(37) J. R. J. asks: What do you base your calculation on for the pressure on the surface of an ordinary slide valve? Do you take the whole surface of the valve or only the area of the exhaust port in combination with such part of steam port that may be covered, etc.? A. We take the whole area of the exhaust cavity of the valve and one steam port while closed. The moment that the steam port is opened the pressure is neutralized for its area. 2. What size siphon will it require to discharge 15,000 gallons water in 30 minutes, with a lift of 8 feet? How much water will a siphon with 5 in. suction and 4 in. discharge, with 2 in. steam pipe and nozzle reduced to 1 in. or ¾ in. with 10 ft. lift, discharge in one hour, steam pressure 60 pounds? A. The best form of siphon ejector upon the market, of the largest size, with a 2 in. steam pipe and 3 in. discharge pipe, lifting 8 ft. with 60 pounds steam pressure, has a capacity of 8,000 gallons per hour. This is nearly the capacity that can be obtained from a 2 in. steam pipe with larger water pipes. We cannot recommend a larger size in one jet. For a discharge of 15,000 gallons per hour you will require four such jets as above described. We know of no trials with larger pipes.

(38) J. S. B., of Virginia, writes: The text bookson physics state that the barometer at the level of the sea stands at 30 in. My aneroid barometer yesterday at this place stood at 31 in. As I suppose 30 in. at the sea level means when the atmosphere is free from moisture, please explain under "Notes and Queries" how the barometer can be at any place higher than 30 in. Please give also height of Washington City above sea level. Also state whether there is any method of telling the height of a place above sea level by barometer, except by observations on some day and some state of weather at the sea level, and at the place whose height is desired? A. The *mean* height of the barometer at the sea level is about 30 in. If your barometer was correctly adjusted, it indicated a high wave of pressure in the atmosphere. The annual mean pressure at Washington for 1879 and 1880 reduced to the sea level was 30·107 in. The same for nine years, 30·058 in. Add for your height above the sea 0·001 of an inch for each foot in height, to the *mean* of your station observations corrected for temperature and instrumental errors.

(39) W. B. H. asks: Will you kindly inform me what resistance a spiral spring 1 in. in diameter and 6 in. in length may be made to bear? A. There is no measure for the strength of small spiral springs. Their strength depends entirely upon the size and shape of the wire, and the material of which it is made. A square steel wire or bar makes the strongest spring. A 1 in. diameter with three-sixteenths square steel of the best quality, well tempered, might be relied upon for 100 pounds.

(40) P. L. H. writes: 1. Will you give your reasons for your answer to second part of question No. 14 in your issue of Feb. 2, 1884? A. The answer to the second partalluded to is correct for thesame reason that the answer to the first part is correct, both coming under the same conditions. The strain upon all cylindrical vessels, whether tanks for holding water, air, gas, or steam under pressure, is inversely as the diameter. In the case of the water tank, the strain is greatest at the bottom and *nil* at the top. The practice among engineers is to make the courses of plates thicker toward the bottom. This is notably so in the great standpipes of water works. The great mistake among people not familiar with engineering is their failure to understand the *cumulative* strain of *unsustained* walls, due to increased diameter. They seem to compare the conditionsof *thin* walls in the distribution of the direction of the thrust directly with walls of masonry, where gravity derived from the weight of material becomes the retarding power. 2. Suppose a wrought iron lap welded pipe 6 in. in diameter and ⅜ in. in thickness be used as a water main with a maximum pressure of 110 pounds to square inch, the same to be buried in the earth at a depth of about 30 inches, what length of time will such a pipe last under the conditions stated? A. Wrought iron pipe is largely used for water, and will last many years. The only difficulty is the gradual decrease in efficiency of discharge by the accumulation of rust nodules upon the inside, which sometimes entirely fill the smaller pipes. Cast iron pipe is the best for water underground. An experience of 40 years has failed to find cast iron water pipes rusted out.

(41) J. C. R.—Aluminum has been used in alloys of copper and zinc and silver, and possibly some other metals. It has been sold as aluminum bronze, and used for jewelry, mathematical and optical instruments, screws, and all. It would probably be a novelty as wood screws, and possibly patentable. You might try it. It costs in Europe about 50 cents per ounce. In this country, about 75 cents to $1.00 per ounce. It is not as ductile as yellow brass—more like gun metal in the form of alumina bronze. If a small portion was mixed with yellow brass, it would not materially affect its ductility.

(42) N. H. asks why will an injector refuse to inject water into a boiler above the line of water level? A. Injectors will feed above the water line. There is no reason for their failure if in perfect order. The only difficulty arises from leaky valves allowing the steam to set back and heat the injector, when it will refuse to start until cooled. There is much difference claimed by the makers of injectors for the power of their various makes. It is possible that some of the 15 kinds now upon the market may fail to feed above the water line from some inherent defect in their construction.

(43) E. H. R. asks: What are the proper chemicals to put into the jars of a battery to run an electro machine or motor to drive a sewing machine? The machine is made for that purpose. The battery is a piece of zinc between two pieces of carbon. The machine has been tried with some kind of acid, but failed to work satisfactorily. The battery is composed of six jars. A. Makea saturated solution of bichromate of potash in hot water. Allow it to cool. Some of the bichromate will crystallize out. Add slowly to the bichromate solution one-sixth its volume of sulphuric acid. This will render the solution hot, and redissolve the bichromate. Add about half an ounce of bisulphate of mercury to every five pounds of solution.

(44) A. L. S. asks for the best method for silvering and oxidizing metals, especially electroplates? A. For information on electro-metallurgy see SUPPLEMENT 310. To "oxidize" silver dip it in a weak solution of sulphate of potash.

(45) A. S. Co. ask whether the moisture could not all be taken out of a damp room heated at the bottom 150°, by ceiling the room with galvanized iron and having a steady stream of cold water flowing over the iron ceiling, and a system of troughs underneath to catch the drip? Would not such an arrangement create a circulation, and convey all the moisture out of a room quickly and thoroughly? A. Heating the air to 150° will largely increase its capacity to hold water; air at 75° that is moist becomes dry at 150°. Your ceiling will require to be much colder than the air before heating it, in order to condense any moisture. A cold room may be made moderately dry by condensing the moisture upon a colder surface and dripping the water into gutters leading out of the room with a siphon.

(46) C. M. H. writes: It is stated that an incombustible paper has been invented by Mr. G. Meyers, of Paris, and that its resistance to heat is so great that fire will not alter its appearance? A. Fireproof paper for writing and other purposes has been made in France by mixing asbestos and wood fiber with a small portion of borax and size, that is said to resist a white heat. The German method is to treat the asbestos with permanganate of potash and then with sulphuric acid before mixing with wood pulp, borax, and glue size. Asbestos and borax are the foundation of all fireproof papers.

(47) S. W. L. asks: What is meerschaum composed of, and where is it found? A. Meerschaum is a silicate of magnesia, and is found in Natoli, Asia Minor. The mines are owned by the Turkish government.

(48) G. L. A.—Petroleum is a preservative for wood. If you can keep it in your fence posts after they are saturated with it, they will be durable.

(49) W. H. T. writes: I wish to make "idler" pulleys 1½ in. diameter with groove for ½ in. round belt to run at 6,000 revolutions per minute. The speed to be kept up from a half minute to five minutes at a time, and pulleys to run noiseless. Of what metal or alloy shall I make them to run with the least amount of oil, and to wear the longest? A. Never run idler pulleys loose on a shaft. Make them of iron or steel fixed on a shaft, and run the shafts in metalline boxes; they will run noiselessly and without oil, or at least with the minimum amount that will moisten the journals.

(50) G. E. E.—It is impossible to form any opinion in regard to the possible amount of silver that a mineral may contain without first assaying it. The larger of the two specimens may contain silver, but the smaller one is simply a piece of iron ore. Cost of assay for silver, $5.00.

(51) F. H. B. asks the best way to case-harden gas pipe, the diameter of pipe 6 in., and 4 in., corrugated on the outside with 18 or 20 corrugations per inch, about three thirty-seconds of an inch deep. I wish to know the most thorough manner regardless of cost. A. All casehardening is superficial, as its name implies. The best method of case hardening is packing the article to be treated in a tight box of iron with ground bone, prussiate of potash, and charcoal, and heat for several hours to a red heat. Then plunge into water. The longer the exposure to the heat, the deeper the coating.

(52) G. C. S. asks: What amount of air can be ejected in one revolution of the piston, say the cylinder is 12in. in diameter and the stroke 18 in? Also, which possesses the greatest power—steam or atmospheric pressure? A. Your cylinder 12 in. diameter, 18 in. stroke, will discharge 1·177 cubic feet for each stroke of its piston, or twice this amount for a revolution of the driving shaft, *without* compression. If you wish to compress air, say to 15 pounds pressure per square inch, then but one-half of the above amount can be discharged without clearance at the ends of the stroke. For equal conditions there is no difference in the power of steam or air.

(53) A. M. B. writes: All old water-mill men insist that a saw runs faster and stronger, and will cut more lumber, at night than in the daytime. Is there any reason for this that can be accounted for scientifically? A. We never could appreciate that water was any heavier, or that machinery runs any lighter, at night than by day. We think that the difference would perhaps be due to the change in the temperature, whereby there will be less friction of the parts.

(54) W. G. F. asks: 1. In making rubber stamps is the rubber melted or dissolved? A. It is softened by heat and pressed into the moulds, and afterward vulcanized. 2. What kind of rubber is used? A. The rubber is mixed with sulphur. It is sold already prepared. 3. How may sticking to the mould be prevented? A. By dusting powdered soapstone thereon. Plaster moulds are generally used, and destroyed after use.

(55) F. A. asks: How much weight can a magnet needle of a ship's compass carry without refusing to do its duty? A. Any weight added to the needle tends to increase friction on its pivot and to make its action heavy.

(56) R. T. M. writes: We have a dispute about a coal burning boiler having no furnace. Is not the plate that separates the steam from the fire the line that distinguishes the furnace from the boiler? A. A locomotive or marine boiler or any internally fired boiler is said to have a furnace, because the fire box forms part of the boiler construction. A cylindrical or brick set boiler comes under the opposite signification. 2. Is machine riveting as strong as hand? Don't hand riveting crystallize the iron? A. Machine riveting if carefully done, so that the rivets are set square and fair, is fully as strong as hand riveting. Crystallization takes place afterward, and is a slow process. We have seen it in old rivets, not often in new.

(57) F. H. C.—The Fuller battery will not readily freeze, and is well adapted to ringing door bells. It will work a long time without attention.

(58) O. N. L. asks the best point of the cylinder of the gas engine to explode the gas? A. Ignite the gas when the piston has completed about one-third of its stroke.

(59) H. J. H. asks: 1. What are the numbers of the three samples of wire inclosed, by the Brown and Sharpe wire gauge? A. The largest is between 23 and 24. Probably intended for 24. The others are respectively 30 and 36. 2. Are the four coils in the Dr. Bradley's improved tangent galvanometer (as described in "Haskins' Galvanometer") wound one on the other? If so, which one is wound first—the fine or the coarse? And how large is the bobbin or tube upon which they are wound? A. There are four coils. The finer wire is wound first. The bobbin is flat and about 1½ inches long. 3. And also how the needle for the same is made, how large the little magnets are, and how many? A. The needle proper is a disk of magnetized steel with aluminum pointer attached. The little magnets are no longer used. 4. How many coils, how wound, and how connected with each other in Queen's universal galvanometer? A. If built according to Bradley's pattern, there are four coils, whose resistances are respectively 150, 25, 3, and 0 ohms. One terminal of each coil is connected with the ground or return wire binding post. The opposite ends are each provided with a binding post. 5. What is the outside lever and inside arm in Bradley's galvanometer? A. It is an arrangement for lifting the needle and clamping it to the cover glass when not in use.

(60) S. McI. writes: I have a Corliss engine, 3 ft. stroke; how near to end of stroke should piston be before exhausting? A. The best point can only be determined by applying the indicator; the proper point depends largely upon size of ports, clearance, and speed of engine; in your case we should judge about 1¼ or 1½ inches. The larger the ports the nearer the point of exhaust can approach the end of the stroke.

(61) J. N. G. asks: 1. How can I hermetically seal the alcohol in a level glass, as it is done at the factories? I find that a sufficient heat from the blow pipe to anneal the glass tube will generate a gas and break before closing. A. Before introducing the alcohol, draw the ends of the tube into a very fine tube close to the bulbs, then fill the tube by expelling the air by heat and drawing in the alcohol by means of the vacuum. The small tube may be readily sealed without bursting the bulb. 2. How is the black, glossy finish put on tintypes used by photographers, and would the same finish do upon a gun barrel? A. It is japan baked on. It might be applied to a gun barrel. 3. In making an induction coil such as are used in microphones, etc., is it necessary to introduce an iron core? A. Yes.

(62) S. H. J. asks: Whether the zinc in a gravity battery is being acted upon when the circuit is open? A. Yes.

(63) A. M. J.—The wire is covered with gutta-percha.

(64) W. C. P. asks: 1. What are the dimensions of a Ruhmkorff coil such as is used in the laboratories for exploding gases, etc? A. The smallest coil that will give a spark will explode gases. 2. What is the rule for computing the length of the spark from any coil? A. The length of the spark depends upon so many conditions that it cannot be accurately calculated.

(65) J. R. asks: What is the simplest way to obtain the electric spark for igniting gas? What is best to ignite with? A. Use the spark of the extra current of an electro-magnet.

(66) J. W. G. asks: Is the name of the wheel barrow's inventor known? A. The wheel barrow is a very old invention. Its inventor could not have been far removed from Adam. We don't know his name.

(67) A. R. B. asks: 1. What term is used to describe the process of either grinding down the deep cuts between the teeth of cross cut timber saws, with emery wheel or file? A. Gumming is the technical name for the operation described. 2. How can I best get the painting and gilding of large letters on plate glass off without scratching the glass? A. Try a warm solution of caustic potash. 3. After using one of my finest paint brushes in shellac varnish, I find that the alcohol will not clean it well. What will do it? A. Ninety-five per cent of alcohol will do it.

(68) C. E. B. asks: 1. What is the length of the armature in the dynamo electric machine of Geo. M. Hopkins' design in SUPPLEMENT, No. 161? A. Four inches. 2. Do the magnets, A and B, require to be charged before being placed in position, if so, how can I charge them? A. The magnet needs no charging. The residual magnetism is sufficient to start the machine. 3. Can you give me a receipt for black ink, one that will be very black, and have the appearance of being varnished when dry? A. See ink receipts in SUPPLEMENT, No. 157. 4. Is the small boiler described in SUPPLEMENT, No. 182, on good principles, and a practical boiler for an engine 2 x 4 in.? A. Yes.

(69) C. M. L. says: Bisulphide of carbon vaporizes at 118, and expands a little rising 400 times, when we have added 94 degrees of heat and brought it up to the boiling point of water, which expands nearly 1,700 times; is it as good, all things considered, as water as a motive power? A. The bisulphide of carbon would be more economical, but all things considered not as good as water for a motive power.

(70) H. M. E. writes: 1. How can I finish induction and other coils in hard rubber? A. The small coils are usually inclosed in rubber tubing such as may be procured of rubber manufacturers in this city. The larger coils are wrapped with very thin sheets of hard rubber, the seam being located on the under side of the coil. 2. Does the incandescent light require a vacuum? If not, what size and length of platina wire should be used with five cells bichromate plunge battery plates 2½ x 6? A. A vacuum is necessary to prevent the carbon filament from burning. Platinum may be used in the open air, but it is very treacherous, being very liable to melt. Use two or three inches No. 34 wire 3. Does this lamp (incandescent) require as much power as the arc light of equal brilliancy? A. For the same quantity of light the arc light is far more economical than the incandescent.

(71) J. H. M. asks: What kind of wax and chemicals is it that map engravers use in making cuts of maps? Or do they use chemicals, but take a plaster of Paris transfer after the map is drawn in the wax? A. When the maps are made on copper the following wax can be used: White wax, 2 oz.; black and Burgundy pitch, of each, ½ oz.; melt together; add by degrees powdered asphaltum, 2 oz., and boil till a drop taken out on a plate will break when cold, by being bent double two or three times between the fingers; it must then be poured into warm water and made into small balls for use. Nitric acid of 15° B. is the liquid used for eating the copper. Electrotypes are taken rather than plaster of Paris moulds.

(72) W. E. W. says: I have a 56 in. circular saw that has not been used in over a year (a smaller one used in place, one side of which is very rusty. What will take off the rust and make it bright? I cannot sell it as it is, but could if I can get off the rust? A. If kerosene will not remove the rust, try spirits turpentine and rottenstone. If the rust is deep, it must be ground out with emery. To preserve the concentric polish mount it on an arbor and rotate it, using emery and oil on a pine or other soft wood stick.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

Mrs. L. D. R.—The specimen is quartz (pure anhydrous silicic acid).—T. F. R.—The sample consists chiefly of pyrites (iron sulphide). It may carry gold. An assay costing $5.00 would be necessary to determine the value of the ore.

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