the line or meridian of midnight passes over that place. The date is constantly changing all the way around the earth during the twenty-four hours of any day. The international date line is a line which is very nearly coincident with the 180th meridian. To the east of that line the date is always one day later than on the west of that line. Night covers half of the world all the time. The meridian through the middle of the night is moving all the time around the earth. On the east of that meridian there is one day, on the west of that meridian there is another. A day is dying on the west side of that meridian, a new day is coming on the east. At eleven at night in your place, the line of midnight is one hour to the east of you. The day has one hour left. The next day is only one hour away to the east. In an hour it has reached you and passes over your head, speeding west ceaselessly, around and around the earth. However, when a ship passes the 180th meridian, it changes its date, since it has passed out of one day into another.

(10936) J. M. C. says: I am making an armature core, and after cutting out about one hundred disks, I thought that may be the iron (?) I am using is not free from steel. I send you three pieces. Examine them, and write me as soon as possible if they are all right. I have an equal number of all three grades cut. No one here can give me a decided answer as to their being strictly iron. Would it make so much difference if there was a little steel in them? The three are all species I can find here except tin. Is tin good for disks? A. Any one of the three pieces of sheet steel you send will answer for the armature core of a dynamo. The piece marked 3 is thinner and softer than the others and will be better, since more disks can be got into the same space. You cannot get sheet iron nowadays very easily. Steel has crowded it out of the market. As you may know, steel differs from iron in having a small per cent of carbon in it. It is iron with carbon, not a different substance.

(10937) C. S. W. asks: It takes several years for light from the sun to reach the earth; the light we now see started from the sun years ago. If the sun's light were extinguished, would we continue to get sunlight for as long time as it takes the light to reach the earth? On this theory, does an eclipse occur at the time we see it, or is it only the result that we see several years after the eclipse takes place? A. It requires 499 seconds for the light to come from the sun to the earth, and about one and one-third seconds to come from the moon to us. Hence, if the moon intercepts the light of the sun, we see the fact in one and one-third seconds after it happens. Whatever occurs on a distant star to affect its light, we see at such a time after it occurs as may be required for the light to pass over the space between us and that star. Anything that occurs on the sun is seen by us 8 minutes and 19 seconds after it occurs.

(10938) M. J. McC. asks: Does the part of a wagon wheel touching the ground while in motion stop while the other part of the outer rim of the wheel revolves, or do all parts of the outer rim revolve at the same velocity? I have heard this argued, but I confess I can't see how one part of the wheel could be in motion while the other was stationary. A. The part of the rim of a wagon wheel which is in contact with the ground is at rest while the rest of the wheel moves along in the direction in which the wagon is traveling, and the whole wheel moves around a line drawn through the center of the axle. Both statements are facts. We might add to this curiosity of motion that the top of the rim of the wheel moves forward in the direction in which the wagon is going twice as fast as the hub of the wheel moves. To understand the matter it is necessary to distinguish kinds of motion. The wheel has two certainly. It moves with a rolling motion over the earth; it rotates on its axle. Its motion of rotation as viewed by a fly which might be standing on one of the spokes is a continuous motion round and round, always repeating itself. The motion along the ground is of another kind. If a fly stood on the ground as the wheel passed by him, he would see a point of the rim come down to his side and stop. It would immediately begin to rise, and would go up high in the air only to descend again, and so on again and again. A point of a wheel in contact with the earth is not in motion with reference to the point of the earth on which it is pressing unless it is slipping backward, a condition which this case does not include. It is at rest therefore on the ground, but in motion around its hub or axle. Rest and motion are frequently relative. To some point a body may be at rest. To some other point it may be in motion. And it is sometimes quite puzzling to determine the rest and motion as it may be in reality. This is the case with some of the motions of the heavenly bodies. The motion of a wheel may be tested by taking a small circular disk and fastening a chalk crayon in a hole close to its edge. Then roll it along a fence in such a way that the chalk will mark a line on the boards. You will be interested in seeing its real path. You will see that it contains a point of rest. The curve traced by the crayon is called a cycloid.

(10939) W. B. C. says: Will you kindly state in your notes and queries column a process for treating wood for open fireplaces so that it will burn with colored flame? Also the substances used to make a slow-burning colored fire? A. In a pail of water put 4 ounces copper chloride, and soak the wood in this solution. When dry it will burn with a green flame. Zinc chloride and strontium chloride may be added, giving bluish and red flames mixed with the green. A slow-burning green fire may be made by mixing potassium chlorate 36 parts, barium nitrate 40 parts, and sulphur 24 parts. For a red flame use potassium chlorate 40 parts, strontium nitrate 39 parts, sulphur 18 parts, lampblack 3 parts. These formulas are from the "Scientific American Cyclopedia of Receipts," which contains many others, besides thousands of valuable receipts. We send it for $5.

(10940) C. A. G. asks: A D and C B are parallel horizontal planes, X is a 40-65 Winchester rifle. The distance A C is one foot and is vertical. Now a bullet is shot from the gun X, and the instant the bullet passes point A, another bullet (same size, etc.) is dropped from this same point, i. e., A. Will both bullets strike the ground within one-tenth of a second of each other? Besides answering this question, I wish you would give me the data from which you derive your answer. A. Both bullets in the case proposed will strike the level plane below at the same instant, not within a tenth second of each other. The reason is that the bullet which is shot from the gun falls by gravity as readily and as much as one which is dropped from the same point at the same time. The law of motion which covers this case is stated as follows: "A given force produces the same effect whether it acts upon a body at rest or in motion, whether it acts alone or at the same time as other forces." One force acts in the line AC, gravity; two forces act upon the ball which is shot from the gun, the force of the powder and gravity, to cause it to pursue the path AB in the same time as the other ball passes through AC.

(10941) G. W. S. says: Assume an air-pipe of considerable length, say 100 feet, open at its ends. Apply an air-pump of 10 pounds force at one end. Air will pass through the pipe because of a pressure at the inlet of 25 pounds against 15 pounds pressure at the outlet. Transfer the pump to the other end of the pipe, and use it as a suction pump.

Again air will pass, in the same direction, due to a pressure at the inlet of 15 pounds and an outlet pressure of 10 pounds. The latter arrangement is alleged to be the more efficient. Why so, since in each case apparently the actual moving force is the superior pressure at the inlet end, and there is the same difference of pressure at the ends? If there is no difference in efficiency, wherein lies the acknowledged great economy in an exhaust steam heating system, wherein a suction pump is placed at the tail of the system, as against a force pump of the same power placed at the head of the system and supplementing the power of the exhaust piston? Apparently here also the actual moving force in each case is a "push." A steam heating book uses the simile of pushing and pulling a rope—apparently an inaccurate one. A. There is no difference in efficiency between pumping air through a pipe and drawing it through by suction. The work required to move the same quantity of air at the same velocity will be the same in either case. The idea that you have regarding the greater efficiency of a vacuum steam-heating system is correct, but for a very different reason. The great difficulty with steam-heating systems is that air gets into the pipes and radiators, and is difficult to dislodge by the circulation of steam under pressure. By means of an air pump, producing a slight vacuum in the entire system, however, there is no difficulty in keeping the system free from air, and having every part of the heating surface effective.

(10942) C. M. H. asks: Could you give me simple method for treating cloth or paper for making a barometer, the kind that changes color—pink for rain, blue for fair? A. A formula which recently appeared for the so-called color barometer is as follows: Cobalt chloride, 30 parts; sodium chloride, 15 parts; calcium chloride, 4.5 parts; gum arabic, 7.5 parts; water, 45 parts. Soak cloth in this solution and dry. The solution absorbs moisture from the air, and so changes color. The cobalt chloride is the substance which changes color by moisture. The cloth is not a barometer in any proper sense, but a hygrometer, since it shows the presence of moisture in the air, and not the pressure of the air.

(10943) A. B. asks: 1. Can you tell me of a simple test to tell platinum wire? A. Platinum is characterized by its high fusing point, about 3450 deg. Fahrenheit. It cannot be melted by any temperature below that of the oxyhydrogen flame. This is the simplest test. Heating in an ordinary flame does not alter it. It is not soluble in any single acid, but is dissolved by aqua regia. 2. Is it true that there is a salt lake that has a crust of salt on the surface? If so, what is the name of it? A. There is a place called Salton in California where salt is plowed up from the surface of the shore of a lake and purified for the market. Later another crop can be harvested from the same place. Salt does not float on water. There cannot be a crust of salt over the surface of a lake. 3. Why is it that ice is a non-conductor and water is a conductor of electricity? A. Neither ice nor water when pure is a conductor of electricity. Water owes its conductivity to minute quantities of impurity in it. Ice tends to freeze itself pure from impure water. Hence ice is usually a non-conductor of electricity. A. Can you explain to me what watt and watt-hours denote? A. A watt is the unit of electrical power. One ampere flowing at a pressure of one volt gives power of one watt. One watt working for one hour makes a watt-hour. You would find all such questions answered in Swoope's "Elementary Lessons in Electricity," which we can send for $2.

(10944) H. O. N. asks: There has been quite a bit of discussion here on this subject, and I write to you so that I may help it along. Which goes the faster—the top of a wagon wheel or the bottom? What would be the center of it in that case? Is a wheel that is on the ground any different than a pulley in the same case? Some say that the top goes twice as fast as the axle, and that the bottom stands still. A. The discussion about the "going" of a wagon wheel turns wholly upon the use of the word "go." Define going, and all will become clear. A wheel *goes* with reference to the axle in one manner and with reference to the ground in quite another manner. Going may then be rotating or moving along. It rotates around the axle. All parts rotate alike, going around at the same speed, that is, going around in the same time, each point in its own proper circle. The whole wheel moves along with the axle over the road at the same speed as the axle and, for that matter, at the same speed as the whole wagon moves over the road. This being settled, it remains to inquire how the parts of the wheel move with reference to a point on the ground past which the wheel may be "going." Consider a point just in front of the wheel. As it approaches this point the tire, or rather a point on the tire, comes down and rests for a moment on this point of the ground. It is not in motion on that point if there is no slip of the wheel on the ground. This is what is meant by saying that the bottom of a wheel "stands still." It is at rest on the ground underneath the wheel for an instant. At the next instant that point of the tire begins to rise from the ground, and goes on up till it reaches the top of the wheel. The motion is a very curious motion, as you can see by marking a point on the tire of a wheel and watching its path as it comes down to the ground and rises again to the top of the wheel. It describes the curve called a "cycloid." Now when the point of the tire is at rest on the ground, the axle does not stop. It moves right on, and so does the top of the wheel. As the top of the wheel is twice as far from the ground as the axle is, it will be seen that the top of the wheel must be moving along two times as fast as the axle is moving. This can be seen in another way. Take a point on the rim which is at the same level as the axle and is behind the axle. As the wheel rolls along the road this point goes up and over and comes down to the front of the wheel and to the same level as the axle. It has gained on the axle the whole diameter of the wheel. It was behind and now is in front of the axle. To do this it must have moved faster than the axle over the road. See if you can calculate how much faster. During the next half turn of the wheel this point drops down to the ground, rises again to the same level, and is behind the axle, by the whole diameter of the wheel. It has lost distance, and has gone over less space than the axle of the wheel went over in this half turn. See if you can calculate how much less distance it has gone over. You will find that there is just as much distance lost as there was distance gained when the point was on the upper part of the wheel. There is more of curious interest in the rotation of a wagon wheel than your questions implied. Most of the differences of opinion in discussion would be removed by a careful definition of the terms employed and a careful statement of the conditions of the case which is under discussion. There are many hot discussions in which both sides mean the same thing, but use words in different senses in expressing their meanings. Probably this is the case with your discussion.

(10945) S. T. B. asks: 1. I have read that in the secondary coils of induction coils there is sometimes a current of 30,000 volts with as low as 0.001 ampere. To me this seems to conflict with Ohm's law. To put it at a safe figure, the resistance of the secondary coil of such an instrument would not be more than 500 ohms. Then if we divide volts by ohms according to Ohm's law, we would get 60 amperes. This I can plainly see would be impossible, but please point out my mistake in reasoning. A. We do not see any reason why Ohm's law should not be applied to any case of volts and amperes to find resistance. No correct result can be impossible. It is, however, not to be supposed that the resistance in the case given is that of the secondary coil alone. It is that of the coil and the air for the spark length, whatever that was. Even when air is ionized, several inches of it has a high resistance. Nor is the resistance of a secondary coil likely to be as low as 500 ohms. No. 36 wire B. & S. has 2.4 feet per ohm, and 500 ohms would be only 1,200 feet, while a large coil giving a 12-inch spark would require at least 17 miles of such wire, with a resistance of 18,270 ohms. Spottiswoode's great coil had 280 miles of wire in its secondary; but that is more than is required for the same spark length nowadays. There are two errors in your note, one in underestimating the amount of wire used in secondaries and another in neglecting the air resistance as a factor in cutting down the amperes required in a secondary coil for a given voltage. Now again the self-induction at the moment of breaking the primary circuit causes a tremendous inductive effect upon the turns of the secondary, with the result that a tremendous voltage is produced in the secondary coil. This rises enormously above 30,000 volts when the spark distance is large. A table recently issued shows that 20,000 volts are required to throw a spark 1 inch between sharp points in the air; while to throw a spark 15 inches, 150,000 volts are required. Now coils have been made to throw 45 inches. 2. How does magnetism interfere with the working of a watch? A. The magnetism of the steel parts of a watch affects the motion of the hairspring and balance wheel when that is of steel or has steel balancing parts upon it. 3. Have diamonds ever been produced artificially? A. Diamonds have been made artificially by Moissan in his electric furnace experiments, and they have been found in meteorites. See Moissan's "Electric Furnace," page 77.

(10946) W. R. M. asks: I am puzzled over a problem in electricity. Here it is: What number of volts and amperes will light a 12-watt electric lamp?

1 volt $\times$ 12	amperes = 12	watts
2 volts $\times$ 6	amperes = 12	watts
3 volts $\times$ 4	amperes = 12	watts
4 volts $\times$ 3	amperes = 12	watts
6 volts $\times$ 2	amperes = 12	watts
12 volts $\times$ 1	ampere = 12	watts
24 volts $\times$ ½	ampere = 12	watts

You see the products are all the same from the multiplication of the volts $\times$ amperes. Please explain about the lamp and voltage and amperage. A. We do not see any puzzle about your problem. You show that there can be seven different ways of dividing the volts and amperes so that the lamp will have 12 watts. There is no puzzle about that. It is quite true. The only question is, which would be the better way to divide the volts and the amperes. We would decide that to be either the 6 volts and 2 amperes, or the 12 volts and 1 ampere, or 24 volts and ½ ampere. The higher the voltage the smaller the wire necessary to carry the current without overheating the wire, and so the cheaper the wiring will be.

(10947) C. B. R. writes: What controls the circulation of elaborated sap of trees? Why does, or does, it rise in the spring? Or where does it come from? At what time each month can a bush having sugar in its roots be cut so that it will sprout and grow? At what time each month will it die if cut? What stops the circulation or keeps it back from the roots at times? Why should freezing the ground make a free flow of sap, and no frost a moderate flow? Why when a board or straw is laid on the ground at certain times, it will settle down, at other times it will rise? A. The rise of water in trees from the root tips to outermost twig is a strange thing, and its mechanics is not even yet clear. Capillarity plays a part, as also does osmotic pressure. The power of living protoplasm to imbibe water was once thought to explain it. Again, others have thought that the evaporation from the leaf surfaces causes the water below to rise as if drawn up by pulling on the end of a filament of water. All these and perhaps other and undiscovered causes may be at work to raise the water sometimes hundreds of feet. The water rises most easily in the new wood, and this is formed in the early summer or late spring. We do not believe that the time of the month has anything to do with the sprouting of seeds or the growing of sprouts. This is an old superstition connected with the moon, which dies hard. If a twig is cut off, the power of growth in the tree usually is sufficient in the early part of the year to produce other shoots to take its place in the support of the life of the tree. Late in the season these sprouts do not so readily appear. There are always buds in the bark which will grow if moisture is supplied to them. They may stay years without starting, and wounds given to the tree may then make them start to grow. Sap circulates freely till the ring of wood and new bark is formed and the walls of the cells have thickened so that water cannot easily pass through these walls. The flow is not then much. The season of growth is over for that year. The flow of sap out of a tree in which a hole has been made, as in the sugar maple, in early spring is due not to the freezing of the ground, as most suppose, but to the expansion of the water by the warmth of the sun during the day. The tree is gorged with sap, which is ready for the production of wood for the spring. The nights are cold, below the freezing point, the day is warm; the large difference of temperature expands the sap, and forces some of it out of any hole in its course up the tree. When this large fluctuation of temperature from the day to the night and back again ceases, the tree also ceases to give sap for sugar. We do not understand the question of the board laid on the ground and sometimes sinking and at others rising. We never saw or heard of that before.

(10948) C. K. B. asks: What is the cause, or where do the prevailing westerly winds of the northern hemisphere originate? How does the rotation of the earth cause the deflection of the trade and anti-trade winds of the northern hemisphere? A. The general systems of the winds are due to the greater heat of the torrid zone. This produces the inflow of air from the cooler regions on either side of the hot region. The heated and lighter air is forced up by the flowing of the colder air under it, and it flows away to the north and south in the upper layers of the air. After this air is cooled it descends, and flows along toward the poles, only to return and again take part in the general circulation of the winds. The rotation of the earth on its axis causes great changes in direction of these currents, and we have northeast and southwest winds as more or less permanent winds in different parts of the northern hemisphere. This is but a rough and general statement of the winds, but may serve as a basis for fuller reading on the subject in the physical geographies. As the current of cooler air flows along over the smooth surface of the ocean in the torrid zone north of the equator, it is passing from a region where the velocity of rotation of the earth is less to a place where it is greater. This causes the wind to lag with reference to the earth under it, and to appear to come from a point farther to the east than it has really come. It thus becomes a northeast wind, and is the northeast trades. For a similar reason the returning currents of air over the ocean become southwest winds, or the anti-trade winds.

(10949) 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.

(10950) 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 articles 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.

(10951) 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.

(10952) 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.

(10953) A. A. B. asks: I wish to ask through your paper if it is not possible for the manufacturers of incandescent light bulbs to complete the bulb without having to form the little sharp point on the rounded end? A. Incandescent lamp bulbs are made without any point upon the large end. They may be had from dealers in electric supplies.

(10954) L. A. H. asks: Is there such a thing in the realm of science as flame or combustion without emitting light? A. Combustion is usually the combination of a substance with oxygen. This may take place with rapidity, so that much heat is produced, and also light; but often it takes place so slowly that no light is seen, and the temperature may not rise very much above that of the air. The rusting of iron or steel is an example of this.

(10955) F. W. B. asks: 1. Please give (in substance) an explanation of the phenomena of rotating storms, such as whirlwinds, cyclones, etc. Do they always rotate in one direction, and why? A. The rotation of storms is caused by the rotation of the earth on its axis. In the northern hemisphere these storms rotate in a direction opposite to the motion of the hands of a clock; in the southern hemisphere they turn with the hands of a clock. All cyclones, hurricanes, tornadoes, etc., follow the same law. 2. Is it possible for a whirlwind to rotate for a time in one direction, and then reverse and whirl in the opposite? I ask this last especially for the reason that two reputable persons of my acquaintance claim to have seen this phenomenon. A. Small whirlwinds, such as form in a field or at a street corner, probably turn in either direction; but if one was seen to rotate one way, and in a brief time another was seen in the same place turning in the opposite direction, we should consider that these were two different whirlwinds, and not a whirlwind which had reversed itself.

NEW BOOKS, ETC.

We have received from Knowledge, 27 Chancery Lane, London, W. C., a circular slide rule devised by Major B. Baden-Powell. The instrument consists of two similarly figured dials, an outer fixed one and an inner rotatable one. These are graduated in logarithmic sequence, and the numbers are arranged in spirals, so that the decimals coincide, as in all slide rules. While not professing to be an absolutely exact calculating machine, this simple appliance ought to prove of the greatest use in everyday life. It is so simple in action, so compact, and yet so reliable, that it should find a place on the writing table of all those who have frequent calculations to make. Not only does it enable one very rapidly to obtain approximate results, even with large figures, in multiplication and division, but for those who have to deal with foreign measures and wish to know, almost at a glance, the equivalent in English measures, this should prove helpful. One advantage of this form of apparatus may be noted, that any special measures which have to be converted, such as rubles to pounds, carats to grains, or kilowatts to horse-power, can be temporarily marked on the card. The equivalent fractions of decimals, proportions, and square roots are also easily found.

The Modification of Illinois Coal by Low Temperature Distillation. By S. W. Parr and C. K. Francis. University of Illinois Engineering Experiment Station. Urbana, Ill.: Published by the University. 8vo.; Pp. 48.

The details of this paper are many and intricate, and the conclusions rather vague and unimportant. The main conclusion appears to be that coal can be made more available for certain purposes by treatment, but neither the cost of the treatment nor the total B.T.U. of the evolved gases is given. In fact, the research is incomplete and hardly ripe for presentation.

Electricity: What Is It? By W. Denham Verschoyle, M.E., M.I.M.E., M.A.I.M.E. London: Swan Sonnenschein & Co., Lim. New York: The Macmillan Company, 1908. 16mo.; cloth; 259 pages; illustrated. Price, $1.

A purely theoretical position has been taken by the author in discussing the question: What is electricity? In seeking the laws that regulate the intermediate action of energy and matter the finding of new facts has been subordinate to generalization through chapters on the gyron, atom, molecule, heat and light, electricity and magnetism, dissociation and devolution, and life. The importance of theoretical work in the new science as demonstrated in this volume may cause additional attention to be drawn to it when known that the tables and general conclusions have received a measure of confirmation in the work of Sir William Ramsay. Spectrum analysis is dealt with in the appendix.

Cement Laboratory Manual. A Manual of Instructions for the Use of Students in Cement Laboratory Practice. By L. A. Waterbury, C.E. New York: John Wiley & Sons, 1908. 12mo.; 122 pages, 28 figures. Price, $1.

This manual has been prepared for the use of students taking the course in cement laboratory practice in the University of Illinois, and for the use of others who may have occasion to use such a laboratory manual. Instructions for the problems originally used in the course mentioned were devised by Ira O. Baker, professor of civil engineering, University of Illinois, under whose direction the author had charge of the cement laboratory at that institution for three years. This manual has been prepared by revising and extending the instructions already in use. The problems which are given herein are suitable to class use and are not intended to serve as instructions for the testing of cements for commercial purposes. However, the problems have been designed to include all of the tests which are ordinarily made, so that a student who shall have completed these problems should be able to do testing for commercial purposes, although the experience which is required for the production of uniformly satisfactory results in the latter class of work can be obtained only by a considerable amount of practice, and cannot be obtained to any considerable extent by a laboratory course which is intended chiefly to teach methods of testing.

Elements of Railroad Track and Construction. By Winter L. Wilson. New York: John Wiley & Sons, 1908. 12mo.; 320 pages, 181 figures. Price, $2.

In this volume no attempt has been made to treat the subjects of railroad track and construction with any considerable amount of detail, but rather to present a few of the fundamental principles in such manner that the inexperienced engineering student can form a general idea of the subjects. There are a number of excellent treatises on track which go into the subject with a wealth of detail and a thoroughness of discussion which is of immense value to the maintenance-of-way engineer with some experience; but, unfortunately, these books are not suitable for class-room work, both on account of the student not being able to appreciate the value of the details and also on account of the impossibility of reading these books in the time usually given to such subjects in an engineering course. Details of practice can be much more readily learned and appreciated from actual experience. There is not much time in the four years of an engineering course that can economically be given to the details of practice, but it is essential that the student should understand the fundamental principles of the subjects. In this volume some of the general principles of track and of the part of railroad construction with which the young engineer may come in contact early in his experience are presented.

Highway Engineering. By Charles E. Morrison, A.M., C.E. New York: John Wiley & Sons, 1908. 8vo.; 315 pages, 60 figures. Price, $2.50.

This was prepared for the second-year students of the department of civil engineering at Columbia University, with a view to furnishing a test in which the fundamentals of the subject should not be buried in a mass of detail, such as is frequently found to be the case in works of a similar character. This book is, therefore, not a reference work, but rather one in which it has been the endeavor to outline and emphasize those basic principles which are essential to good highways.

The Engineers' Descriptive Charts in Colors. Showing the Development of the Steam Boiler. Showing the Development of the Steam Engine. Showing the Development of the Electric Generator. By Joseph G. Branch, B.S., M.E., Author of Stationary Engines, Conversations on Electricity, etc. New York and Chicago: Rand, McNally & Co., 1908. 28½x22 inches; illustrated. Price, 50 cents each.

The charts are clearly illustrated and effectively printed in three colors. The development of the subjects is both technical and historical and the charts will prove to be an invaluable aid to all engineers, firemen, machinists, students, and electricians.

Steam Power Plant Engineering. By G. F. Gebhardt. New York: John Wiley & Sons, 1908. 8vo.; 816 pages, 461 figures. Price, $6.

This book is the outcome of a series of lectures delivered to the Senior class of the Armour Institute of Technology, Chicago, Ill. It is primarily intended as a text-book for engineering students, but, it is hoped, will also be of interest to practising engineers. The field embraced by the title is a large one and it has been necessary to limit the treatment to essential elements. Much of the matter contained in the author's original notes, including that relating to steam engine design, valve gears, steam boiler design, and the like, has therefore been omitted. The numerous references appearing throughout the text and the appended bibliographies, which have been carefully compiled, are depended upon to extend the scope of the work. The standard codes of the American Society of Mechanical Engineers for conducting engine and boiler trials are in frequent demand by engineers and have therefore been included as an appendix. Authorities have been freely consulted and extensive use made of current engineering literature, due acknowledgment being made by footnote or reference whenever possible. The matter included is representative of American practice and no effort has been made to include any other except in a few special cases.

Long Odds. By Harold Bindloss. Boston, 1908. 12mo.; 401 pages. Price, $1.50.

This latest and best book by this popular teller of tales is a story of splendid endeavor, the scene Portuguese West Africa. A promise to a dying partner sends the Quixotic hero out into the steaming jungle on an errand of freedom and into innumerable perils which thrill the imagination with the strange ways of the mysterious and fascinating Dark Continent. The vivid picture of the so-called contract labor conditions, which amount to Negro slavery, is of particular value to everyone interested in the Congo reform movement. There is an American missionary of fine heroism whose acquaintance every American will gladly make, and the absorbing love story holds the reader enthralled.

Herculaneum, Past, Present and Future. By Charles Waldstein, Litt. D., Ph.D., L.H.D., and Leonard Shoobridge, M.A. With Appendices. London and New York: The Macmillan Company, 1908. Illustrated. Imperial 8vo.; 324 pages. Price, $5.

Dr. Waldstein has written an exciting book, says the New York Tribune. Archæology has always had more romance about it than the prosaic layman has been prepared to admit, but in the present instance it makes a peculiarly alluring appeal. If it stirs the blood to think of what the excavator feels when he uncovers a single tomb in Egypt it is positively thrilling to contemplate the possibilities summed up in the name of that Campanian town which was buried by an eruption of Vesuvius in 79 A. D., and has been left almost undisturbed in its sleep ever since. There are reasons why we are justified in believing that Herculaneum, if fully uncovered, would yield treasures of art and other vestiges of the ancient past incomparably richer than those dug up at Pompeii. The Italian government has committed itself to excavate Herculaneum on its own responsibility. The work will necessarily be slow. It requires prodigious sums, which only the nations of the world, acting together, could supply. No better contribution could be made toward a movement culminating in such a scheme than is made in these pages. Obviously, excavation at Herculaneum should reveal innumerable objects for a few hundred to be found at Pompeii. Furthermore, the two towns suffered in distinctly different degrees from the malice of Vesuvius. Herculaneum is a mile and a quarter nearer than Pompeii to the foot of the volcano. Pompeii suffered enough in all conscience, but she got off with, on the whole, less damage. Now what happened at Herculaneum? With overwhelming suddenness a sea of liquid mud swept over the town and buried it to a depth of about eighty feet.

The Book of the Pansy, Viola, and Violet. By Howard H. Crane. New York: John Lane Company, 1908. 16mo.; 106 pp. Price, $1.

The beautiful flowers of the pansy, that we are now accustomed to see in nearly every garden worthy of the name, were not evolved in one short space of time. They are the outcome of many years of persistent effort on the part of a comparatively few enthusiasts, who, by dint of infinite patience and labor, have helped to evolve the glorious blooms that are now so largely grown. The pansy dates only from 1813. With careful breeding the pansy was evolved from the heart's-ease. The book deals with everthing relating to the pansy, the viola, and the violet.

Les Nouveaux Livres Scientifique et Industriels. Vol. I. Annees 1902 à 1907. Livraisons 1 à 20. Bibliographie des Ouvrages publiés en France. Du 1er Juillet, 1902, au Juin, 1907. 1° Table alphabétique des sujets traités. 2° Table alphabétique des noms d'auteurs. 3° Livraisons trimestrielles (Nos. 1 à 20). Paris: H. Dunod et E. Pinat, Editeurs, 1908.

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