plied with different quantities of oil in accordance with their requirements.

BARREL-PACKING MACHINE.—J. H. Vogt and L. Storck, Stamford, Conn. The invention is an improvement in packing machines for barrels and such like shipping cases which are filled with granulated or pulverized material and has for its purpose to provide for the uniform hammering or application of pressure to the material as the latter is placed in the case.

Prime Movers and Their Accessories.

MEANS FOR CONNECTING AND DISCONNECTING RECIPROCATING ENGINES.—S. S. Smith, Osage, Iowa. The object of the improvement is to easily and quickly disconnect any reciprocating engine, and especially those of a locomotive, and leave the same balanced after it has been disconnected as it was while working or under normal working conditions. In such engine construction counterbalances are used to equalize the weight of the pitman or connecting rod.

INTERNAL-COMBUSTION ROTARY ENGINE.—H. Lee, Bowral Street, Kensington, near Sydney, New South Wales, Australia. The purpose of the inventor is to provide an engine working on the rotary principle, which will utilize the power of the gases generated by the explosion more fully than heretofore. Its essential features consist of a rotary compressor, an intermediate rotary valve, and a nave or rotor carrying a sliding piston within a chamber of peculiar construction and varying contour.

Railways and Their Accessories.

CAR-FENDER.—C. Kleymeier, Covington, Ky. The purpose of this invention is to provide details of construction for a street car fender, which render the device compact and convenient for placing upon or removing from a car; the fender, when in position for service, being adapted to positively guard against accidents, and when in operation gently but positively removing laterally from the track a person or object, that is picked up by the fender, and without injury to the person or object.

RAILWAY CROSS-TIE.—F. N. Drane and H. A. Drane, Corsicana, Tex. The object of the invention is to provide a tie, provided with spaced concrete tie blocks, connected with each other by a metallic cross rod, extending centrally through the blocks and having means for adjusting the blocks toward or from each other, to bring rails held on the blocks to proper gage, and to allow of raising either block and maintaining both blocks and their rails in the same plane.

Pertaining to Recreation.

BOWLING-ALLEY. — C. B. Brenneman, Boston, Mass. The invention is an improvement in bowling alleys and the alley-way is of ordinary form and construction, comprising the floor, the side walls, and the return grooves, adjacent to the side walls, and upon each side of the floor. Instead of pins, balls are used, and that portion of the floor upon which the balls are placed is provided with depressions arranged in proper position with respect to each other.

Pertaining to Vehicles.

WHEEL FOR MOTOR VEHICLES.—J. V. Pugh, Guiting House, Allesley, Warwick, England. This invention relates to the wheels of road vehicles, and the object is to provide a reliable and readily detachable wheel. It consists in a wheel composed of a permanent wheel hub, a removable hub enveloping the permanent hub and carrying the spokes and felly clutched members between and formed integral with the hubs.

VEHICLE-WHEEL.—G. H. Groth, Cincinnati, Ohio. The invention relates to certain improvements in vehicle wheels, and more particularly to the steering wheels of motor vehicles. The object is to so construct the wheel that the ordinary steering knuckle may be employed, but at the same time, the pivot of the steering knuckle may be located in the plane of the wheel.

SELF-PROPELLED VEHICLE.—C. Richter, Tampa, Fla. The invention relates to self-propelled vehicles, and more particularly to that class usually characterized as automobiles. An object of the invention is to provide a self-propelled vehicle which is adapted to travel on land and water. Also to provide a vehicle adapted to travel on land and water and having means for propelling the vehicle on land and water.

LAND-ROLLER.—H. P. A. Andersen, Cushing, Neb. The invention provides a roller, wherein plain disks with a central peripheral grip alternating with toothed disks mounted upon a common axle, so that they revolve with the axle and revolve thereon, whereby opposing plain disks form ridges and pack the soil, preventing the finer particles from rolling away, while the interposed tooth disks penetrate the crowns of the ridges, cultivating the ground and leaving it in the best condition to absorb moisture, thus tending to prevent the earth from being washed away.

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.

Full hints to correspondents were printed at the head of this column in the issue of November 14 or will be sent by mail on request.

(11012) H. J. P. says: 1. When a town is being changed by an electric company from a direct-current system to an alternating, it is not possible to run a motor of any kind of direct-current type with the alternating system, is it? A. Some forms of alternating current may be used upon a direct-current motor by bringing the motor to speed before the current is thrown on. The motor will then keep step with the current. It is far better to use a self-starting alternating-current motor. 2. Which is considered the most up-to-date system, the direct or the alternating current? A. The alternating current is displacing the direct current in a great many places. 3. Rewiring of the houses I presume would not be necessary? A. The house wiring is the same for both kinds of current.

(11013) J. M. K. says: 1. How should I make the connections for a miniature overhead trolley line, direct current? A. The positive pole of the current is usually connected to the trolley wire and the negative pole to the rails. 2. Are magnetism and electricity the same? A. Magnetism and electricity are not the same. Magnetic whirls are the result of an electric current, and surround the wire through which an electric current is flowing. 3. In your issue of October 17, 1908, page 257, is an article on ice making at home. Is Prof. Audiffren's machine on the market? And if so, where can it be gotten? A. The machine will probably be placed on the market in this country in a short time. Address will be supplied by mail. We do not give addresses in this column. 4. Cannot the current from a 6-volt, 4-ampere direct current be raised to 110 volts direct current through transformers or something? A. An electric current can be transformed from 6 volts to 110 volts, by means of a transformer, but the amperes will be cut down in the same ratio as the volts are raised. Starting with 4 amperes you will have about 0.2 ampere at the finish and not much work can be done. 5. Acetylene gas made from calcium carbide is not adapted for use in balloons.

(11014) R. S. says: Would you kindly inform me whether a dynamo is capable of creating more power than that required to run it? In other words, when a dynamo is creating a certain amount of power, is the power back of the dynamo greater or less than that created? A. The power used to drive a dynamo is always greater than the electrical power which the dynamo can furnish. There are no perpetual-motion machines in operation as such a one would be if it could furnish more power than is put into it to make it go. The dynamo is simply a transformer of energy and not a creator of energy. There is no machine which can create energy. All machines merely transform energy to some special use, always with a loss, the object being to get some other form of service, the loss being the price paid for the exchange. Steam in the engine cannot be used for light; electricity can be so used. Steam cannot be conveyed many miles to drive cars at a distance from the engine house. Electricity can be conveyed hundreds of miles, and there be used as power or light.

(11015) L. W. H. says: If you will allow me I will state the question: In a dynamo, electricity is generated by the armature shaft cutting the lines of force of a magnet. Is it a fact that clouds passing east or west generate more electricity than those passing north or south, considering the earth as a great magnet? Is this why our electrical storms come from the west? A. We do not know whether clouds moving from west to east generate more electricity than do those moving north or south. Storms all move from a westerly toward an easterly quarter. The wind in a storm is moving with a rotary motion, drawing from the outside toward the center of the storm. The rotation in the northern hemisphere is opposite to the motion of the hands of a clock, or over from east to west. This is caused by the rotation of the earth upon its axis. In the southern hemisphere the rotation and the winds in storms are in the opposite direction from what they are in the northern hemisphere. This is to be found fully discussed in Davis's "Meteorology," which we will mail for $2.50.

(11016) W. P. B. asks: 1. What can I mix with coal tar to dissolve it? A. Any of the hydrocarbon oils will dissolve asphaltum, or coal tar—gasoline, naphtha, benzine, kerosene, as also turpentine. 2. The house fly can use its legs and wings with great rapidity, the two fore legs as a man uses his hands. Are they moved by muscles? If not, by what? A. Flies and other insects move their legs and wings, and other parts also, by muscles as do the higher vertebrate animals. There is this difference, however, that the muscles of insects are not gathered into bundles terminated by tendons, as are those of the vertebrates, but are in straight fibers, not joined to each other in most cases. The fibers form layers which may be regarded as separate muscles. The fibers are composed of minute fibrillæ which have been seen to be striated as are the muscular fibers of vertebrates. It is hardly necessary to add that these fibers are very numerous, numbering several thousand in a single insect. The segments of the body are also well provided with muscles. Some of these go from the front of one segment to the front of the next, and others go to the rear of the next segment. Thus the segments can be tilted to and fro. The muscular strength of many insects is enormous, far exceeding that of the higher animals, relative to their weight. It is said that a flea can leap 200 times its own length. An equivalent leap for a man 6 feet would be 1,200 feet. A beetle has been known to sustain 500 times its own weight and creep out from under it. What would an equivalent load for an elephant be? For a man of 200 pounds in weight it would be 50 tons. Beetles often gnaw holes in lead pipes, and an instance is recorded of a European beetle gnawing a hole an inch in diameter in an iron canister in which it was confined, proving not only its muscular strength, but also the hardness of its mandibles. 3. Jupiter and Venus are now and have been in view near together. Approximately how far apart are they? A. When Venus and Jupiter are to be seen near each other in the sky Jupiter is nearly 500 millions of miles farther from us than is Venus, or about his own distance from the sun. 4. What can I put around the roots of trees from 1 to 4 inches in diameter to kill them? A. An ax at the root of a tree is the easiest mode of killing it. The simplest mode adopted in clearing new land by the early settlers was to girdle the trees near the ground and they were dead the next season. There is nothing which can be put into the ground to kill a tree that would not kill whatever else was growing there.

(11017) W. B. B. says: 1. In E. S. Lincoln's article in the Supplement for September 26, should not the formula $X = \frac{R(D-1)}{d}$ read $D - d$ instead of $D - 1$? Letting the currents corresponding to deflections D and d be represented by I and i respectively,

$$I = \frac{E}{R}, \; i = \frac{E}{RX}.$$

Whence, $$\frac{I}{i} = \frac{D}{d} = \frac{R+X}{R} = 1 + \frac{X}{R}.$$

This gives $X = \frac{R(D-d)}{d}$.

A. Your correction of the printer's error in the article seems to be justified, and to be all right. 2. If the efficiency of a motor is $\frac{E-e}{E}$, where E and e are the impressed and counter E.M.F. respectively, so that eI is loss, then to have efficiency 100 per cent, e must equal E, in which case no power at all would be used. At least that is the only way I can see it, though I have been studying the matter for years. In other words, if the motor uses any power at all, all the power it uses is loss and is therefore not used after all. Can you explain that so that I can understand? If it is not all loss, what part is not? A. Take care and do not conclude that a motor of 100 per cent efficiency would be a perpetual-motion machine. It is a queer inference that you make, "in which case no power would be used." What is to produce E to which for 100 per cent efficiency e becomes equal? Power must be spent every instant in forcing the motor against the counter electromotive force, and the current it generates, else there would be no motion of the motor and no counter electromotive force to be overcome by the impressed electromotive force. We suggest that you read the chapters in Carhart's "University Physics," vol. 2, upon "Electromagnetic Induction and the Efficiency of Motors." We will send the book for $1.75 postpaid.

(11018) O. B. F. asks: We want formula for painting concrete walls of a bathroom, so that it may be washed with water; would also like an enamel effect if it could be had. A. Cement may be painted with any waterproof washable paint, such as is used for bathrooms, if the caustic properties have become sufficiently neutralized by exposure for the paint to adhere. As this requires some time, it is often effected artificially as follows, with new concrete. Sponge the surface with a solution of 12 fluid ounces of oil of vitriol (H_2SO_4) to a gallon of water. This neutralizes any caustic lime present in the cement surface and turns it into the inert sulphate of lime (gypsum). It also roughens the surface so as to give the paint a firm hold. To remove final traces of alkali, wash with strong vinegar and allow it to dry thoroughly before applying the paint. Prime the surface treated as above with a coat of good old raw linseed oil, and let it dry and get quite hard; if applied liberally that will have stopped all the pores, and next put a coat of flat paint, composed of the necessary pigments, linseed oil, turpentine, and Japan dryer, which may be repeated if the first coat shows up unevenly, and finally, a finishing coat of weatherproof gloss paint or enamel. By the above method, you can use any colors you prefer, but if you wish to preserve the natural color of the cement, a wash of 1 part of water-glass (silicate of soda) to 3 parts rain water may be applied; this decomposes any lime present on the surface, and converts it into silicate, the surface becoming hard and glassy and entirely resisting the action of moisture.

(11019) W. K. asks: I am in a plumbing shop where they do some lead-burning occasionally, and in order to become thoroughly familiar with the theory I got a book from you on the subject, by Fay, in which it says that pure hydrogen can be produced from pure zinc or iron steeped in sulphuric acid; it further says that hydrogen for lead-burning is generally obtained by using ordinary spelter (and acid), and by this latter process we obtained very good results. We ran out of spelter one day and tried the iron, both cast as well as malleable, and we certainly obtained some kind of gas, but it would not burn with a blue flame; the flame was yellowish green; the addition of air from the mixing fork would not change its color; it was oxidizing and the lead would not unite. Now, I would like to know what kind of iron must be used to get a blue unoxidizing flame, or if there is a practical way to purify this gas so as to make it fit for burning acid to give a flame similar to that obtained from spelter, without making the lead-burning apparatus unhandy and complicated? A. We should not advise using iron for making hydrogen, nor sulphuric acid either. We use zinc or spelter, and hydrochloric acid, or as you may know it better by the older name, muriatic acid. You cannot get hydrogen rapidly by the use of pure zinc. Commercial zinc will yield hydrogen rapidly. If pure zinc is used a few drops of platinic chloride should be added to start the action. To prepare the spelter for the action of the acid it should be melted and poured from the ladle into a pail of water, slowly, so as to allow it to granulate. The large surface presented to the acid by granulated zinc will give a rapid evolution of gas.

(11020) J. C. B. asks: 1. Can the experiments made by means of the rectilineator be taken for granted as demonstrating the concavity of the earth? It was found that the earth curved concavely toward a straight line 8 inches the first mile, 32 the second, 72 the third, and the fourth mile the rectilineator touched the water. A. No experiments have ever been performed which proved the earth to be concave. It is not concave, but convex, and curves away from a straight line by 8 inches in the first mile, etc., as you give the figures for concavity. They are the figures for convexity. Within a few years the experiment to show the convexity of the earth by setting stakes in still water has been several times performed, and always with the result that the middle of a set of stakes is seen to be higher above a straight line than the end stakes. All astronomy, navigation, engineering, surveying and geography proceed upon the basis of a convex earth, and the results come out right. This conformity of fact to theory proves the theory to be true. 2. If the sun is such a great distance as 93 million miles from the earth, why is it in the morning or evening shining through clouds the rays of light seem so slanting? A. The slanting up of the sun's rays at rising or setting is due to the rays passing over our heads. As they come from the horizon and pass over us they must seem to pass from the horizon toward the place overhead. Thus they must seem to rise. If the earth were concave they would seem to descend and not to ascend.

(11021) J. W. E. L. asks: Your reply No. 10898 has brought to my mind a condition that I have often thought of. Am I about right in asserting that only a little more than 30 per cent of the energy stored in coal is available at the boiler stop valve? This in being converted into useful work at the engine is again so wasted that in ordinary triple marine engines about 8 per cent is available to propel the ship. A common type of marine engine is twin screw, four Scotch boilers, developing 5,000 I. H. P. I have often wondered what condition would be brought about by dividing the engine into four or six high-speed types, and building them *inside* the boilers. Practically I think that it could be accomplished, and I would value your opinion upon its theoretical efficiency. A. Your suggestion of putting the engines inside the boilers in order to save the heat lost by radiation is certainly novel and ingenious, but we fear it is hardly practicable. Your figures are about right as to the proportion of the heat energy in coal actually delivered by the engine in useful work, but the principal losses are not at points where they would be prevented by the insertion of the engines in the boilers. Of about 90 per cent total losses only 1.5 to 2 per cent is lost by radiation from main and auxiliary pipes and about 2 per cent or a little over in radiation from engine; these are the only losses which could be saved as you suggest, the balance being 1 per cent lost through grates, 5 per cent radiation from boiler, 20 per cent or more in chimney gases, and the balance in main and auxiliary exhausts. The theoretical advantages would therefore be hardly sufficient to justify such a change, apart from the practical disadvantages such as inaccessibility of the engine for repairs, etc.

(11022) E. E. L. asks: 1. I have a Wheatstone bridge arrangement the conductor of the four arms of which is ordinary tap water and into the circuit of the ordinary wire bridge is interposed an electro-magnet

arranged so that it may lift a small armature. Supposing that a dilute acid be poured into one of the arms, will a current flow through the bridge and will it be sufficient to lift the small armature? I intend using a small relay to lift a heavier armature; also a glass vessel for holding the water and carbon electrodes. A. The question you ask regarding a water resistance has only the answer that the current will lift the armature of an electro-magnet if you make it strong enough. The only way to determine the matter is to make the experiment. 2. Can a small dynamo be used for charging a condenser or, in other words, is it possible to charge a Leyden jar to the same capacity as with a frictional electric machine, by a direct continuous current? A. A dynamo will charge a condenser to its own voltage and no higher. It may be 110 volts, or some other voltage. When that is reached the action stops. As a friction machine has many thousands of volts in its spark, it can charge a condenser to a much greater height than a dynamo can do. An alternating current will not charge a condenser; a continuous current will do so.

NEW BOOKS, ETC.

THE WAR IN THE AIR AND PARTICULARLY HOW MR. BERT SMALLWAYS FARED WHILE IT LASTED. By H. G. Wells. New York: The Macmillan Company, 1908. 12mo.; 395 pages. Price, $1.50.

The author leads up to a peculiar situation in which the cockney hero finds himself marooned on Goat Island with the bridge to the American shore destroyed by the wreckage of a dirigible balloon, and cut off from the main land by the swirling Rapids. The hero, however, succeeds in getting hold of a damaged Japanese "heavier-than-air" machine and escapes. The book is filled with the most romantic, but not altogether impossible incidents. There is no question that the dirigible balloon and the heavier-than-air machine are both destined to play a very important part in the wars of the future. Mr. Wells writes as entertainingly as ever and is never unscientific. It must be said that his knowledge of New York geography is impeccable.

THE TEMPERATURE-ENTROPY DIAGRAM. By Charles W. Berry. New York: John Wiley & Sons, 1908. 12mo.; 300 pages, 109 illustrations. Price, $2.

In the revised edition of the Temperature-Entropy Diagram a more extended application of the principles of the $T\phi$-analysis to advanced problems of thermo-dynamics has been made than was possible in the limited scope of the previous edition. The chapter on the flow of fluids has been entirely rewritten and treats at length various irreversible processes. A graphical method of projecting from the pv- into the $T\phi$-plane has been elaborated for perfect gases and its application illustrated in the chapters on hot-air engines and gas engines. The various factors affecting the cylinder efficiency of both gas and steam-engines have been thoroughly discussed. One chapter has been devoted to the thermodynamics of mixtures of gases and vapors, and another to the description and use of Mollier's total energy-entropy diagram.

THE MECHANICAL ENGINEERING OF STEAM POWER PLANTS. By Frederic Remsen Hutton, E.M., Sc.D. New York: John Wiley & Sons, 1908. 8vo.; 825 pages, 700 illustrations. Price, $5 net.

A former edition of this book, issued in 1897, embodied the study and experience of the author gathered during the previous twenty years and brought together for teaching purposes. The years since then have been a period of great and rapid progress in the power plant and in all engineering departments contributory thereto; and while the old edition was modernized here and there and year by year, the time had come with the opening decade of the twentieth century that it be rewritten entirely. The present edition is the result of such rewriting. It is a new book so much enlarged that the old plates could not be used, but the size of page has been increased, new illustrations chosen, and many new topics and treatments have been introduced. While the former approved analytical view-point is retained and amplified, there has also been introduced a discussion in many chapters of the principles and data of applied mechanics attaching to the subject in hand. This has been done to enable teachers who desire to enliven the drill in the mathematical classes to find practical problems and applications of interest and future meaning, and to encourage teachers of the applications of theory to find easily the links and bases for such sound applications. The distinction between the applied thermal principles and those derivable from other departments of theory should tend also to clearness and benefit.

ALONG THE RIVIERA, FRANCE AND ITALY. Written and illustrated by Gordon Home. London: J. M. Dent & Co., 1908. New York: The Macmillan Company. 8vo.; pp. 328. Price, $3 net.

This is a beautifully made book, with most charming colored illustrations. The Riviera may be described as a collection of jewels strung together at irregular intervals on a rough mountain chain. Some are genuine antiques, others are overlaid with modern workmanship, and they vary much in size and shape, but the mediæval holds good nevertheless. It has been the author's endeavor to describe every place along the whole coast from Marseilles to Pisa, omitting only a few towns close to Genoa which have suffered through the growth of factories and uninteresting houses. There is nothing more delightful than an automobile trip over the perfect roads of the Riviera, and thousands of enthusiasts take this trip each year. The book is beautifully printed and bound and belongs to the series known as "Old World Travel." The aim of this new series is to describe both by pen and brush those parts of the Old World which travelers find most worthy of their attention, and to do for countries and districts what the same publishers' well-known "Mediæval Town" series has done for cities. The various volumes will prove not only welcome to the traveler during his visit, but will serve as pleasant reminders of bygone days, and will also bring the different districts vividly before the minds of those who are unable to leave home. The colored illustrations are in all cases reproduced from drawings actually made on the spot.

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