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, andlike 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.

The Charge for Insertion under this head is $1 a Line.

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 eyepiece 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 length, 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