Prime Movers and Their Accessories.

EXPLOSION-ENGINE. — R. O. Le Baron, Pontiac, Mich. The object in this case is to provide a gas, gasolene, or the like explosion-engine arranged to utilize the expansive power of the gas to the fullest advantage and to allow running the engine with the greatest economy. Mr. Le Baron does not limit himself to the number of pairs of cylinders as the same may be varied and two or more than three pairs may be used and connected with each other for producing the desired result.

DRAFT-DRIVEN GENERATOR. — W. H. Jordan, Hays, Kan. This invention relates to engines, the inventor's more particular object being to economize the draft thereof in such manner that when the draft is excessive it may be used to operate machinery, thus utilizing a certain amount of power otherwise wasted. It is of peculiar value upon locomotives, where under certain conditions the draft requires to be frequently shut off.

ROTARY ENGINE.—J. P. Bruyère, Passaic, N. J. A purpose of the inventor is to provide an effective construction of rotary engine, and one which will be economic in the use of steam. A further purpose is to so construct the engine that a piston is located in a casing, both of which parts may be employed as drivers, and wherein each is mounted to revolve relatively to the other. Another is to provide the engine with a simply-applied and readily-effective reversing mechanism and cut-off.

Railways and Their Accessories.

CONCRETE RAILWAY-TIE.—G. S. Miller, Burlington, Vt. The purpose of the improvement is to provide an economic form of tie in which the devices for seating and securing the rails consist in box structures having chambers to receive spikes and means for removably holding the spikes in said chambers in firm clamping engagement at their heads with the flanges of the rails, it being possible to expeditiously and conveniently replace any damaged spike without disturbing the rails or an adjacent spike.

FOLDING EXTENSION-STEP. — J. S. Coxey, Aberdeen, Wash. The intention in this case is to do away with the small tool or box employed to facilitate the landing of passengers from railway-coaches at stations where there is no convenient platform and to accomplish such result by providing an auxiliary bottom step having folding or swing connection with the lower step of the usual series fixed to the platform of a coach, and to control the movements of the auxiliary steps by means of a series of levers conveniently operated through a handle member located at the platform of the coach.

VENTILATING MEDIUM FOR CARS.—C. P. Bonnett, New York, N. Y. The aim of the inventor is to provide means for ventilating cars in a thorough manner and without subjecting the occupants to drafts, and in the construction of the appliance to provide means for regulating the amount of air to be admitted, the said means being conveniently operated from the interior of the car, and further to so construct the upper portion of the car that the foul air will be sucked out from the interior and fresh admitted.

Pertaining to Recreation.

APPARATUS FOR INDICATING THE SCORES OF PLAYERS IN SUCH GAMES AS BILLIARDS OR THE LIKE.—C. S. Oakes and J. A. Manton, Parramatta, New South Wales, Australia. The invention refers more particularly to a mechanical device for indicating the score of players in the game of billiards, and has for its object to provide a simple scoring-board which may be easily read and understood from a distance, so that the players, as well as the onlookers, may be kept advised as to the state of the game as it progresses, while at the same time it is capable of easy and accurate manipulation by the marker.

Pertaining to Vehicles.

REELING DEVICE.—C. A. Hadland, Bennington Township, Minn. This device is for use in reeling wire and the like and is designed to be mounted upon a wagon-body, so that the wire may be reeled or unreeled as the wagon moves. The principal objects are to provide means for removably attaching the device to the body of a wagon, to provide for securing the reel in operative or in inoperative position, and for manipulating a guide for the reel, and for operating these devices conveniently from the seat.

HITCHING-WEIGHT HOLDER. — H. H. Tothill, Lockport, N. Y. This invention has reference to improvements in devices for supporting a horse-hitching-weight on a delivery-wagon or other vehicle, an object being to provide a supporting device of simple construction by means of which the weight when not in use may be suspended from the footboard or other portion of a vehicle in such manner as to be readily lowered to the ground or raised by a person sitting in the vehicle.

Designs.

DESIGN FOR A BUTTON-RIM. — G. E. Schwerg, New York, N. Y. In the present design, from the open center of the button neat and attractive scroll work radiates to the outer edge of the rim, which edge is dotted with a row of small circles, the whole giving a very clean and pretty ornamental effect.

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.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 7075.—For makers and dealers in novelties and newly patented articles.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 7076.—For manufacturers of self-propelling invalid chairs.

2d-hand machinery. Walsh's Sons & Co., Newark, N.J.

Inquiry No. 7077.—For dealers in colored celluloid goods, also celluloid in the crude state.

Perforated Metals. Harrington & King Perforating Co., Chicago.

Inquiry No. 7078.—For makers of rubber goods.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 7079.—For manufacturers of springs wound by a key and run for five or ten minutes.

Adding, multiplying and dividing machine, all in one. Felt & Tarrant Mfg. Co., Chicago.

Inquiry No. 7080.—For manufacturers of and dealers in hydraulic rams for use in shallow wells or ponds.

Wanted.—Bids for making an article similar to a safety pin. Box 337, Blairsville, Pa.

Inquiry No. 7081.—For makers of machinery used in manufacturing dynamite, stumping powder, etc.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 7082.—For makers of ice-making machinery.

Marketers of meritorious inventions and specialties throughout the world. Tatem Mfg. Co., Buffalo, N. Y.

Inquiry No. 7083.—For manufacturers of small springmotors, such as used in toys and novelties.

I sell patents. To buy them on anything, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 7084.—For makers of camera fittings, as screws, etc.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company, Foot of East 138th Street, New York.

Inquiry No. 7085.—Wanted, second-hand, small rail for miniature railroads.

Gut strings for Lawn Tennis, Musical Instruments, and other purposes made by P. F. Turner, 46th Street and Packers Avenue, Chicago, Ill.

Inquiry No. 7086.—For makers of "Buffalo" stock whips.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, wood fiber machinery and tools. Quadriga Manufacturing Company. 18 South Canal Street, Chicago.

Inquiry No. 7087.—For makers of face masks.

Absolute privacy for inventors and experimenting. A well-equipped private laboratory can be rented on moderate terms from the Electrical Testing Laboratories, 548 East 80th St., New York. Write to-day.

Inquiry No. 7088.—For manufacturers of a game known as parlor croquet.

Manufacturers of all kinds sheet metal goods. Vending, gum and chocolate, matches, cigars and cigarettes, amusement machines, made of pressed steel. Send samples. N. Y. Die and Model Works, 508 Pearl St., N. Y.

Inquiry No. 7089.—For manufacturers of road-making machinery, rock crushers, etc.

Wanted.—To buy ideas or patents for new articles to manufacture as a side line. Will consider all propositions, but prefer articles commonly used by the populace. Briefly give full particulars. F. Raniville Co., Grand Rapids, Mich.

Inquiry No. 7090.—For makers of machinery for manufacturing wood screws.

VACATION TRIPS.

If you are going away this summer be sure to send for "Mountain and Lake Resorts," a beautifully illustrated publication of one hundred and twenty-eight pages, just issued by the LACKAWANNA RAILROAD. The Jersey Hills, the Pocono Mountains, Delaware Water Gap, Richfield Springs, Lake Hopatcong and other delightful summer resorts are described in a way that will tell you how you can go, where you can stay, what you can see and how much it will cost. It is a book that will help you in making your plans.

It will be sent for ten cents in stamps addressed to T. W. LEE, General Passenger Agent New York City.

Inquiry No. 7091.—For makers of raw rubber, such as used by makers of rubber stamps.

Inquiry No. 7092.—For dealers in gold leaf for for gilt woodwork.

Inquiry No. 7093.—For makers of painted satin, canvas or perfume boxes or bags.

Inquiry No. 7094.—For makers of town clocks.

Inquiry No. 7095.—For makers of motor canoes, motors, fire engines, or fire pumps, without horse power.

Inquiry No. 7096.—For machinery to cut metal in thin strips like tinsel.

Inquiry No. 7097.—Wanted, wholesale powdered aluminium and barium peroxide.

Inquiry No. 7098.—For the manufacturers of the Fairy Floss candy machine.

Inquiry No. 7099.—Wanted, machinery to manufacture granular effervescent salts, for druggists' use.

Inquiry No. 7100.—For an etching fluid for use with rubber dies, for making polished steel.

Inquiry No. 7101.—For makers of all kinds of hinges in large quantities, also for makers of all kinds of boxes.

Inquiry No. 7102.—For makers of gasoline motor cars for use on interurban lines (on rails).

Inquiry No. 7103.—Wanted, an apparatus for ozonizing air; with a capacity of ozonizing about 500 cubic feet of air per minute, and it is desired, if possible, to use a 3-phase alternating current of 60 cycles at whatever voltage might be best.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9699) L. F. P. says: In your highly esteemed journal I notice with interest the development of motive power from the windmill. Would you be kind enough to answer the following through your columns: Is it necessary that rudder area should be greater than blade area? If not, why would not the mill turn around on the transmission shaft? Am I not right in stating that the rudder has to hold the mill against the wind, and also against its own force, and consequently the rudder area plus its leverage must be greater than blade and power area? We will assume there is a five-horse wheel and five horse-power is being consumed through the transmission shaft. What holds the mill against the transmission shaft? If it is the rudder, does not this rudder exert the five horse-power thrust? A. Windmills are constructed in a great many ways, some transmitting the power from the windmill by crank and connecting rod motion, others by means of gears in such a way that there is no reaction from the driven shaft, tending to move the windmill out of a plane at right angles to the wind. Such windmills require very small rudders, as the force of the wind is balanced on the vanes of the mill, and the rudder is only necessary to turn the mill, so that it will always face at right angles to the direction of the wind. Where, however, the power is transmitted to a vertical shaft by means of a single pair of beveled gears, there is a reaction tending to turn the mill from the plane at right angles from the wind equal to the force tending to rotate the mill multiplied by the leverage. In such a case, the force of the wind on the rudder multiplied by its leverage must be sufficient to balance it.

(9700) K. H. L. says: Will you please give me the numbers of your recent papers that have an explanation of the Edison three-wire system of electric lighting? Also the numbers that have its history and recent application? Will you please also give me the numbers of papers that deal with the subject of electrical heating? A. We can furnish you with two papers, Supplement Nos. 309 and 737, containing valuable articles about the Edison three-wire system. We do not know any recent application of this system. It is being very rapidly superseded by the alternating-current systems of lighting, since it cannot be used very far from the central station. The number of articles relating to electric heating is very large. We name Supplements 825, 1037, 1059, 1077, 1112, 1182, 1374, 1375, 1419, 1420, 1421, 1472, 1502. All papers are furnished at ten cents each. New Supplement Catalogue sent on request.

(9701) H. B. M. asks: Is there any way that one can change an alternating current of 110 volts to 20 or 25 direct suitable to run small motor? A. Alternating current can be transformed to direct by means of a rotary transformer, wound to give any voltage desired; or a Cooper-Hewitt mercury arc converter can be used. 2. What changes would have to be necessary in a magneto generator to furnish current to operate an induction coil giving a 1-inch spark? A. The changes needed to fit a magneto to run a 1-inch induction depend upon what the magneto is. We do not think the ordinary telephone call magneto can easily be made to do this. 3. How many times does an ordinary door bell make and break with three dry batteries? A. We can only guess how many times a bell strikes a second when three dry cells are attached to the circuit. We guess three times. If you will count a bell for a quarter of a minute, you can find out if we have guessed right. 4. What is the best interrupter for induction coils? A. For small coils a vibrating interrupter is always used. For large coils a rotary interrupter is sometimes used, and sometimes an oscillating arm dipping into mercury is used.

(9702) C. C. B. asks: Will you please tell me through your paper whether the zinc tubes or cups used in making the dry battery described in the Supplement No. 1387, August 2, 1902, on page 22225, can be used more than once, that is, can it be refilled? A. In the action of a dry cell, the electricity is produced by the solution of the zinc in the sal-ammoniac. If there are no holes eaten through the zinc when the other materials are exhausted, the zinc cup of a dry cell may be refilled and used for another charge.

(9703) J. L. W. asks: Will you kindly inform me as to the relative speed of light and electricity? A. Electricity travels in space with the speed of light. Indeed, light is simply an electromagnetic disturbance of the ether of space. In wires and through matter electricity travels with other lower velocities. See Watson's "Physics," price $3.50; Thompson's "Electricity and Matter," $1.25, or Thompson's "Elementary Electricity," price $1.50.

(9704) H. A. K. says: I have a hollow cylinder 1¼ inches diameter by 3 inches high. How many cubic inches of air will be compressed into it at 100 pounds pressure per inch? At 200, at 300, at 400, at 500? If the height of the cylinder is cut in half, how many cubic inches will it contain at the same pressures? What is the rule for finding the volume of air compressed into a given space at a given pressure? What books treat on the subject. A. Your cylinder contains 3.68 cubic feet of air at atmospheric pressure. At 100 pounds pressure it will contain 3.68 times $\frac{114.7}{14.7} = 28.8$ cubic inches. At 200 pounds per square inch it will contain 53.8 cubic inches. At 300 pounds per square inch it will contain 78.8 cubic inches. At 400 pounds per square inch it will contain 103.8 cubic inches. At 500 pounds per square inch it will contain 128.8 cubic inches of air at atmospheric pressure. If you halve the height of the cylinder, you will halve the amount of air that it will contain. The pressure of the atmosphere on an average is about 14.7 pounds per square inch. When the pressure is increased, the volume of each cubic inch of air is decreased in the same ratio that the pressure is increased above 14.7. In working these problems it is necessary to remember that pressures as ordinarily measured by gages are pressures above the atmospheric pressure. To obtain the absolute pressure or true pressure, it is necessary to add 14.7 to the pressure given by the gages, as has been done in working the examples above. We recommend and can supply you with the following book relating especially to the subject you refer to: "Compressed Air: Its Production, Uses, and Application," by Hiscox, price $5 postpaid.

(9705) L. H. N. asks: Where is the north magnetic pole now located? A. The north magnetic pole was found by Ross in 1831 to be on Boothia Felix near Hudson's Bay. This must be considered an approximate determination. It is not probable that the same point is the pole now. 2. Is it moving, and if so, in what direction and how fast? A. The pole is probably not at rest, though little can be said definitely on the point, and nothing is known as to the rate of its motion. An expedition is now engaged in making a new survey to determine the north magnetic pole. 3. How many degrees east or west of a line running north and south does the compass needle point for central lower Michigan? A. In 1902 the needle pointed 2 minutes west of true north in Michigan. In 1896 it pointed 26 minutes west of true north at your place. The line of no variation passed into Michigan almost in the center of the southern boundary of the State in 1902. 4. Is there any easy method by which a person can tell the time to within a few seconds where telegraphic service cannot be had? A. The time of day can be best determined by a sundial in the absence of the telegraph and the railroad.

(9706) O. D. asks: In the type of open-circuit battery listed in catalogues as "National No. 2," how much black oxide of manganese should be put in the porous cups with the pulverized carbon to make the cell give the best results? In mixing the sal ammoniac solution in quantities, how much sal-ammoniac should be used for each gallon of water? A. For all sal-ammoniac cells with porous cup use granular and not pulverized peroxide of manganese and coke broken into small lumps. A mixture of equal parts may be used. For the electrolyte take from 1 to 2 pounds of sal-ammoniac to a gallon of water. A saturated solution is not desired, since any crystals left in the bottom of the jar tend to cause a deposit of crystals on the zinc, and will weaken the action of the battery.

(9707) M. A. asks: 1. Will a primary uninterrupted galvanic current pass over or through any part of the human body? The writer has failed to detect such passage with a delicate galvanometer, even with twelve or fifteen Samson cells. A. If your galvanometer is sensitive enough, there is no difficulty in detecting a current which passes through the human body. Connect the wires to a piece of zinc and one of carbon or copper. Dip the hands in water, and take the zinc in one hand and the copper in the other hand. The galvanometer will show a deflection, due to a current produced by the hands. So will it if two pieces of zinc were used as above. Let several persons wet their hands in clear water and join hands, the outer persons taking the zinc and carbon, as above, and the galvanometer will show a sensible deflection. You do not need a number of cells. You need a more sensitive galvanometer. 2. If a mixture of gas and air confined in a tight cylinder was fired by electric spark or otherwise, a disastrous explosion would be the result. Why does not the same occur when firing the mixture in a gas engine cylinder? A. If a quantity of gas and air mixed are exploded in a cylinder

strong enough to withstand the explosion, the cylinder will not break. This is what is done in a gas engine. If the cylinder is not strong enough, it breaks. The gas-engine cylinder is strong enough.

(9708) W. G. asks: Could you tell me how I can determine the positive and negative side of a live wire, not tracing it to the station or to the lamp or motor, etc.? Is it possible? A. The direction of flow of an electric current in a wire may be told by a compass needle placed so that the current flows along the needle, that is, lengthwise of the needle as the needle stands north and south. In this case the needle will be turned more or less across the wire by the magnetic action of the current. To determine the direction of the current, hold the open right hand over or under the conducting wire, but so that the wire is between the hand and the needle, so that the palm of the hand is toward the needle, and so that the thumb is extended in the direction in which the north or marked end of the needle is deflected; the fingers will point in the direction of the current.

(9709) E. B. E. writes: In your paper for April 15 is given a rule for the approximate extraction of square root. The first part of the rule is a well-known method, and applies quite generally and not merely to numbers within the limits given. The second part seems rather obscure, and is not easy to remember. The best rule is perhaps that given by Charles Hutton, a prominent mathematician of the eighteenth century:

$$\sqrt{N} = \frac{3N + r^2}{N + 3r^2} \times r \text{ approximately.}$$

(Where r is an approx. root.)

Example: Let $N = 271$, $r = 16$

$$\sqrt{271} = \frac{3 \times 271 + 256}{271 + 768} \times 16 = 16.4620 \text{ approx.}$$

True value 16.4621

The corresponding formula for cube root is:

$$\sqrt[3]{N} = \frac{2N + r^3}{N + 2r^3} \times r$$

Example: Let $N = 271$, $r = 6$

$$\sqrt[3]{271} = \frac{542 + 216}{271 + 432} \times 6 = 6.469$$

True value 6.471

A. The rule given above is far more simple than the one formerly printed in this column. If one needs an approximation for the square root, we should advise that this rule be copied and employed.

(9710) E. R. MacP. says: 1. *Re* inquiry 9615, under date April 15: I quite follow your reply, but I think that your correspondent must have been thinking of the influence of wind on a bullet; for it is a well-known fact that when the wind is blowing in the same direction as a bullet (or any projectile) it has a tendency to elevate the bullet above its usual trajectory. And just the reverse happens when the wind is against the bullet. 2. What is the formula for measuring rain? It runs something like this, I think: "So many square inches of catchment area require so many cubic inches in order to measure one inch of rain." A. To measure the fall of rain in cubic inches, it is necessary to have as many cubic inches of water as there are square inches in the "catchment area." A better way of determining the depth of rainfall is to use a rain gage. The United States Weather Bureau rain gage is a metal dish about 8 inches in diameter at the top. The rim is of heavy copper turned to a sharp edge. This opens below into a narrow dish, whose sectional area is exactly one-tenth of the area of the upper dish, and whose depth is 20 inches. It is obvious that the water will be ten times as deep in the lower dish as it would be if retained in the upper dish. The rain caught is measured in the lower dish, and the depth divided by ten gives the rainfall. Two inches of rain would fill the lower dish. 3. Is it possible to calculate an "angle of safety" for a circular cycle track? For instance, I want to build a circular track 50 feet in diameter. What would be the angle of safety for that? When I use the term "angle of safety," I mean the greatest possible angle that the track can be inclined without the rider being thrown off, granting of course that he is riding at a high rate of speed—say 15 or 20 miles an hour. A. The "angle of safety," as you term the angle of inclination of a track on which there would be no tendency for a bicycle to slow in going around a corner, will vary with the speed of the rider and also with the radius of the track. If the track is W feet wide, the proper elevation (measured in feet) at the outside can be found from the following formula:

$$\text{Elevation} = W \times \frac{z^2}{32\,R}$$

Where z^2 = the velocity of feet per second, and R = the radius of the track in feet.

(9711) T. A. B. asks: There are two grounded telephone lines—entirely separate—running parallel at a distance of about 100 to 150 feet apart. A conversation on one line may be distinctly heard on the other. One line is private, and the other runs to a switchboard. A. Wherever two telephone lines interfere with each other, the cause is always the induction of the current in one line upon the other line. It can be remedied by the use of a metallic circuit, with twisted or crossed wires.

(9712) E. M. B. says: If an Archimedean screw is placed so that the opening in the lower end is under water during its entire revolution, will the screw raise a continuous stream, or will the flow from the upper end be intermittent, and why? A. If an Archimedean screw is placed so that the opening in the lower end is under water during its entire revolution, the flow from the upper end will be continuous, provided the conditions are such that there is any flow at all, if the pitch of the screw is uniform, and the speed of rotation is uniform; otherwise, it will vary. If the angle of the screw is too great, or if the pitch of the screw is too great, or if the speed of rotation is insufficient, there will be no flow of water at all.

(9713) F. De M. asks: About what is the resistance of the dry cell in common use, standard size 2½ x 6¾ round, such as the Mesco, Columbia, New Standard, etc.? A. The internal resistance of dry cells is not constant, and must vary during the life of the cell. Since the E.M.F. of these cells is not high, the internal resistance should be low. Some makers give the resistance of their cells as low as 0.15 to 0.25 ohm. This quantity is difficult of measurement because these cells polarize very rapidly, and the current changes for that reason.

(9714) W. F. W. asks: 1. There is a widely prevalent belief that a razor by being kept in constant use loses its good shaving qualities, and that by allowing it to "rest" for a while unused it will recover its original shaving qualities. Has that belief any real foundation? If so, please explain the cause for such remarkable metallic peculiarities. A. The only suggestion we can give you as a foundation for the belief that allowing a razor to rest would improve its shaving qualities is as follows: The literal *edge* of a razor is only of microscopic thickness. This edge, when exposed to the atmosphere, oxidizes rapidly. The tendency of "rest" therefore would be to produce a jagged edge, which when very much magnified would look somewhat like the edge of a saw, and it is well known that a rough edge, when keen, will cut better than an edge which is too smooth and uniform. We believe, however, in spite of the facts that we have just described, which may have improved the cutting qualities of razors in a few exceptional instances, that imagination, which plays all kinds of freaks with things too small to be seen, is the real foundation for the belief to which you refer. 2. Why do blacksmiths pour water upon the burning coals in the forge? I have never been able to get an entirely satisfactory explanation from the blacksmiths themselves. A. Blacksmiths pour water on their forges in order to control the size of their fires. As a rule, they wish to heat their iron only for a limited distance along the bar, and therefore must control the diameter of their fire. The water also serves two other useful purposes. It tends to make the coal cake in such a way as to be nearly impervious to the blast. Thus a nearly air-tight ring or chimney may be formed around a fire, which will help to concentrate the air from the blast at the point where it is most needed. This caking of the coal helps in the process of transforming blacksmith's coal into coke, in which condition it forms a better fuel and produces a better fire than could be obtained from green coal. From this last reason, blacksmiths will often be found wetting their coal to aid in the process of manufacturing coke, when wetting the fire would not be necessary for the particular job they have at hand. 3. What are wash drawings, and how are they made? A. "Wash drawings" are ordinary India-ink drawings on paper which have been tinted with water-color paint, to make them more accurately represent in appearance the object for which they are made. Architects' drawings are often prepared in this way, and the practice was common with engineers a generation ago. 4. Please explain how the "parallax stereogram" pictures were made which were exhibited at the St. Louis Exposition. Portions of the objects projected forward, appearing to be in front of the frame, and other portions appeared to be considerably farther back. A. Parallax stereograms are constructed of sets of lines, so that each set forms its part of the scene represented. Some of the dailies have been issuing these pictures as supplements, so that now they are very common.

(9715) H. H. S. asks: Please let me know through the SCIENTIFIC AMERICAN how to find the gage of wire. In other words, of a certain piece of wire of known diameter in fractions of an inch, what is its number? A. There is no way of finding the gage of a wire except by the use of a wire table, which gives the number of a wire and its diameter in thousandths of an inch. Nor is a wire known unless the name of the gage by which it is measured is expressed as B. & S., Stubs, or some other. The whole matter of gages is in a bad condition, and some unification should be made. The best would be to denote a wire by its diameter.

(9716) J. McL. asks: In SUPPLEMENT No. 1215, page 19474, you have an article advising the use of dilute phosphoric acid in water to ward off old age, etc. I have seen a warning in some book to not use more than 15 drops of dilute acid in water three times a day. I believe there is sound reason in the article referred to, and would ask if it would not be a good idea to print same in SCIENTIFIC AMERICAN soon, with the warning to not use more than 15 drops of the acid in water three times a day. What would be the effect on the teeth of using same, or if any hollow teeth were present would it affect the jawbone? A. Phosphoric acid is a very excellent tonic, and if one's physician prescribes it, we should certainly advise you to take it. We should not advise anyone to prescribe for himself even a most excellent remedy. Let medicines alone till some one outside of yourself orders them. That is good advice for anything beyond simple household remedies, such as catnip tea and the like, which do no harm when they do no good. When phosphoric acid is to be taken, it is usually given in the form of a phosphate or phosphite. The soda fountain drink orange phosphate, so popular of late, is simply an acid phosphate with orange syrup added. As to the action upon the teeth we cannot pronounce, since the doctors have not decided just what causes the necrosis of the bone in the case of workers in match factories. We cannot advise one whether to study mechanical drawing or photo-engraving. The man should study the one he likes best and can do the work best in, or the one which is nearest his hand. All sorts of wages are paid in both trades, and a good man can get a living at either, though he will not get rich at either working on a salary.

NEW BOOKS, ETC.

CAMS AND THE PRINCIPLES OF THEIR CONSTRUCTION. By George Jepson. Cambridge, Mass.: The University Press, 1905. 8vo.; pp. 59.

Cams are one of the most important parts of nearly all machinery; and a clear and concise work on their design and construction will be found valuable to all mechanical engineers. This little volume is such a work, and we heartily recommend it to the engineering fraternity. It is largely filled with exceedingly clear drawings of different kinds of cams used for various purposes, and there are several half-tone plates of cams on different machines.

CELLULOSE, CELLULOSE PRODUCTS, AND ARTIFICIAL RUBBER. By Dr. Joseph Bersch. Translated from the German by William T. Brannt, Editor of "The Techno-Chemical Receipt Book." Philadelphia: Henry Carey Baird & Co., 1904. 8vo.; pp. 345. Price, $3.

This work is a very complete treatise on that most useful industrial material, cellulose. Cellulose, as is well known, is used in many ways, its use extending from the preparation of nitro-compounds to the manufacture of artificial silk and distillation of alcohol. All these uses are gone into and fully described in the present volume. The author first tells how cellulose is prepared from wood or straw, and how parchment is manufactured from it. He afterward describes the methods of obtaining sugar, alcohol, and oxalic acid from this substance. Later on in the work he discusses the production of viscose, the nitro-celluloses, and cellulose esters, artificial silk, celluloid, rubber substitutes, oil rubber, and factis. The work is very complete, and will be found of great value to all who wish to gain a knowledge of the uses and nature of this substance.

FLORA AND FAUNA OF THE BLOOD. By Henry G. Graham, M.D. Chicago.

This is a very interesting little pamphlet, the result of six years of hard labor, descriptive of the infusoria contained in human blood. It is illustrated with two colored plates, showing these microscopic animals as they appear under varying conditions. The book is well worth the perusal of all interested in the wonders of the human body. It is written in a popular manner, and may be understandingly read by any person of ordinary intelligence.

STAIR BUILDING MADE EASY. By Fred T. Hodgson. New York: The Industrial Publication Company, 1904. 12mo.; pp. 160. Price, $1.

The third edition of this small volume will be found very helpful by all young carpenters, and even by those of greater experience in the building of stairs and stairways. It gives a full and complete description of all kinds of staircases, and instructions for designing and erecting the same. It is fully illustrated with over 100 engravings, and is provided with a glossary and index, which make the information it contains easily obtainable.

MACHINE TOOLS AND WORKSHOP PRACTICE FOR ENGINEERING STUDENTS AND APPRENTICES. By Alfred Parr. New York: Longmans, Green & Co., 1905. 8vo.; pp. 444; ill., 550. Price, $4.

The aim of this textbook is to explain the construction and use of machine tools in a connected form. The book covers a large range of subjects, and will be found especially helpful to the practical worker, as it will enable him to study the action of the machine tools he uses, and give him hints on how best to do the various kinds of work which these tools are calculated to perform. The book contains, among its many chapters, several on Measurement; Turret Lathes; Grinding; and Milling, which have been prepared and illustrated in great detail, on account of their importance to the student and practical worker. The illustrations are both in half-tone and line cuts. They are numerous, and will aid greatly in instructing the student.

LLOYD'S REGISTER OF AMERICAN YACHTS, 1905. Published from New York office of Lloyd's Register of Shipping, 15 Whitehall Street, New York. Pp. 542, colored plates 42. Price, $7.50.

With the opening of the yachting season comes the new volume of the American Yacht Register for 1905, published by Lloyd's Register of Shipping. Though only in its third season, this book is already well known in all parts of the United States and Canada as the standard work of reference for yachtsmen.

The Register is a book of 542 pages, with 59 colored plates of club burgees, national ensigns, and owners' private signals, the latter to the number of 1,440. The total number of yachts listed is 3,389, of which 2,130 are sailing craft and 1,259 are propelled by steam or some other power. The tendency of the times is shown by the fact that while but a year ago the sailing yachts made 67 per cent of the total, this year they make but 62 per cent.

Among the power yachts the new gasoline cruisers in all sizes from 30 to 80 feet figure conspicuously, this type of craft being deservedly popular from its great utility, its adaptability to all waters, and the comparatively low cost of running.

In addition to the main list of yachts, giving the most complete particulars of hulls and engines, there are lists of signal letters, of former names of yachts, of builders and designers of the United States and Canada, and a very complete list of over 3,100 yacht owners, with addresses and clubs, as well as the yachts owned by each.

OUTLINE OF INDUSTRIAL CHEMISTRY. A textbook for students. By Frank Hall Thorp, Ph.D., Assistant Professor of Industrial Chemistry in the Massachusetts Institute of Technology. Second edition, revised and enlarged, and including a chapter on Metallurgy by Charles D. Demond S.B. New York: The Macmillan Company, 1905; 8vo., pp. 618. Price, $3.50.

Prof. Thorp's outline of industrial chemistry has been used more or less constantly by the Editor of this journal ever since its publication in 1898. The practical use to which the volume has been put during those seven years has enabled him to form a more just estimate of its technical value than can possibly be attained through the cursory reading which is usually alloted by the reviewer to a newly-published volume. The work has proved itself an excellent handbook of ready reference on industrial chemistry, and its excellent references to bibliographies at the ends of divisions have more than once proven of value. In this new edition, Prof. Thorp has included an account of the more important advances made in the chemical industries during the last seven years, and has therefore considerably improved the technical value of his volume. Mr. Charles Demond's elementary chapters on metallurgy constitute a feature which, as far as we know, is new in textbooks of industrial chemistry, but which we venture to state is likely to be found in them ere long. This metallurgical review, although necessarily brief, nevertheless gives one a very good idea of the elementary chemical principles that underlie most modern metallurgical processes.

DUALITY OF THOUGHT AND LANGUAGE. An Outline of Original Research. By Emil Sutro. New York: The Physio-Psychic Society, 1904. 12mo.; pp. 300. Price, $1.50.

Starting with Gladstone's utterance, "The scientific investigation of the spiritual is the most important subject before the public today," the author endeavors to prove the supremacy of spirituality over matter, in man. His theories, from our present-day standpoint, are nothing if not peculiar, but he is nearly always interesting, and at times helpful and inspiring.

LECTURE NOTES ON SOME OF THE BUSINESS FEATURES OF ENGINEERING PRACTICE. By Alex C. Humphreys. Published by the Department of Business Engineering of Stevens Institute of Technology, 1905. 8vo.; pp. 187.

This book has been written by Prof. Humphreys with a view to aiding students under his tuition by giving them a *résumé* of the lectures delivered in the course on business engineering. All the matter included in the course is not found in this volume, but that which is most difficult to comprehend is given, and will be found of great aid to the student. The book also contains notes on the law of contracts by Howard E. White, Esq., and the Commencement address delivered by Walter C. Kerr to the Class of 1904.

STEAM PIPES: THEIR DESIGN AND CONSTRUCTION. By William H. Booth. New York: The Norman W. Henley Publishing Company, 1905. 8vo.; pp. 187. Price, $2.

This book forms a practical treatise on the principles of steam conveyance, and the means and materials employed in practice to secure economy, efficiency, and safety. The book is well illustrated, and gives many useful ideas with regard to the making of pipe joints, expansion offsets, flexible joints, and self-contained sliding joints for taking up the expansion of long pipes. The chapters on the flow of steam and expansion of pipes will be found extremely useful to all steam fitters. The pressure strength of pipes and the method of hanging them, as well as valves and bypasses of all kinds, flanged joints and their proper