Recent American and Foreign Patents.

Improved Sulky Harrow.

Daniel F. Shaw, Hamilton, Mo.—This improved harrow may be readily adjusted to make a wide or a narrow cut, and to work as a diamond harrow or as a double-A harrow. It may also be readily raised from the ground to clear it of weeds, grass, stubble, etc., and for convenience in passing from place to place

Improved Machine for Making Barrel Heads.

William W. Trevor, Lockport, N. Y., assignor to himself and Francis N. Trevor, same place.—This invention relates to machinery for circling barrel heads by revolving clamps and a circular saw, the clamps being contrived to move the pieces to be sawn up to the saw, and turn them around one revolution, and then move away at the same time that they open to discharge the finished head; and it consists of the apparatus for gearing the shaft of the clamps with the saw arbor to turn it thereby; also the apparatus for closing and opening the clamps; also mechanism for starting, stopping, and allowing the clamps to rest for changing the work; and also mechanism for causing the clamps to turn a little more than a revolution at each operation in combination with an automatic stop, to insure the cutting of the complete circle.

Improved Tower Clock.

Charles Fasoldt, Albany, N. Y.—The invention consists mainly in the separation of the hand-moving mechanism and its actuating power from that of the clock train, and its connection with an unlocking wheel of the main arbor by an intermittingly operated planetary motion device, actuated at certain intervals by the hand driving weight, that transmits also motion to the hands on any suitable number of dials above or below the clock.

Improved Galvanic Battery.

Jerome Kidder, New York city.—This invention relates to an improved galvanic battery, with a series of cells in which the fluid is quickly and easily distributed to and emptied from all the cells, and also the action of the same on the elements in an instant interrupted and established, the same being guided reliably and securely to their proper positions in the cells. The invention also relates to a battery casing with a number of longitudinal and lateral partitions forming the cells and with outer higher walls. A longitudinal end reservoir, with horizontal gutter flange and corner spout, assists the filling and emptying of the cells, while a detachable top guide frame with corresponding subdivisions guides the vertically moving elements, applied to a common supporting plate to their respective cells.

Improved Fishing and Similar Floats.

William T. Quinn, Paterson, N. J., assignor of two thirds his right to Will Hague and John Hague, same place.—This is a float contrived to run deep in the water, and have considerable side draft. There is a rod along one side, to which a cord for drawing the float is attached by a ring, so that it will shift from end to end of the rod freely, according to which end of the float the draft is to be applied. This enables the float to be run out readily from the shore, and then be drawn forward and backward at the limit of the line, as a means of carrying fishing lines or running out the float to persons in distress, or to operate a decoy duck.

Improved Ice Velocipede.

Charles M. Day, Elizabeth, N. J.—This invention consists of a screw propeller, combined with a chair or other conveyance for running on the ice, and so arranged that the edges of the vanes or blades run in contact with the ice to impel the carriage, the screw being turned by foot, hand, steam, or other power. Springs support the weight of the carriage, so that the same does not come upon the propeller blades.

Improved Cultivator.

William Weaver, Greenwich, N.Y.—The frame is diamond-shaped, with its obtuse angle cut off. The point of draft attachment may be adjusted higher or lower, as may be required. By suitable arrangements, in digging potatoes, the forward plow will open the hill, hoes will turn the soil over, leaving the potatoes upon the top of the ground, and the rear plow, running a little deeper than the forward plow, will raise any potatoes that may be left by said plow. The hoes may be adjusted wider apart or closer together, according to the distance apart of the rows to be operated upon.

Improved Water Wheel.

Harvey W. Hawley, Walton, N. Y.—This water wheel may be used either in horizontal or vertical position, utilizing nearly the whole head of water, and allowing the adjustment of the buckets to different angles to the wheel, if desired. The invention consists of a water wheel with central web and solid or detachable buckets extending to equal distance and suitable angles therefrom.

Improved Sheet Iron Barrel.

Charles M. Wyvell, Scottsville, N. Y.—This barrell is formed in two parts, having their adjacent edges notched to each other, and secured by the hoops and locking strips. With this construction, the barrel, when empty, can be readily taken apart and nested for storage or transportation, and can be put together when required for use.

Improved Filter.

Henry F. Scherr, St. Louis, Mo.—This invention consists of a filter, composed of a lower reservoir for the filtered water, an upper receptacle with the filtering tube for receiving the water to be filtered, and of an intermediate filtering pan attached to the filtering tube to compel the water to pass first in down, and then in upward, direction through the filtering material.

Improved Anvil.

Edwin Hodgdon, Springdale, Me., assignor to himself and Ansel J. Cheney, same place.—This invention consists in a rotary swage or anvil having a number of working faces, which is supported and seated upon a recessed block having its top portions properly conformed to said anvil in shape. To enable the anvil to be raised from the base block, and rotated for the purpose of changing the working face, it is pivoted to and between parallel vertically movable bars.

Improved Document Envelope.

John Pritchard, Maysville, Mo.—This invention consists of an interior fold, open at the sides and closed at the ends, that is applied to an outer inclosing wrapper by being firmly attached at one side and connected by an adjustable band at the other side. It expands and contracts with the thickness of the papers.

Improved Bee Hive.

Hiram Penoyer, Anna, Ill.—Two separate and detachable frame sections are hung into the central chamber from top frames, a sufficient space being provided between the sections for the passage of the air. Each section may be taken out separately, and thereby the swarming of the bees prevented by replacing the full section with an empty one.

Improved Fire Escape.

Andrew J. Culbertson, San Andreas, Cal.—By pulling upon a cord, a lever is operated to push the device from its seat above the window and allow it to drop down to the window sill, where it will be stopped by a ratchet wheel and pawl, and held until the person or persons to descend have taken their places upon the platform. The pawl is then turned back from the ratchet wheel and the device is allowed to descend, the rapidity of descent being regulated and controlled by a brake and hand screw.

Improved Bench Plane.

Charles Bridges, Lowell, Mass.—Devices are provided whereby a plane iron is instantly placed in the stock and guided exactly into its place, being also readily adjusted to any thickness of shavings by the screw bolt. The cutter edge can be squared to the throat or face of the plane by moving a screw slightly to the right or left in the recess of the partition, which is made wide enough for this purpose. The arm piece attached to the handle is adjusted in such a manner that, when the handle is slid forward on the plane stock, the wedge pieces and bottom ribs bind rigidly on the ends of the arm piece, define the position of the handle, and seat the rear part of the handle exactly on the circular rear partition of the stock. The thumb piece of the lengthened screw bolt is then turned up, and thereby the handle securely locked to the plane iron and stock, so that no detaching during use is possible. The invention is an improvement or device of the same inventor, patented December 8, 1874.

Improved Furnace Grate.

Samuel J. La Rue, Russell, Mo.—By vibrating a lever a shaft is rocked, and the grate bars are made to receive a swinging and slightly upward motion, which has the effect of clearing the coal or other fuel from ashes, and renovating the fire. Air cells in the tops of all the grate bars allow the air to circulate over the bars transversely and increase the combustion.

Improved Cutter Head.

Simon P. Randolph, Tehama, Cal.—This is an improved matching cutter for rabbeting machines, by which work may be accomplished without requiring frequent sharpening for keeping the grooves and tongues in proper size. The knives, which make a clean cut without splintering the edge, are curved at the forward end, and made with two lips, for cutting the groove part of the matching boards. The forward curve of the cutter causes the cutting edge to strike the wood square and avoid scraping.

Improved Wash Bowl.

Henry M. Weaver, Mansfield, Ohio.—This is a detachable valve plug, which is fitted into the waste pipe, and provided with sieves attached to its stem, to be raised by a fulcrumed lever and connecting rod from the side of the bowl for emptying the same.

Improved Farm Gate.

Amos Callahan, Maryville, Tenn.—This invention consists in combining adjustable diagonal bars with a grate for the purpose of supporting its front end, and thus preventing or taking up sag, or adapting it to pass over an inclined or uneven surface.

Improved Bias Gage.

John A. Hamilton, Chippewa Falls, Wis.—This is a marking and cutting rule, to which is attached another rule or gage parallel to it, so as to be shifted, and having one end beveled, so that, when placed parallel with the edge of the goods to be cut into bias strips, it will gage the principal rule to the proper bias for cutting the cloth. The width of the strips is gaged by the distance of one rule from another.

Improved Brake Shoe.

William Robinson, Jr., Wilmington, Del., assignor to himself and Samuel Harris, same place.—The brake shoe is provided with a recess at the upper end, and with a slot at the lower end, which serve to connect the interchangeable and detachable sole part by a top hook, locking into recess, and by a perforated lug passing through the lower slot. The ear is firmly secured to the shoe by a suitable key.

Improved Oiler.

George F. Dutton, Farmington Falls, Me., assignor to Eliza C. Dutton, of same place.—This is an oiler having a chamber above the reservoir, in which is a glass tube which screws into the opening at the top of the reservoir, and which forms a tightly packed joint at the top of the chamber. The chamber is rigidly attached to the discharge nozzle, and is screwed on to the collar of the reservoir.

Improved Road Scraper.

Jacob W. Wilson, Summerford, assignor to himself and Addison Shanklin, London, Ohio.—This invention relates to that class of rotary road scrapers in which the scraper box and the handles are connected and disconnected for revolving the scraper by manipulating the handles. The latter are attached to the draft yoke eccentrically to the connection of the yoke with the scraper, in such manner that the scraper is detached by swinging the handles upward, and connected by swinging them downward. The invention consists of a guard hook, in combination with the connecting devices, to prevent disconnection by the downward movement of the handles.

Improved Marking Board for Pin Pools.

George H. Decker, Belleville, N. J.—This relates to such an improvement in marking boards for pin pool that the numbered balls may be taken out without the annoyance of dropping the same on opening the slide gates or hinged caps at present in use. The invention consists in recessing the marking board for the round or otherwise shaped plugs that contain the balls securely in concave recesses.

Improved Car Coupling.

John A. Acton, Jackson C. H., Ohio.—The invention consists of a drawhead with a crooked pin bar, that swings in a longitudinal top slot of the same, and is keyed at the rear end to a lateral shaft with ratchet wheel and pawl, and provided at the front end with the pivoted coupling pin. The release of the pin-controlling ratchet, either from the sides or top of the car, drops the pin through the link, which completes the coupling operation.

Improved Compound for Flavoring and Preserving Tobacco.

George E. Sterry, New York city.—This is an improved compound for sweetening, flavoring, and preserving tobacco, formed of powdered salt and licorice root.

Improved Hot Air Furnace.

Thomas Langstrath, Germantown, Phila., Pa.—The smoke pipe leads out of the top of the combustion chamber into a horizontal pipe, going through the furnace from front to rear, and on the latter side receiving a dust pipe, leading up from the ash pit, to carry off the dust when the ashes are shaken down At the front of the horizontal pipe is a damper, to be opened to let in air to check the draft without opening the furnace door and letting cold air in directly on the hot plates.

Apparatus for Separating Gold from Sand, etc.

Thomas W. Irvin, Eureka, Cal., assignor of one half his right to Alex. Gilmore, A. Dolan, E. Brown, and Maurice F. Moloney.—This invention consists of suitable apparatus for drying and separating the sand, and conveying the same by an elevator to a system of connected channels and conductors, in which the heavier gold particles are separated from the sand by the current of an exhausting fan, and the current of air and its force is changed and regulated by adjustable valves, while additional chambers or receptacles collect the finer mixture of gold dust and sand for transmission to the amalgamator.

Improved Toy.

George F. Morse, New York city, assignor to himself and Joseph F. Tobin, of same place.—This is a recessed ball, mounted with a bell forming a part of the spherical shape of the same, and sounded by a spring clapper or other device within.

Improved Revolving Horse Rake.

John H. Randolph, Jr., of Bayou Goula, La.—This is an improved sulky rake, designed especially for pulling pea vines for hay, and leaving them in bunches to dry. By the provision of detachable stop blocks any pitch of the rake teeth may be given, and the stops can also be thickened to the required point by applying one or more additional pieces thereto. There are also improved devices for holding and tipping the rake head.

Improved Apple Corer and Slicer.

Charles E. Kimball, New York city.—The invention consists of quartering blades radiating from a common center, in which is a revolving shaft carrying a couple of bow-shaped knives, which, being turned after the quartering blades have been pressed into the apple, will cut out the core, after which the quartering blades, being driven down through the apple, will finally separate the cored quarters.

Improved Boiling Pot.

W. H. Hennaman, and W. F. Shaw, Jr., 19 S. Chester street, Baltimore, Md.—The invention consists in a sectional boiler having opposite flange grooves, sliding plate, and a cover hinged to the top of a vertical partition.

Improved Warming Apparatus.

John F. Reilly, Washington, D. C.—The invention consists in an overflow pipe and a longitudinal steam pipe between cover and pan, together with a steam coil extending under the warming plate and provided with discharge outlets.

Improved Crank Motion.

Charles E. Whipple, North Charlestown, N. H.—This invention consists of a connecting rod connected to the crank pin by a slotted hole, and extended beyond it and connected to another crank, which is pivoted eccentrically to the axis of an idle wheel, on which it is mounted, and is carried around with the connecting rod. By this arrangement, when the main crank pin is on the centers the connecting rod ceases to pull or push on it on account of the slot, but continues to pull or push on the auxiliary crank, which, not being on the center, carries the rod laterally against the main crank pin, and thus carries it past the center.

Improved Hook Bale Tie.

William Greet, Mooresville, Ala.—One end of the ball band is passed into a hole on a separate locking piece, back through another aperture, and then is doubled over. The other end is bent to form a loop, pushes through a hole in the locking piece, and is secured by a pivoted hook on the latter.

Improved Earth Auger.

Joseph E. Hall, Paxton, Ill.—The door is attached by points at the lower end and the stud screws at the upper end of the edges, engaging with the sockets and notches respectively, in the barrel, the edges being fitted inside of the edges of the barrel, and fastened by a screw. The lip is hinged to the under side of the bottom of the barrel in the clearance, where it does not obstruct the turning of the auger, and it is contrived to drop down on the bit when the auger is raised, and convert the auger into a sand bucket by closing the throat. The bit is attached by a dovetail-shaped shank on it, and a corresponding socket in the auger bottom, for readily detaching it.

Improved Miter Box.

Peter Johnson, Wauconda, and Nicholas H. Johnson, Blackberry, Ill.—The table is supported on pivoted base arms that may be folded to the under side of the table after use. A sliding spring-cushioned sleeve supports, on branch arms with end sleeves sliding on pillars of a revolving base plate, a saw guide frame, which extends downward below the supporting disk, and carries in forked guide ends the saw for cutting the miter.

Improved Tyre Tightener.

Henry A. R. Horton and Amos P. Hayes, McKinney, Tex., assignors of one half their right to John H. Owen.—The joint is composed of two nuts connected together by a bolt with right and left threads. In the center of the bolt there is an enlarged place of octagon shape. The bolt, when screwed entirely up, enters into holes made in the ends of the fellies. In one end of the tyre a tongue is cut, and in the other end there is a slot into which this tongue fits. The miter joint, formed by tongue and slot, is intended to prevent the ends of the tyre from springing apart laterally. The joint is covered underneath by a clip made so as to fit up to the edges of the tyre. The ends of the fellies are cut into blunt wedge shape, and covered by thimbles, and the nuts are so shaped that the thimbles fit into them exactly.

Improved Clothes Wringer.

William T. Bunnell and Anson G. Ronan, Ottawa, Can., said Ronan assignor to said Bunnell.—When a handle roller is forced down, spring cams bear upon friction rolls and force the upper rubber roller downward in contact with the lower rubber roller, and in doing that the crabs in which the lower roll revolves are made to clasp the tub or vessel, while the handle roller serves as a guide to conduct the clothes between the rollers.

Improved Milk Cooler.

Owel H. Willard, Randolph, N. Y.—The invention consists of milk pans and vats constructed with bottoms with diagonal pitch or inclination toward the lowest corner, at which the tightly-sealing milk outlet is arranged, that may be readily detached for allowing the separation of pan and vat for cleaning purposes.

Improved Cistern Cover.

Sebastian Haffter, Highland, Ill.—The invention consists of a flanged cast iron well cover, provided with supporting standards for the pump stock or pump chain tube, a hinged lid, and filtering basket below the lid. The cover admits ready access to the cistern for repairs, and allows the taking out of the pump stock or casing without removing the well cover.

Improved Metallic Truss Bridge.

James Valleley, Canton, Ohio.—The stay or brace pieces are formed of a wrought metal plate having its end portions in different but parallel planes, and joined by a middle portion, which is inclined at about an angle of forty-five degrees thereto. The said end portions constitute what may be termed the feet of the braces, and are perforated to receive the bolts by which they are secured in the arch. One foot is bolted to the upper and the other to the under plate of the chord, the length of the inclined middle part determining the distance between the plates.

Improved Clothes Pin.

Uriah D. Mihills, Fond Du Lac, Wis.—The notch of a block is passed over the clothes line, and a key is forced down, clamping the line between its edge and the side of the notch in the block.

Improved Gang Plow.

Eugene P. Pulliam, Palmyra, Mo.—This invention includes simple devices which enable the altitude of all the beams to be simultaneously regulated.

Improved Shoe Fastener.

George P. Reeves, Helena, Montana Ter., assignor to himself and Charles Rumley, of same place.—This consists of a lacer applied by prongs to the leather or other material, and provided with a central concavity and surrounding ridge, open toward a hook-shaped part, which is turned back far enough to prevent the catching of the dress or other objects thereon.

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Pure Water.

From the days of the old Romans down to the present time, political economists have sought for an abundant supply of pure water as the first great need of any great city. The question, today, when railroads and manufactures concentrate humanity at so many points, is of more importance than when settlements were made merely where nature has provided a full supply of the true water of life. Our great cities are all seeking an additional water supply, and in many the water now received is expensive and unsatisfactory in quality from the immense waste and sad deterioration consequent on a faulty system of piping. Many different materials have been used for the conveyance of water long distances. The old Roman aqueducts brought water of only the purity of ordinary streams, open to sun, air, dust, and like minor evils, a style not feasible in this day or country. The first American aqueduct of which we have cognizance, that at Portsmouth, N. H., in operation in 1790, brought water through heavy pine logs, and so continued up to a year or two since. Lead has proved dangerous for piping, and lined with tin has been found enormously expensive for a doubtful result; while plain cast and wrought iron rust and corrode; iron lined with cement, glass or porcelain, has been found impracticable, on account of a lack of elasticity; and galvanized iron, which it was hoped would solve the problem, has been found seriously affected by the various salts and alkalis held in solution by the water conveyed therein.

Again, the dependence of a city or large town on a single main of great size has been a cause of disaster from any defect therein, and the future water supply will be doubtless through a number of smaller mains, each independent of the other, thereby precluding any possibility of a general failure. The National Tube Works Company of Boston, Mass., and McKeesport, Penn., seem to have solved the problem as to a perfect pipe, furnishing a seamless lap-welded wrought-iron pipe, of from one half to fourteen inches diameter, coated inside and out with an indestructible elastic enamel, and capable of withstanding a pressure of 1,000 pounds to the square inch. The coating resists all known corrosives, and is elastic enough for all working purposes, while all the connections are made by a sleeve joint that prevents any leakage.—*Boston Daily Globe.*

Business and Personal.

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See N. F. Burnham's Turbine Water Wheel advertisement, next week, on page 141.

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Peck's Patent Drop Press. Still the best in use. Address Milo Peck, New Haven Conn

Faught's Patent Round Braided Belting—The Best thing out—Manufactured only by C. W. Arny, 301 & 303 Cherry St., Philadelphia, Pa. Send for Circular.

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For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

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Barry Capping Machine for Canning Establishments. T. R. Bailey & Vail, Lockport, N. Y.

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Notes & Queries

A. J. B. can harden screw plates and dies by the process given on p. 75, vol. 28.—A. K. will find that imitation pearls are described on p. 250, vol. 30.—R. F. will find a recipe for liquid glue on p. 250, vol. 30.—R. K. W. will find a description of a good cheap telescope on p. 298, vol. 30.—F. J. will find a recipe for a cement for millstones on p. 251, vol. 31.—L. H. R. will find rules for proportioning safety valves on p. 330, vol. 32.—S. H. D. will find a rule for ascertaining the horse power of an engine on p. 33, vol. 33.—B. J. F. will find rules for ascertaining the required pressure of water in pipes on pp. 73 to 79, *Science Record* for 1873.

(1) H. E. says: 1. I have tried the recipe for indelible ink, and cannot dissolve the prussiate of potash. I tried to dissolve it in benzine, to mix it with printer's ink; but it will not dissolve. I also tried alcohol: it would not mix with the ink. What is the matter? A. What recipe do you refer to? Yellow prussiate of potash is soluble in water. 2. Is there anything that will make printer's ink indelible? A. Carbonaceous substances, such as asphalt, with proper solvents, have been used for this purpose.

(2) F. A. asks: 1. By what process can I make a good nickel solution for nickel plating? A. Use a strong solution of the cyanide or double sulphate of nickel and ammonia, obtained by dissolving the salts in hot water until the solvent is nearly saturated. 2. What is the proper quantity of cyanide of potassium? You mention 1¼ ozs. to 1 gallon. Would it not make a very weak solution? A. Use water 1 gallon, cyanide of potassium 12 ozs., cyanide of silver 1½ ozs.

(3) Y. P. asks: How long must I leave a pistol cylinder in a gold solution, so that the coating will last a year? A. About 24 hours will give a good deposit. It is not necessary to disturb it until finished. 2. Will an old watch case do to make the solution? A. Yes. A gold solution made with a battery is a good one for the purpose.

(4) F. H. J. asks: 1. Would a 1½ inches achromatic object glass, of 30 inches focus, and a plano-convex lens, of ½ inch diameter and 1 inch focus, answer in constructing a telescope as described on p. 7 of vol. 30? A. The 1½ inches objective is rather small for 30 inches focus. The plano-convex lens of ½ inch diameter and 1 inch focus for an eyepiece will not answer very well. The eyepiece should consist of two lenses, both plano-convex and with the flat side to the eye, one of, say, 1 inch focus near the eye, and one of 2 inches focus at the distance of 3 inches from the first. 2. Which is the best for an eyepiece, a plano-convex or a double convex lens? A. Plano-convex lenses are better than biconvex. 3. How can I make a terrestrial eyepiece and a celestial eyepiece? A. A celestial eyepiece consists of one set, that is, two such lenses; a terrestrial eyepiece consists of two such sets. A celestial eyepiece shows inverted images. The additional pair of lenses in the terrestrial eyeyiece reverts the inverted image to its natural position. 4. Would the above telescope, if fitted properly, be powerful enough to see Jupiter's moons and Saturn's belts? A. If a good one it may do to see the satellites of Jupiter, but not Saturn's belts. 5. What work on the telescope would you recommend, for an amateur without a teacher? A. There are many books on the microscope, but few or none on the telescope alone. In some of the larger treatises on physics, such as Silliman's, Ganot's, etc., you may obtain some special information on various points.

(5) H. L. G. says: The following question involves the principle of the hydrostatic paradox, that the pressure of fluids is according to the hight and surface pressed upon, and not according to the quantity pressing. This is evident in case of water; but does it hold also in the case of air pressing upon itself under the same circumstances, either with or without forcing? Of course it would require a vacuum opposite to make the test. A. Yes.

(6) S. M. L. asks: What is the best material for belts to which slats three quarters of an inch in width are to be fastened, the belts to run over rollers three and five inches in diameter, the larger being the driving roller? A. Try a flat chain.

1. What is compressed air? A. It is air, the volume of which has been considerably decreased by pressure. 2. Is it as elastic as steam, or more so? A. It is more elastic at low temperatures. 3. If compressed air be confined, would it lose its elasticity? A. No.

Would a wheel that would start itself on an axle and keep on continually revolving, moved only by an eccentric weight of its own, be considered perpetual motion? A. Yes.

(7) L. W. says: I am coppering cast and malleable iron by dipping in a solution of sulphate of copper: but the copper does not attach itself as permanently to the malleable iron as to the other. What is the remedy? A. Clean the surface well by dipping in dilute oil of vitriol, and scouring with sand.

(8) D. B. T. says: I have long had a theory that the absorption of air by water decreases its cohesion to an extent unthought of by our best scientists. It is a well known fact that water absorbs about four per cent of air under one atmosphere's pressure, and that the absorption goes on in the same ratio with every increase of pressure. It is easy to conceive of a condition of things when the air under an enormous pressure would penetrate the intermolecular spaces of the water, to an extent sufficient to dissociate its elements and probably form a new combination and produce a new gas. A. There is no doubt that the addition of air to the water of a steam boiler, and even to the steam itself, is effective in increasing pressure. This was verified by Professor Rogers of Philadelphia, Pa., who even made it a matter for a patent, and constructed an engine which illustrated the difference of admitting and excluding air. But that air, under great pressure, would be able to penetrate the intermolecular space of the water, so as to dissociate its elements and form a new combination or gas, is a totally unsupported hypothesis; and we fear that your drawings for a generator and engine to work this gas, if it exists, have been labor wasted.

(9) S. A. R. asks: What is the best material used for filling fireproof safes? A. Plaster of Paris and alum, usually.

(10) C. H. M. says: Your correspondent I. S.M. asks for a rule to find the size of hole in which a thread is to be cut, and at the same time gives the following: Deduct from diameter of the screw 1½ times the pitch. Is not the following rule more accurate? As most of the threads used in this country are cut on a 60° angle, by taking the cosine of ½ the angle, that is, 0 8660, and multiplying it by the pitch, then doubling the result, and deducting it from the diameter of the screw, you will have the proper size for the hole. To illustrate the above rule: Let pitch be 0·10″, diameter of the screw 1″; then 0·1″×0·8660×2=0·1732; 1″—0·1732=0·8268. By I. S. M.'s rule: 1—0·15=·8500, giving a difference in size of hole of 0 0232. A. Below are the rules for proportioning the American standard screw, which is flattened at top and bottom. D=outside diameter of screw. d=diameter of hole in the nut. p=pitch of screw. n=number of threads per inch. (All dimensions in inches.) $p=\frac{\sqrt{16D+10}-2{\cdot}909}{16{\cdot}64}$. $n=\frac{1}{p}$. $d=D-1{\cdot}299\times p=D-\frac{1{\cdot}299}{n}$. If the thread is not flattened at top and bottom, $d=D-1{\cdot}732\times p$. For a screw, not flattened at top and bottom, with any angle, a, of thread, $d=D-\text{cotangent}\frac{a}{2}\times p$.

(11) W. F. R. asks: Which will last longest in an upright boiler, cast or wrought iron grates? A. Cast iron, generally.

(12) E. P. says: In an article entitled "Work for Arctic Explorers," you make the following statement: "In longitude 112° W. of Greenwich, the explorers will have arrived between the north pole and the magnetic pole." I do not understand how this can agree with a previous statement: "When 40° E. of Greenwich is reached, the north pole will lie between the explorers and the magnetic pole." Has the magnetic pole magnitude, or was there a mistake in printing one of the above mentioned numbers? A. The magnetic pole in question has very considerable magnitude: it covers an area of many square miles. This, however, is not the sole cause of the paradoxical compass bearings mentioned in our article. You are doubtless aware that there is another north magnetic pole on the Siberian side of the geographical pole; and the lines of magnetic direction are still further complicated by magnetic conditions which have not yet been fully made out. The statements of our article on this point were founded as stated therein on the compass directions laid down on a provisional map constructed, for the expedition lately sailed, by the hydrographer of the British Admiralty, showing the magnetic conditions which may be expected in all unexplored polar regions if the distribution of terrestrial magnetism based on the knowledge acquired up to the present time, and elaborated by Gauss, Sabine, and others, turns out to be correct. If the compass bearings of any point could be predicted from its geographical position, or its position from its compass bearing from a known point such a map would be unnecessary, and the difficulties of arctic exploration would be greatly lessened; they are seriously complicated when the voyager has to rely so largely on the guidance of an instrument, the behavior of which he is unable to predict with any certainty. The provisional maps supplied to the British expedition will doubtless prove of great assistance, though they lay down merely what is probable.

(13) F. R. B. says: I have an achromatic microscope, powers from 20 to 100 diameters. I would like to construct with it an astronomical telescope. What sized object glass would it require, and of what focus? Should it be achromatic? A. Object glasses for astronomical telescopes must be achromatic, and may be had of all sizes and focal ength, varying from 2½ to 3 inches in diameter and 3 or 4 feet focus to those of 27 inches diameter and 30, 40, or more feet focus.

(14) G. W. P. says: 1. I require from a magnetic engine as much power as a man would exert by opening and closing his thumb and forefinger 60 times a minute. Can I get this much from two Léclanché cells? A. Yes. 2. How many, and what sized, magnets should I use? A. Make your magnets so that the weight of the wire and the iron are equal, and determine the size by experiment. Two magnets are sufficient. 3. Can I gain more power by using more battery, or by less battery and more magnets? A. Make the cores thin and the poles thicker and use more battery.

(15) A. S. asks: Can a lamp wick be lit by electricity? A. Not unless surrounded with gas.

(16) L. J. S. says: D. L. B. asks if a solid bar of steel or iron would sink in the ocean in the deepest part, or float when the amount of water displaced equaled in weight the bar of iron. I wish to say that the weight of a body, specific or otherwise, depends on its density. As water is only slightly compressible, how could it be made as dense as iron? If it were so compressible that it could be made as dense as iron, it would be no longer water but a solid. The pressure of water has nothing to do with bodies floating and sinking in it. A. We would be glad to know your reasons for this conclusion.

Would it expand the air beyond its present limits to lesser the gravity of the earth? Suppose, for instance, that the material of which the earth is composed were several times lighter, would not the air be much more rarefied and reach much beyond its present hight? A. Yes.

(17) F. W. H. asks: Is it practicable to make a machine to run by a weight or spring, that will take the place of a Grove battery in plating small articles, such as watch cases, spoons, etc.? A. No.

(18) W. E. D. asks: 1. In an exhausted Léclanché battery, which needs replenishing, the oxide of manganese or the gas carbon? A. The manganese. 2. Will not a sheet of lead or copper answer as well as carbon to put in the porous cell, to make the positive pole of the battery? A. No. 3. Is there any metal that will take the place of zinc or platinum for making the negative pole of a battery? A. Nothing so good as zinc. Platinum forms the positive pole. Iron can be used in place of zinc, but it is not so good. 4. Will not a porous cell made of common stoneware (unglazed) answer as well as the ones we buy? A. Yes. 5. Cannot the above cells be made at any pottery, and should they be glazed or unglazed? A. If glazed they will not be porous. 6. What kind of pitch or resin is used to seal Léclanché batteries, and is it necessary to seal them? Will they not work as well if left unsealed? A. Shoemaker's wax will do. The sealing is done to prevent evaporation. They will work if not sealed, though not for so long a time.

(19) W. P. asks: What is the smallest magnet I can use, and what are the amount and size of wire required for it, to move a small latch of a door? A. A magnet 1 inch long will answer with 200 feet of No. 20 wire.

(20) F. W. R. says: In your article on the instability of the earth's surface, you state that the coast of Texas was rising at a comparatively rapid rate. This statement is certainly a very erroneous one, and I draw this conclusion from these facts: In 1841 I landed first in Texas, on Galveston Island. The place was but little elevated above the waters of the bay, but the street called Strand was above the ordinary tides; and was only overflowed after winds from certain quarters. It has been filled up to a hight of several feet, and is now barely above high tides. Salt water was reached at a depth of four or five feet, and is, I think, still found at that depth. The tide reaches the town of Houston and marks about a similar point on the wharf. I have often heard it said that our coast was rising; but so far as my appreciation of it goes, the rise must be very slight during the last thirty-four years. A. You must consider that the coast of Texas along the Gulf of Mexico is between 300 and 400 miles long, and that the northeastern portion, adjoining Louisiana, is of the nature of the latter State. It has not been asserted that Houston is rising; but 300 miles southwest of that place, near the mouth of the Rio Grande, it adjoins Mexico; and the condition is very different there, as the strata partake more of the volcanic nature prevailing in Mexico. It has been repeatedly stated, by those who visited that region 40 years ago and recently, that it is rising. It is a very common occurrence that a coast line descends or is stationary in one part; while, at a distance of 300, 200, or even 100 miles, a gradual rising takes place.

(21) S. K. L. says: A friend and I had a dispute as regards the ground wire of a telegraph. He says the ground current takes a direct line from one point in the earth to the other. I say it takes the course of the line wire. Which is right? A It takes the course of a direct wire having no resistance.

(22) W. M. D. says: I wish to construct an electro-magnet and get as much force as possible with a given amount of material. Will 200 feet of No. 20 wire wound on 4 soft iron cores of U shape, each weighing ¼ lb. and each having 50 feet of wire, be as effective as 200 feet of No. 20 wire wound on 1 core weighing 1 lb. or as much as all the 4 small ones put together, the battery to be the same for the large one that is used for all 4 of the others at one time? A. Yes.

(23) F. R. says: I have a plating shop, and find great trouble with batteries. I was thinking of getting a friction battery to do gold, silver, and nickel plating with. How could I make a cheap one, to go by steam? A. You can buy magneto-electric machines for the purpose. You could hardly make one without great labor and expense

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