RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY ENGINE.—George H. Graham, Ridgeland, Ill. This engine is designed to be simple and durable in construction while being very effective in operation and utilizing the motive power to the fullest advantage. The invention provides principally a spring-pressed valve within a casing in which a friction roller is journaled and from which a valve stem extends, a lever being pivoted on the stem and springs pressing against the lever, there being a lubricant-receiving space in the rear of the roller. Three of these valves, arranged radially and sliding in suitable bearings in the rim of the cylinder, are located on the peripheral surface of the piston, between the vanishing points of curved flanges arranged near the ends of a radially extending head of the piston, close to the inner sides of the cylinder.

BOILER FEEDER. — Heinrich Rauser, Charles Wieber, and Alexis Sokoloff, Moscow, Russia. In combination with the boiler and feed pump is an ejector connected with the boiler and in communication with the valve chamber of the pump, a float arranged in the boiler controlling a valve connecting the ejector with the boiler. The invention also comprises other novel features, the improved boiler feeder being completely automatic in operation, preventing a dangerous filling of the boiler and also giving a signal in case the water should sink to a dangerous level, while the construction is of a simple and durable character.

AERIAL TRAMWAY. — Emilio Prunetti and Giambattista Avignone, Sierra City, Cal. This invention relates to suspension tramways operated by gravity, to transport loads in receptacles from an elevated to a lower plane in a speedy and safe manner, as in the conveying of ore from mountain deposits to reducing plants. Combined with an endless cable are two upright frames on which are mounted two horizontal grooved pulleys, with a brake mechanism, while in connection therewith are two wire rope tramways, and windlass supports therefor, cars being mounted on the tramways and oppositely connected to the endless cable.

DREDGE.—John H. Kuoni, Marysville, Kansas. This invention provides an improvement in what are known as "clam shell dredges," simplifying their construction and making them more easy to operate, the dredge being more particularly adapted for cleaning wells and similar purposes. It consists of a bottomless receptacle to the opposite sides of which are hinged shovels, while to opposite ends is secured an arched bail having a central loop or aperture through which passes a rod, chains connecting the shovels and the rod, and a locking bar pivoted to one of the shovels being connected with the rod by intermediate devices.

GRAVEL SCREENING MACHINE. — Franklin T. Gilbert, Walla Walla, Washington. A continuous treatment of gravel is provided for by this machine, whereby a number of separations of the coarser from the finer grades will take place. The machine has a series of rotary screens of different mesh, the coarsest receiving water and gravel direct from the flume or hopper, which serves to throw aside the coarsest gravel but allows to pass the water and finer grade of gravel, which is led to the next finer screen, where the same operation is repeated and so on with the remaining screens, the waste water being utilized to drive the screen-operating shafts. According to another patent granted the same inventor, the machine comprises a main frame formed with a series of bins, over which receiving troughs are mounted step by step, each trough having a closed receiving and an open discharge end, the discharge end of one trough being over the receiving end of the next succeeding one, while a series of screens of different mesh is interposed between the meeting ends of the several troughs, to successively separate the larger particles from the water and deflect them to their respective receiving bins. In operation the screens are constantly shaken or agitated by a reciprocating bar.

Railway Appliances.

AIR BRAKE. — Ray G. Coates, Punta Arenas, Costa Rica. In this brake the cut-off and exhaust of the brake cylinder pressure is controlled by the action of the brake cylinder pressure and the train pipe pressure on the one hand and the auxiliary reservoir pressure on the other hand, each acting on a suitable flexible diaphragm. A governing or a triple valve is provided with an auxiliary diaphragm, subject to the pressure in the brake cylinder, to assist the pressure of the train pipe acting upon the principal diaphragm of the ordinary valve in controlling the supply and discharge of the cylinder, for the purpose of maintaining in the cylinder any desirable pressure. Another invention, for which also a patent has been granted the same inventor, relates to automatic air brakes in which the brakes are set by a reduction of the pressure in the train pipe. This invention provides an improved triple valve by which the brake cylinder may be supplied with air at the full auxiliary reservoir pressure or any part of that pressure, any loss due to leakage when the brakes are set being restored from the auxiliary reservoir pressure, the valve being used in connection with a reservoir of such size that the pressure in it does not noticeably fall by the loss of one charge of air to the brake cylinder. The triple valve has an auxiliary governing piston connected to and moving the main governing piston of the valve, the cylinder of the auxiliary piston being connected by proper ports with the brake cylinder.

CAR COUPLING. — William P. Clark, Elberton, Ga. This improvement is designed to afford an extremely simple and efficient device, easily secured to a car, and enabling the cars to be automatically coupled, which may be operated without danger, and can be readily converted into an old fashioned coupling if necessary. It consists of a hollow drawhead in which is pivoted a protruding latch with beveled head and a side recess, a locking pin with an inclined shoulder on one side being held to move vertically through the drawhead, while an adjacently mounted crank rod has a crank connection with the locking pin. The coupling is practically a double one, and should one of the latches be broken by a strain, the other one would hold to prevent the separation of the cars.

RAILROAD SWITCH.—Clifford E. Nowlin, Battle Creek, Mich. This switch is designed to be conveniently operated from an engine or car to facilitate the switching of trains and allow them to make a siding quickly and with perfect safety. The switch rails are supported by a movable switch plate to which are secured cables extending parallel with the track and extending over guide pulleys and sprocket wheels, above which are mounted spring-pressed castings, connected with the sprocket wheels by a pitman and crank. Side rails arranged parallel with the track are pivoted to the castings, and means are provided for depressing the side rails from the train, the mechanism consisting of a sleeve on the locomotive in which is held a spring-pressed shaft carrying a contact wheel, there being a cushion for the shaft and a screw mechanism for adjusting it.

Mechanical Appliances.

FLAX HACKLING MACHINE. — John Erskine, Wolfhill Mill, Ligoniel, near Belfast, Ireland. This invention consists principally of a nipping device for ending the flax or fiber, a finishing hackle operating on the fiber in conjunction with the nipping device. The fiber holder has a vertical sliding motion, and gripping or clamping plates open and close on the ascending and descending of the holder, clamping the fiber held by it, the nipping device below the clamping plates consisting of two revoluble rollers adapted to pass the projecting fiber for ending it. Combs operate to comb the fiber when the holder ascends, brushes operating in conjunction with the combs, while tow catchers arranged below the combs remove the tow or combings.

WOOL CARDING MACHINE. — David Lamson, Elmira, N. Y. In this machine the parts are arranged around the main cylinder in a manner designed to rapidly and nicely straighten the fibers without any unnecessary work, and so that each part will give a forward motion to the stock operated upon, delivering it in good condition, with a material saving of labor, to the doffer. A licker-in is placed in advance of the main cylinder and a doffer is placed behind it, a tumbler and fancy being disposed one above the other between the licker-in and the main cylinder, a worker arranged between the tumbler, fancy and main cylinder, and a series of workers and strippers arranged around the upper part of the main cylinder, the workers being placed in advance of the strippers.

PUNCHING MACHINE. — Robert H. Ireland, New York City. A punch especially adapted for punching plate iron, beams, channels, and other structural shapes is provided by this invention. The machine can be controlled to carry the punch to engage with the article or to reciprocate above without engaging with it, as the operator may desire. The frame has upper and lower girders separated by transverse blocks, the lower girders carrying a table and there being a stationary casing in which is journaled a crank shaft between the upper girders, a block in the casing having vertical movement and having an opening through which the crank arm of the crank shaft passes. The blocks are adapted to receive a punch, a frame sliding vertically in the opening of the block, while a block sliding laterally in the frame has a pivotal connection with the crank arm of the crank shaft. The machine is designed to accomplish the operation of punching as rapidly as the pull rod can be drawn outward.

SAWMILL ATTACHMENT. — Thomas J. Williams and Tiberis S. Murray, Ironton, Ohio. This attachment is designed to be conveniently applied to any kind of a circular, band, or veneer sawmill, to enable the mill to rapidly and accurately saw beveled lumber, as weather boards, shingles, etc. On the front face of a frame adapted to be connected to the sawmill carriage is a rock shaft on which a series of sawmill dogs are mounted to rock with the shaft, the dogs having adjustable teeth projecting beyond their front faces to grasp the timber to be sawed, while the frame is provided with means for rocking the shaft and its series of dogs. The thickness of the beveled strips is regulated by adjusting the sawmill head blocks in the usual way, and different adjusting shafts may be used with the attachment to regulate the bevel of the strips.

HAMMER.—Arthur Chambers, Williams Bridge, N. Y. The head of this hammer has a side opening extending through to the eye and having beveled walls, and an elastic or slightly elastic plug of rubber or leather or similar material is fitted in this opening, the inner face of the plug being beveled, and the handle securing the plug in position. This forms a hammer having a side striking face with some elasticity, and combines in a measure a mallet and a hammer without diminishing in the least the adaptation of the hammer for its usual work.

Miscellaneous.

OXIDES OF METALS MANUFACTURE.—William H. Birge, Franklin, Pa. This invention provides an improved apparatus for manufacturing oxides from readily oxidizable metals at a low cost. A nozzle comprising a disk extending into a spraying recess has a central aperture for the passage of molten metal to the top of the disk, a hot air blast connection leading to the recess under the disk. As the apparatus is arranged, an air compressor is not required for forcing the necessary amount of air into the oxidizing chamber, only such force of hot air blast being required as is necessary to spray the molten metal on top of the disk and force the sprayed metal up into the oxidizing chamber.

RIFLE SIGHT. — Robert W. Parker, Camp Huachuca, Arizona Ter. This device has a base adapted for attachment to a barrel and a supplemental base moving transversely on the main base, a vertically swinging sight leaf provided with a projection extending at right angles therefrom and having a peep hole for use when the leaf is swung down. The base has a vertical portion at its rear, on the front edge of which is a series of gauge marks to serve as a wind gauge, and indicate the degree to which the supplemental base should be moved to one side or the other. The sight is designed to be easily brought to any desired adjustment to enable the rifle to be quickly and accurately aimed.

CAPODASTRO. — Henry Dahlman, Cambridge, Minn., and Theodor Blomgren, Stanchfield, Minn. This invention consists of a cushioned plate adapted to extend across the strings on the neck of the instrument, a yoke pivotally connected with the plate, a clamping arm pivoted on the yoke and adapted to engage with its free end the under side of the neck, and a hand lever to press the arm into contact with the neck of the instrument. The device can be quickly and conveniently placed and locked in position, and is designed to uniformly hold, quickly tighten, and shorten the vibrations of the several strings on the neck of the instrument whenever it is desired to raise the tone to a higher key.

WATCH IMPROVEMENT. — Roswell E. Moreland, Trenton, N. J. This invention provides a stem winding and setting mechanism in which the winding pinion is capable of both a rotary and end movement, remaining in gear with the crown wheel in any position. Means are also provided whereby the winding stem or arbor may be expeditiously and conveniently attached to the winding pinion, the entire mechanism being so constructed that the pendent setting is operated independent of any attachment in the case, and can be attached to any ordinary winding stem or arbor, such as commonly used in stem-winding watches.

SHEARS.—Anton Prohaska, Hoboken, N. J. The cutting blades of these shears are preferably made of sheet steel, by stamping or otherwise, while the handles are preferably of cast metal. A spring plate, held in position by a screw screwing into a pivot integral with one of the members, presses the cutting edge of one blade on the cutting edge of the other, so that a fine cut can be made at all times, and the cutting edges are self-grinding.

ROW BOAT FOOT REST.—John J. Sherman, Traverse City, Mich. This device consists of a central stationary inverted T shaped rail secured longitudinally in the bottom of the boat, and a sliding transverse foot board adjustable on or along the upright web of the rail, the whole forming a center slide adjustable foot rest or brace. By the support of the foot board upon the central rail in the bottom of the boat, the pressure of the feet is more directly conveyed to the center or keel line of the boat instead of to either side, making the steering easier, while the central fixed rail forms ballast in the bottom of the boat.

GATE HINGE.—Gabriel Rohrbach, Del Rio, Texas. The improvements shown in this invention may be applied to any swinging gate, but they are specifically adapted for use in connection with gates for yard and park inclosures, the hinges being adapted to hold the gate in open position. The hinge consists of two brackets having overlapping leaves and having a pintle connection, the leaf of the bracket attached to the gate having inwardly inclined slide flanges, in combination with two spring hooks adapted for attachment to the gate post and to engage the flanges. The gate when hung normally rests in closed adjustment, owing to the relative inclination of the bearings or leaves on the hinges, but when the gate is opened in either direction it is slightly elevated, and will close with a slight impetus.

DOOR SECURER.—Columbus F. Cardwell, Bridal Veil, Oregon. This device consists of a plate formed at one end with a toothed angular arm adapted to engage the door jamb, bearings being formed on one side of the plate in which slides a bar having an angular arm extending from its inner end and having notches in its outer end to engage the outer bearing, a brace being pivoted to the plate on the opposite side from the bar, and the brace having points to engage the door jamb or casing. This fastener is designed for ready and temporary attachment to any door for securely locking it, and may be folded up for conveniently carrying it.

CASTER.—Caughey S. Fleming, Shelbyville, Ind. This invention relates to two-wheeled casters for furniture, trucks, etc., providing therefor a caster capable of tilting in its support, thereby enabling it to more readily ride over obstructions. The spindle or support has a horizontally ranging member on which is a loose sleeve, the axle of the wheels passing through the sleeve and spindle, while the axle has its bearing in the sleeve and is capable of tilting with it independently of the supporting spindle.

HARNESS.—William H. Violett, Grand Junction, Col. By this invention a snap connection is provided at one end with a hook to engage the neck yoke ring and at its other end with a loop and a hook adjacent thereto, there being a double spring tongue for closing the hooks, and one of the holdbacks being secured in the loop and the other in the adjacent hook. By this improvement the wear on the holdback strap resulting from its sliding back and forth in the yoke ring is avoided, and the connection with the yoke may be easily and quickly made.

SLING CINCH.—Denis O'Sullivan, Spokane Falls, Washington. This is a device for securely fastening packs upon the pack horses, mules, and burros used in mountainous countries, and permits the pack to be quickly and securely attached and as easily removed when desired. It is composed of a strap having at one end a metal fastening consisting of a hook having a lateral outlet, with an anti-friction roller in the bend of the hook, a cramping pawl closing the outlet and having at its other end a plate or attachment provided with an offsetting eye.

ANIMAL SHEARS.—Charles and Harry Burgon, Malin Bridge, near Sheffield, England. This invention relates to improvements in instruments for shearing or clipping sheep or other animals, having for its object to enable the crosshead or forked end of the vibrating lever, by which the reciprocating motion is imparted to the upper cutters, to adjust itself freely to the plane of the cutting surface of the lower cutters, upon which the upper cutters work. An improved means is also provided of applying pressure to the upper cutters, to maintain a constant steady pressure sufficient to insure efficient cutting action without requiring great nicety or care in making the adjustment.

PNEUMATIC TIRE.—William R. Foster, Bermondsey, England. A tubular tire with closed ends wrapped around the wheel rim, the ends tapered to lap over each other and make a scarf joint, is combined with a jacket or cover in the form of a complete annulus of nearly tubular cross section, but with a slot extending around its inner circumference, the jacket being adapted to envelop the tire and its edges, and being detachably secured at intervals to the back of the wheel rim. With this improvement the tire may be readily removed and replaced by another in case of injury without entirely removing the cover of the tire from the wheel, and without dismounting the wheel from the machine.

TEMPORARY BINDER.—Adolph A. Hunziker, St. Louis, Mo. This is designed to be a simple and efficient binder for temporarily binding magazines, loose pamphlets, blank books, etc. To the back support to which the covers are attached, at one end, are fixed hooks adapted to be entered between the leaves of the pamphlet as the latter is placed in the binder, a spring-held double hook, sliding in guides, being at the same time drawn out from the other end of the back support, the pointed ends of the double hook when released entering between the leaves of the pamphlet at the other end.

ROLL PAPER HOLDER AND CUTTER.—George M. D. Manahan, New York City. This is an upright device in which upright cutter frames with attached knives are arranged down both sides of the roll, the frames being hinged to a yoke or frame, while cords and weights operate to keep the knives up against the roll and follow it up as draught is made on it. The apparatus, instead of being carried by a main frame, and standing by itself away from the wall or in the middle of the floor, may be set up against the wall as an attachment to save room.

KNITTING AND FORMING HOSE.—Frederick W. Simons, Philadelphia, Pa. This invention provides an improved method whereby the sock or stocking has its heel, foot, and toe knit continuously on a circular knitting machine without removal, transfer, or addition of any fabric knit on any other machine, the heel being knit continuously with the foot, and afterward cut, readjusted, and looped together. Any ordinary circular seamless knitting machine suffices in carrying out the invention.

GAME BOARD.—Edgar L. Williams, Rochelle, Ill. This board consists of a case having pins of uniform size grouped in opposite ends and projecting vertically from the bottom, a taller pin being arranged between the groups of pins, and sliding lids held in the upper portion of the case, in connection with a series of rings to be thrown upon the pins. The game to be played on the board is designed to afford amusement to persons of all ages, there being enough elements of chance about it to make it interesting and exciting.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention and date of this paper.

NEW BOOKS AND PUBLICATIONS.

GEOLOGICAL SKETCHES AT HOME AND ABROAD. By Archibald Geikie, LL. D., F.R.S. With illustrations. New York: Macmillan & Co. 1892. Pp. x, 332. (No index.)

The delightful story of what Professor Geikie considers the turning point in his life, his first geological excursion when a mere schoolboy, opens the present attractive work. We then travel with the distinguished author over Scotland, England, France, Sweden, and America, with most fruitful results. The subject is presented from the more popular side, and gives a graphic aspect of the world's history as pictured in the mind of a leading geologist. The work is largely a reprint of scattered essays, and will be a welcome addition to the general as well as scientific library.

HEROES OF THE TELEGRAPH. By J. Munro. London: The Religious Tract Society. Fleming H. Revell Co., New York and Chicago, sole agents. Pp. 288. Price $1.40. (No index.)

The lives of Wheatstone, Morse, Sir William Thomson and other notabilities in the electric world, past and present, are treated seriatim in this work, with many portraits of the subjects of the memoirs. It is a graceful tribute to the practical world's workers in electric science, to those who have shown how closely interconnected theory and practice may be.

DEAFNESS AND DISCHARGE FROM THE EAR. By Samuel Sexton, M.D., assisted by Alexander Duane, M.D. New York: J. H. Vail & Co. 1891. Pp. 89.

The treatment of the ear for its troubles by the more radical methods of treatment, based upon modern surgical methods, is advocated by the two authors of this short manual. Dr. Sexton appears as a strong advocate of these methods, and a number of cases successfully treated are detailed.

METHODS OF GAS ANALYSIS. By Dr. Walter Hempel. Translated from the second German edition by L. M. Dennis. London and New York: Macmillan & Co. 1892. Pp. xv, 384. Price $1.90.

Dr. Hempel's methods of gas analysis have won for him a place comparable with that of Professor Robert Bunsen. The introduction of his absorption pipette really marked a new step in the difficult work of accurately analyzing commercial gases. The present man-

ual, with its very numerous and elegant illustrations-tables and general data, is about the most important addition to the literature of the subject since Bunsen's work was published. The earlier book marked the creation of an exceedingly accurate standard analysis that has never been displaced and has hardly been improved in the many years since it was published. The present book describes the far quicker and almost as accurate methods first introduced by Dr. Hempel. The work in every way is a worthy presentation to the English-speaking gas engineers and chemists of Hempel's classic researches.

DIE PRAXIS DER MOMENT-PHOTOGRAPHIE AUF DEM GEBIETE KUNSTLERISCHER UND WISSENSCHAFTLICHER THAETIGKEIT. By L. David and Charles Scolik. 12 plates. 449 illustrations. Pp. 459, text. Wilhelm Knapp, publisher, Halle a. d. Saale, Germany. 1892.

This publication, printed in German, treats in a very comprehensive manner on the practical workings of instantaneous photography and the results obtained thereby relative to artistic and scientific research. The volume is divided into sixteen chapters, which give a complete description of the present state of the art, and with the help of 16 plates—reproductions from original photographs—fully illustrate the results obtained by the best apparatus and methods in use. The various apparatus and the practical arrangements necessary for producing good work are amply illustrated and described in an excellent manner and testify to the authors' thorough knowledge of the subject under consideration. The chapters treat on the results obtained by instantaneous photography, cameras, objectives, shutters, methods for measuring exposures, means for obtaining correct exposures, finders, illumination of objects, production of negatives, methods for obtaining series pictures, the stroboscopes or instantaneous figures, instantaneous pictures of various kinds, including projectiles, sound waves, balloon photography, lighting, etc., detective cameras, stereoscopic apparatus, and selection of detective or hand cameras.

THIRTEENTH ANNUAL REPORT OF THE BUREAU OF STATISTICS OF LABOR AND INDUSTRIES OF NEW JERSEY. For the year ending October 1, 1890. Trenton, N. J.: The Trenton Electric Printing Company. 1891. Pp. xvi, 474.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Notes & 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.
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.

(4013) W. E. W. asks about crystallized boron, its demand and price per gramme or ounce. If there is a concern that makes a specialty of manufacturing it, would it be enough in demand to take the place of the diamond in some of its uses in the arts? A. Boron hitherto has been only a chemical curiosity. If produced in quantity it might have value, but nothing could be safely predicated concerning its introduction. It is said that it is harder than the ruby, or nearly equal to the diamond.

(4014) B. P. B. asks: Please inform me if at any period of the year the sun setting in Alaska will be rising in Maine. Also if the south pole is as cold as the north pole, and if a compass be taken below the equator, will it still point north? A. From the 10th of June to the 2d of July the sun shines on the most northern parts of Alaska during the whole twenty-four hours of the day, and during this time shines on Alaska near the horizon when rising in Maine. We have no means of knowing the difference in temperature at the poles. The probability is that the south pole is the coldest. The needle points the same or has the same polarity north and south of the equator, but dips in opposite directions; the north end dips in north latitudes, and the south end in south latitudes.

(4015) B. A. C. writes: I have constructed a telegraph line about a mile in length, but I am unable to tell how many batteries to use. There are only three stations on the line. Will you kindly give me information? A. The rule is to make the resistance of the battery equal to the resistance of the line including that of instruments.

(4016) A. D. D. asks: 1. What is the cause of the detonation when a fuse burns out in the fuse box of an electric car? A. The fusion is so sudden as to amount practically to an explosion. The noise is produced by the impact of the air, as in the explosion of a fulminate or of powder. 2. If the mechanism of the throttle valve in a locomotive should in any way get out of order, how could the engine be stopped at once, if running at the rate of about 20 miles an hour? Could the air brakes stop it? A. The engine could be reversed, or the reversing lever could be put in a central position, thus preventing the valves from acting and excluding steam from the cylinders.

(4017) J. S. writes: I have been making a magnetic key similar to one described in "Experimental Science," Fig. 465, but cannot make it induce any noticeable current in a detector such as described on page 395. What points is it likely that I have overlooked? A. Possibly you expect too much from the key. Try it in connection with a magneto bell. If your magnets are strong, and if you have used a sufficient length of fine wire, the key should operate. 2. How and by what means can this key be made to give a shock? Should the circuit outside the key be of same resistance as the two bobbins, and should the terminals be connected to handles? A. Connect the terminals of your coils with handles formed of metal tubes. Moisten your hands when you take the shock.

(4018) W. Mc. P. asks: 1. What is the principle of the Babcock fire extinguisher? A. The large vessel is charged with water and sodium bicarbonate. Above it a corked bottle of sulphuric acid is supported. A short hose with stop cock and nozzle connects with the liquid. To use it a handle is turned, breaking the acid bottle. The acid falls into the solution and sets free enough carbon dioxide to generate high pressure in the vessel, which is tightly closed. On turning the stop cock a jet of water is expelled which is a little more efficacious than ordinary water on account of the sodium sulphate dissolved in it and the carbon dioxide carried with it. 2. Do chemists in general believe that there is but one element? A. It is hard to say. William Crookes, of England, is one of the prominent believers in the original element or "protyle."

(4019) E. R. E. asks: Can you explain the phenomenon of a wagon or carriage wheel turning backward when it passes over an icy or slippery place? I have witnessed it many times, and to-day, as a heavily loaded coal wagon passed along, one of the rear wheels, as it touched a slippery place, several times reversed about one-eighth of a circle. I can easily see how it might stop when the friction of the tire on the ice or soft clay was less than that of the hub on the axle, but why should it rotate backward? A. The only explanation we can make is to suggest that the wheel was not round or a perfect circle or that the axle was not central, when in very slippery places it would slip forward or back upon its shortest radius.

(4020) F. H. R. asks: What amount of electric current would be required for heating 100 feet of No. 30 German silver wire up to 212° Fah.? A. 0·43 ampere, requiring a difference of potential of 59 volts for its maintenance. These figures are necessarily only approximate.

(4021) J. S. H. asks for the method of finding the mantisse of logarithms. Most mathematical works on the subject of logarithms state the use of tables of logarithms, but not the construction. A. The original calculations of Briggs and his collaborators are still at the basis of our tables. The calculations are very laborious and cannot be explained within our limits. In the Encyclopædia Britannica, 9th edition, vol. 14, page 777, you will find the explanation desired.

(4022) C. H. M. asks: 1. Has there ever been any theory advanced in respect to the significance of Bode's law for planetary distances? A. Bode's law is only an approximate relation, and breaks down in the case of Neptune. It is regarded as a mere coincidence, there being no reasonable explanation of its numerical relation to the distances of the planets. 2. What is the explanation of the fact that whirlwinds are in their direction of gyration contrary to watch hands in the northern hemisphere and in direction of watch hands in the southern hemisphere? Is it attributable to magnetic influences? A. The equator is the central line dividing the relative directions of the winds and whirlwinds in the northern and southern hemispheres. The motion of the earth is the cause of the general circulation of the winds. Hence the northern and southern influence will be alike, as illustrated in the trade winds, which blow westerly and toward the equator in both hemispheres. The same conditions that produce the whirling storms are alike both north and south of the equator. Hence they must rotate in reverse order. 3. Suppose the earth to be of homogeneous material and of its present dimensions and density, where then would be its densest portion? Would it be on a spherical plane taken at one-fourth its diameter? Its density would be *nil* at its center; then its densest portion would fall somewhere between its center and its circumference. A. The densest part of the earth would be at the center, from the pressure of the surrounding mass under the influence of gravity, but the force of gravity would disappear at the center. 4. Is it not true that if there were mechanical motion enough in the universe, gravity would be annihilated? As centrifugal force overcomes gravity, then gravity must be the result of insufficient centrifugal motion. If there were sufficient force—motion—to atomize and distribute all the matter of the universe equally in space, gravity would be extinguished, would it not? A. Gravity is a constituent of all matter and cannot be annihilated. It is the force of gravity that has brought the universe out of chaos.

(4023) W. E. S. asks: 1. What is the difference between the electricity used for illuminating purposes and static electricity generated by friction and collected in a Leyden jar? A. Static or, more properly, frictional electricity has a very high E. M. F. with very small amperage. Whereas electricity generated by dynamos and batteries has E. M. F. varying from a few volts to several thousand, but always with more amperage than electricity produced by friction. 2. Is it galvanic or static electricty used in executing criminals in the State of New York? A. Galvanic or current electricity.

(4024) W. P. B. asks: Can you please give the value in cubic feet and in gallons of the statute inch of water of Colorado and of California? Also same values for the miner's inch. A. We do not know of a "statute" inch of water. The name indicates that it is a State law. An inch of water as described in deeds of water privilege and approved under court practice in various States is the quantity that will flow through a 1 inch square hole in a given thickness of plank under a given head, 2 inches and 1½ inch being the usual thickness. The usual head is 4 feet, but various heads are specified. The miner's inch most used is a 1 inch square hole through a 2 inch plank, with its center 6½ inches below the surface, and is equal to a delivery of 1·57 cubic feet per minute, or 11·77 gallons. The head varies somewhat among different water companies in California, as 9 inches head, 7 inches head, 6½ inches head, all measured from the center of the opening.

(4025) J. C. F. A. asks: If the ordinary steam engine only produces in power about 30 to 35 per cent of the energy of the coal, how is the loss of 65 to 70 per cent divided between the boiler and engine? How much of the theoretical force of steam is lost in converting it into power through the ordinary high pressure engine? A. In ordinary boilers from 20 to 25 per cent of the fuel passes up the chimney. Of the balance, from 8 to 10 per cent is utilized in ordinary high pressure engines. In condensing and compound engines, 11 to 12% of the total heat units may be realized.

(4026) F. W. S. asks: What amount of pure gold is required to be added to raise 100 dwt. of 18 karat gold to 20 karat gold. Please give rule and example. A. Your 100 dwt. of 18 carat gold contains 75 dwt. fine gold and 25 dwt. alloy. To bring this up to 20 carat, you must add enough fine gold to make the proportion of one-fifth or five times the alloy, which is 125 to 25, or add 50 pennyweights to your 100 of 18 carat, or 50 per cent.

(4027) G. L. H. asks: 1. How many cells of the Fuller battery will be required to run the simple motor No. 641? A. It will require about 20 cells. This battery however is not very well adapted to the motor referred to, on account of the small zinc surface. 2. How long will batteries run steadily with one charging? A. Owing to the low resistance of the motor, the battery would probably run down in two or three days. 3. Could I make them in the form of the large plunge battery, using a number of wooden boxes painted with P. and B. battery compound? A. Yes. 4. What book will give me the different resistances of wires in copper, German silver, etc.? A. Sloane's "Arithmetic of Electricity," $1 by mail, contains this information. 5. Where can I find the arithmetic of dynamos and motors, that is, the relative resistances of the armature and field, also the winding of machines to conform to circuits of different E. M. F. and amperage? A. In the above named book and in Hering's "Dynamo-Electric Machinery," $2.50 by mail.

(4028) Inquirer writes: I am interested in Mr. Wightman's method of fixing the paste for the positive plates of storage batteries. Now, will he kindly write again and explain best method for the negative plates?

(4029) W. J. A. asks: What is the accepted theory as to the origin of the salt in the ocean? And is it increasing or diminishing? A. It is generally conceded that the saltness of the sea was at first partially derived from the combination and precipitation of the vapors of its constituents during the earliest of the geological ages, and that the disintegrated azoic rocks continued to furnish the chlorine and sodium in gradually lessening quantities, which during the present age is said to be scarcely perceptible by analysis.

(4030) M. A. L. says: Would be pleased to have you state the composition of the strongest known castings. The tensile strength of same. Also, supposing a tubular steel shaft 2½ inches diameter outside by ¼ inch thick by 2 feet long, resting in a suitable bearing, and a pulley 4 feet diameter attached to each end, one pulley made fast. What safe working load could be suspended on the circumference of the other pulley? What load would it take to break the shaft? The same in composition. The same with a solid shaft 1¾ inch diameter in steel and composition. A. Nickel steel is claimed to be the strongest metal. Tensile strength about 100,000 lb. per square inch. The steel hollow shaft will break with a load on the pulley from 900 to 1,000 lb., according to quality of steel. A solid steel shaft 1¾ inch, about 3,500 lb. The composition shaft, 2½ inches, ¼ inch thick, about 150 lb., variable according to composition and hardness.

(4031) Reader, Selma, Ala., asks why the drift wood keeps in the center of a rising stream, and why it goes to the banks when the stream begins to fall? A. The high and steep banks at Selma retard the stream at its edge and cause a whirl that sets the surface toward the center of the stream during high water. As the stream falls, the current becomes slower and more under the influence of the bottom, when the drift wood begins to spread toward the banks.

(4032) G. L. F. asks: 1. How much pressure per square inch will a boiler stand, of following dimensions: diam., 12 to 14 inches; thickness of shell, 1-8 to 3-16 inch; about 3 feet long, with locomotive type fire box? Boiler well riveted. A. It is a very slim basis upon which to judge of the pressure that your boiler will carry from the data that you give. The strength of the cylinder may be satisfactory, but the locomotive fire box is an unknown quantity in all its details, and this is the life of the boiler. If the fire box is as strong in proportion as the cylinder and properly stayed, it might be safe for 50 lb. working pressure. 2. In firing boilers with petroleum, which is best—a steam or hot air blast? A. You should have an air blast to start with; after steam is up, the steam blast is most convenient and proper. 3. Can the hand power dynamo illustrated in "Experimental Science" be made to run one 16 candle power electric light, by using power to run dynamo? If so, what wire should be used on armature, etc.? A. It will not. Two 6 candle power lamps connected in parallel can be run by it.

(4033) C. E. T. says: Can you tell me the reason why the pipe leading to a steam gauge of boilers has the coil of pipe? Is there any advantage in it, or is it there for looks, or some other less important reason? A. The coil is essential to preserve the interior of gauge spring from contact with the steam, which injures the gauge. The coil gathers water by condensing the steam and makes a seal between the air in the spring and the hot steam.

(4034) J. McD. says: When the hot water faucet at sink is opened, a great rattling noise is produced in boiler, which is of copper, 40 gals., and continues until faucet is shut off again, then producing a sudden sharp click in boiler; all is quiet until hot water faucet is used again, when the above is repeated; pipes to water back in range are all run correctly and are not trapped. Hot and cold water pipes run down from sink, then under kitchen floor, 20 feet horizontally, then vertically 40 feet to other fixtures, remaining separate all the way and not joining at top. Can you suggest a remedy? A. The noise is caused by the sudden vibration of steam in the water back, caused by the reduced pressure in the water when the faucet is opened. The steam rushes into the boiler through the circulating pipe, where it comes in contact with the cooler water, and suddenly condenses with a hammering noise. A larger cold water inlet pipe from the street, and an air chamber, will be a partial remedy; perhaps the street pipe is partially closed, which is often the case where galvanized pipe is used. This will cause the hammering.