## Notes & Queries

T. F. D., Jr., will find on p. 315, vol. 29, directions for tempering edge tools. Back numbers of this journal are sold for 10 cents each. See publishers' notice on the second page of this issue.—E. R. does not send sufficient data as to his boat, engine, and boiler.—S. W. H. will find directions for coloring brickwork on pp. 235, 236, vol. 36.—T. P. P. will find something on changing the color of the hair on p. 220, vol. 35.—E. will find a recipe for cologne on p. 75, vol. 31.—C. P. G. will find a full description of the Great Eastern steamship on p. 346, vol. 31.—A. S. will find directions for making crucibles on p. 330, vol. 32.—O. A. P. will find directions for recovering tin from tinned plate scrap on p. 319, vol. 31.—F. W. J. will find a recipe for a gold-plating solution on p. 116, vol. 33.—W. H. H. will find a recipe for a silver-plating solution on p. 299, vol. 31.—W. C. will find a recipe for a stain to imitate black walnut on p. 90, vol. 32.—L. G. L. will find on p. 379, vol. 31, a good recipe for a paint for smoke stacks, boilers, etc.—J. H. B. will find on p. 130, vol. 35, directions for making imitation marble.—C. M. can drill glass by following the directions on p. 218, vol. 31. A cement for fastening glass to wood is described on p. 143, vol. 33.—E. F. M. will find a recipe for Vienna bread on p. 185, vol. 33.—N. E. L. will find an article on sending the time by telegraph on p. 358, vol. 30.—M. G. will find directions for ridding fruit trees of insects on p. 200, vol. 36.—G. H. P. will find an answer to his query as to the surface of a brake on p. 273, vol. 31.—W. R. W. can make his glass windows opaque by following the directions on p. 264, vol. 30.—E. H. will find something on parhelia and halos on pp. 132, 171, vol. 28.—C. W. B. will find a recipe for a liquid dressing for shoes on p. 107, vol. 36. For a recipe for writing fluid, see p. 92, vol. 33.—S. A. S. will find directions for dyeing crimson on p. 235, vol. 36.—J. A. will find directions for mending rubber boots on p. 203, vol. 30.—H. J. M. will find directions for making potato starch on p. 315, vol. 30.—J. R. will find directions for making rubber hand stamps on p. 156, vol. 31.—E. P. will find descriptions of emery wheels and their uses on p. 22, vol. 29.—E. W. will find directions for ridding a house of cockroaches on p. 43, vol. 31. As to bedbugs, see p. 378, vol. 24.—R. H. M. will find directions for glazing earthenware on p. 353, vol. 35.—W. H. T. can fasten rubber rollers to their spindles with glue. For wringing machines, marine glue would be best. See p. 43, vol. 32.—L. S. B. will find something on endurance of life in an airtight place on p. 202, vol. 32. To make oxygen, see p. 299, vol. 33.—L. C. will find a recipe for cement for stopping leaks in boilers on p. 202, vol. 34.—E. H. P. will find a recipe for invisible ink on p. 267, vol. 34.—J. A. T. can calculate the power of his engine by the rules given on p. 33, vol. 33.—W. C. J. will find directions for removing freckles on p. 187, vol. 32.—J. H. will find on p. 298, vol. 30, a recipe for cement that will fasten metals to glass.—J. A. McC. can blue his gun barrels by the process described on p. 123, vol. 31.—J. C. K. should trap his moles. See p. 223, vol. 26.—J. R. J. will find directions for making an æolian harp on p. 330, vol. 26.—A. M. N. will find directions for drilling holes in glass on p. 218, vol. 31. Hydrofluoric acid will dissolve glass. See p. 203, vol. 33.—C. W. H. will find on p. 171, vol. 36, a recipe for a cement that will fasten paper to stone or iron.—A. S. will find a recipe for waterproof glue on p. 43, vol. 32.—G. I. M. will find a full description of the East River bridge on p. 99, vol. 35.

(1) A. McG. asks: Why do frost crystals form on windows? A. If ice water be introduced into a glass vessel in a warm room, it speedily determines the precipitation of the moisture from the surrounding air, which forms as beads of dew upon the exterior surface of the vessel. If instead of cold water a mixture of pounded ice and salt be introduced, the condensed moisture will be frozen as it forms into hoar-frost, which is composed of minute crystals of ice. This precipitation and congelation is precisely analogous to that which takes place upon window panes in cold weather. All frozen water is crystalline.

(2) J. R. L. asks: How can I give shirt bosoms the polish and stiffness obtained by shirt manufacturers? A. Rub 1 oz. best potato starch up with a little cold water, so as to reduce all the lumps; add a tablespoonful of best loaf sugar, an equal quantity of dextrin, a little soluble indigo, and a lump of pure paraffin about the size of a nutmeg. Then add a pint of boiling water, and boil, with occasional stirring, for half an hour (not less). The starch should be strained through a linen cloth before using.

(3) D. F. H. asks: What is used on the end of magnets to keep the wire in place? Will iron or brass do? A. Brass or bone rubber.

(4) J. A. H. asks: 1. In an electromagnet made of 25 feet of No. 18 copper wire, of what length and size should the core (composed of small soft iron wires) be, to give the greatest inductive effect to a secondary coil? A. Of 7½ or 8 inches length and ¾ inch diameter. 2. Which will give the most magnetic power, a single coil 1 foot in length, or 4 layers 3 inches long, and should the iron cores be the same size in each case? A. The single coil, with proper battery? 3. What is the rule regulating the proportionate lengths of helices to their diameters and to the diameter of the iron cam? A. About 8 or 10 to 1 is a good proportion. 4. What rule regulates the size of the wire of which the helix is composed? A. The wire should be of such size that, when filling the proposed space, its resistance about equals that of the battery.

(5) W. S. asks: 1. Please give a description of how a good vibrator is made, and how is it applied on electrical apparatus? A. Connect one end of the coil of an electromagnet to the armature of the same; the other end, to one pole of a battery; and the opposite pole of the battery to an adjustable spring against which the armature presses when not attracted. The points of contact of armature and spring should be made of platinum. 2. Can you mention a good work on experimental electricity and magnetism? A. Read Davis' "Manual of Magnetism," Pynchon's "Chemical Physics," or Tyndall's "Lectures on Electricity."

(6) G. M. F. asks: Will 60 feet silk-covered copper wire, $\frac{1}{16}$ of an inch in diameter, for the primary coil, which is 6 inches long, and 1,200 feet of silk-covered copper wire, $\frac{1}{40}$ of an inch in diameter, for the secondary coil, give a severe shock? A. Yes.

(7) H. F. G. says: 1. I am making a small horizontal steam engine; the cylinder is of brass, cast, with a 1 inch bore and two inches stroke. How large and heavy must I make the balance wheel? A. Make it 9 inches in diameter, to weigh 4 lbs. 2. How large must I make a boiler of sheet copper, and how much pressure will it stand? How large must I make a boiler of sheet iron, and also what pressure will it stand? A. Boiler should be 8 inches diameter and 15 inches high. Copper should be $\frac{3}{32}$ thick, iron $\frac{1}{8}$ thick, for a working pressure of from 50 to 60 lbs. per square inch.

(8) H. P. asks: 1. Would steam at low pressure mingled with compressed air at a higher pressure moisten the air and increase the pressure? A. Yes. 2. What thickness should I make my air tank to stand a pressure of 150 lbs., the diameter being 19 inches? A. About $\frac{5}{16}$, if it is wrought iron.

(9) S. A. H. says: 1. I bought a telegraph sounder having about No. 32 wire on it; and I have made another instrument using No. 18 wire—about 175 feet in coil. When working it alone, it works well; but when I attempt to work the two instruments together in a short line, I find only one of them will work, the one which has the fine wire on it. What is the difficulty? A. The resistance of the fine wire is too much for the circuit, both instruments should be wound with the same size wire. 2. Please publish a recipe for a varnish or composition to be used on wire as an insulator in place of the silk covering generally used. A. Shellac and alcohol is sometimes used for the purpose. 3. Can you publish a process for making hard rubber? A. See p. 123, vol. 32.

(10) G. M. G. asks: Has an electromagnet more attraction on an armature approaching directly upon it than it has on one approaching in an oblique direction toward the poles of the magnet? A. Yes.

(11) A. E. T. asks: Of what are the zinc plates made that are used in medical batteries, so that they do not need to be amalgamated, but can be used until they are worn out? I refer to the kind used in a bichromate solution. A. A very small amount of mercury is sometimes put in the molten zinc before casting.

Please give me details of the process of tempering steel springs? A. See pp. 27, 363, vol. 32.

(12) J. D. J. asks: 1. Is there anything that will neutralize the attraction of a lodestone? A. Its attraction can be neutralized by placing an equal magnetic force of the same polarity in juxtaposition with it. 2. Has a lodestone ever been used as a light motor power? A. No.

(13) D. W. L. asks: 1. Will a small magneto-electric machine, such as is used for medical purposes, be sufficient to charge a small magnet? A. No. 2. Has electricity in this form ever been used for telegraphing? A. Yes.

Is the exhaust steam of an ordinary engine heated to above 212° Fah.? A. Yes.

(14) A. S. asks: Does it take more time to send one letter by telegraph over a continuous line of 10,000 miles than over a line of 1,000 miles? A. Yes, one hundred times more.

(15) C. S. M. says: Some time ago I purchased a second hand galvanic battery; and when I added the solution and tried to run it, I could only feel the very slightest current, and that only lasted a few minutes. How can I remedy it? A. We cannot tell you, unless you state what the battery is composed of.

(16) J. F. D. asks: Can I run by foot power a magneto-electric machine capable of heating a ½ inch steel rod to a red heat? A. No.

(17) W. R. B. says: In making vinegar, I use a common German generator containing corncobs soaked in vinegar. When I let a stream of cider flow in, the temperature rose to 110° Fah.; but when it flowed out at the bottom, it was flat, like warm water. I have made strong vinegar in this way before, and with the same apparatus. Can you tell me what is the difficulty? A. Add a little vinegar to the cider and let it ferment a short time before running through the acetifier; or return the liquid to the same, and let it trickle slowly through it a second time, and even a third time, if necessary.

(18) F. W. J. says: Can you give me a recipe for a gold wash for watch chains, etc.? A. Clean the articles perfectly, and wash them in a strong neutral bath of chloride of gold in warm water. Then dip for a moment into moderately strong solution of copperas, dry, and polish. Or use an etherial solution of chloride of gold, dry, and reduce by contact with hydrogen gas (coal gas will answer) in a tight apartment. Or dip in the gold solution first mentioned, and then in a hot solution of caustic alkali.

(19) G. S. says: 1. I wish to make a collection of marine animals, such as sponges, anemones, and algæ. Which is the best time to commence it, spring or summer? A. We believe the latter part of the summer is generally chosen for such collections. 2. Would such animals live in water mixed with common salt in the same proportion as salt or sea water? A. Experience has shown that genuine sea water is best. 3. Do you think it would improve the health of these animals to have the light of the sun filtered through yellow paper or glass? Professor Draper, of New York, says: "The yellow ray of the sunlight is that portion which is the peculiar stimulus of the chemistry of the leaves and plants." I doubt not but that it would have some influence on the *polypi*, but I would like to have your opinion. A. Dim, diffused sunlight is best.

(20) J. B. H. asks: How can I best make a cement that will stand fire and not wash or crumble out? I have a boiler in two parts, and a space between the two has to be stopped with a V-shaped piece of iron. The cement that I have used dries and crumbles out. A. Use a cement made as follows: Cast iron borings 10 lbs., red lead 1 lb., alum ½ lb., lime 5 lbs., sal ammoniac 2 ozs. Dissolve the alum and sal ammoniac in a small quantity of hot water, and mix in the other ingredients.

(21) J. H. H. asks: Can you give me a recipe for cement with which I can fasten thicknesses of paper together, which, on application, will cause no enlargement (expansion or contraction) or alteration in shape or size? A. We do not know of such a preparation.

(22) J. C. C. asks: 1. How can I make stearic acid without an hydraulic press, or the use of costly chemicals? A. It is not practicable. 2. How can beeswax candles be prevented from guttering? A. Add about 10 per cent of stearic acid to the wax. 3. How is paraffin wax made? A. The mode of obtaining paraffin differs according to its being an educt or product: an educt as from petroleum, neft-gil, ozokent, etc., and a product of the dry distillation of brown coal, peat, and bituminous shale. It is usually obtained from petroleum, by distilling the residues after the separation of the lighter oils, with steam at a temperature of from 300° to 400°. It is separated from the liquid distillate by artificial cold and the centrifugal machine, purified by treatment with oil of vitriol and steam, and neutralized with lime water. It is then rapidly redistilled, and treated in the hydraulic press, as in the preparation of stearic acid.

(23) M. J. B. asks: What is an east and west line? Is it a parallel of latitude or a line running at right angles to a meridian? A. It is a parallel of latitude.

(24) E. A. H. says: 1. What is the pressure of water freezing in an airtight cylinder? A. About 30,000 lbs. per square inch. 2. What is the strength of cast iron and sheet iron, of ⅜ inch and ⅛ thick respectively, to resist water pressure? A. Cast iron 18,000, and sheet iron 35,000 per square inch. 3. Which plan would be best for strength of resistance to the hammer in riveting, a bar 5 feet in length one end not supported, or a 10 feet bar with both ends supported? A. There might be no difference, if the bars were sufficiently rigid. Steel or wrought iron would answer for the bar.

(25) J. B. O. asks: Is it possible to build an electro-magnetic engine of one-half horse power? A. Yes. 2. If so, what size of magnet will be required? A. It requires a combination of magnets to get continuous work. 3. Will a cast iron magnet answer as well as a wrought iron magnet? A. Wrought iron is best.

(26) G. G. says: A little while ago I made a simple telephone, to be used without the electrical current. I tried a thin sheet of brass in place of a membrane as a cover to the mouthpiece for receiving and for transmitting the vibrations made by the voice to the connecting line. I found that the brass would not answer. If a sheet of iron or other metal is used, what is the shape, and how is it held in position? A. The transmitting instrument consists of a simple electromagnet, in front of which is a tightly stretched membrane of skin; just opposite the poles of the magnet, on the membrane, is a small permanent magnet which vibrates with the former when set in motion by the air. The receiving instrument is a tubular electromagnet formed of a single helix with an external soft iron case, into the top of which is loosely fitted a light iron plate which is thrown into vibrations by the action of the magnetizing helix. 2. Does it require a circuit to transmit the electrical current? A. Yes. The helices of both electromagnets are included in one circuit, which may also include a battery.

(27) J. A. T. says: I have an engine 1¾ by 4 inches. What power will it give with a horizontal boiler 18 inches x 12½ inches with tubes 1½ inches in diameter? A. Possibly you may realize ½ a horse power.

(28) J. A. C. asks: What is the easiest method by which a conducting surface can be imparted to cloth, leather, etc., for the purpose of electro-plating? I have tried plumbago, but it will not do for my purpose. A. Try the following: Immerse the object in a solution of nitrate of silver in wood naphtha. When partially dried, treat with ammonia. After being thoroughly dried, the object should be exposed to the vapor of mercury, when its surface will become completely metallized in a few moments; transfer to bath immediately. Great care must be taken not to breathe the mercury fumes.

(29) D. C. W. asks: 1. Which solution in a Bunsen battery requires to be changed, and how often? A. The nitric acid requires to be changed first, but the frequency of change depends upon the work done. The best rule is to change whenever the battery becomes too weak to do the work. 2. How can I make an electrotype of an autograph? A. You must photo-engrave it first. See p. 272, vol. 32.

(30) F. D. H. asks: If I connect one cell of a carbon and one cell of a Leclanché battery, for either quantity or intensity, do I utilize the entire energy of both, or is there a waste owing to the elements being dissimilar? A. It is a bad plan to connect batteries differing in electro-motive force, for quantity; connected in series, the resulting electro-motive force is equal to the sum of all the electro-motive forces of the different cells.

(31) C. E. J. says: Inclosed find sample of battery wire. The wires have been in use in an hotel for two years. About 6 months ago, a portion of the house telegraph ceased working. Upon examination, I found the battery wire corroded and eaten off; since then I have had the same trouble about a dozen times, and in every case was the battery wire eaten off, as in the sample. The floor is double, with cement in between. The wires run in a groove cut in the cement; the battery wire is precisely the same as the room wires, and runs in the same channel. In most cases, the battery wire would be in the middle of the other wires; but I failed to find that any of the other wires were affected. A. If the wires are in a damp place, the action of the battery probably causes the corrosion. Better use kerite covered wire, and be sure the covering is perfect.

(32) T. J. L. asks: Is there such a word in the nomenclature of telegraphy as "telehiro" or "telehiero?" A. No.

(33) E. W. W. asks: What form of battery will be the best to work a set of alarm bells (four large gongs and six small gongs) all controlled by one large vibrator on a circuit of about 500 feet length? The main requisites in the battery are to be strength of action

with permanence and requirement of the least possible care. A. If all are in one circuit, and only used for a few seconds at a time, four or five Leclanché cells will probably be found to give satisfaction.

(34) H. L. C. says: I wish to make some permanent U magnets 8 inches long, of cast steel ⅜ inch thick and 1 inch wide. If I make an electromagnet of 1 inch round iron of the same size and shape as the steel, and wind it with 150 feet of No. 14 cotton insulated copper wire, and use for battery two Hill cells, will it be sufficient to charge the steel magnets so that they will each support 8 or 10 lbs.? A. Yes, if the plates are so large that the battery resistance is very small. You had better use one or two Grove cells.

(35) E. D. G. asks: Does the latest authorized survey show Gray's Peak to be the highest altitude in Colorado? If not, what is the greatest altitude? A. We believe that the latest information shows that there are several peaks slightly higher than Gray's.

(36) R. B. C. says: 1. I am about to have a propeller wheel made, of 32 inches diameter, and would like to know how much pitch to give it. I have an abundance of power, and would like to get the greatest possible speed? A. Four feet pitch. 2. I have a horseshoe boiler, and would like to know if it would be advisable to heat the feedwater in the back breeding of the boiler by means of pipes, in the form of return bends. If so, where shall I locate the check valves, between the pump and pipes? A. If your boiler steams well at present, there is no necessity for the change.

(37) W. L. asks: In what book can I find how to calculate the times of rising and setting of the sun for each day in a year, for any degree of latitude? A. There are many special methods used by computers which are not given in ordinary treatises on astronomy; but you will find a good discussion of the subject in Norton's "Astronomy."

Which of two horses pulls more on the double tree of a wagon if one is a little ahead of the other? A. Usually the one that is a little ahead.

Why does a gun barrel scatter the shot? A. Generally it is due to the fact that the barrel is not true or is foul, or to the shape of the breech.

(38) T. L. says: How many horse power will be developed by using 100 inches of water (miner's measure) on a 20 feet overshot wheel, and also on an 18 feet wheel? A miner's inch of water is an amount that will run through one inch square aperture under a five inch pressure or head. A. About six and five horse power respectively.

(39) J. H. H. says: 1. I propose making a wrought iron jacket cylinder, 2½ feet in diameter and 6 feet long, with a steam space of 1¼ inches, to be run by superheated steam. I understand that steam can be superheated to 1200° Fah. The outside of the cylinder is to be covered with a non-conducting covering. With a cylinder of this construction, how many degrees of heat will be radiated to the interior of the cylinder? We expect to use between 25 and 40 lbs. of steam A. You do not send sufficient data. 2. Would an elliptical cylinder be as good as a circular one? A. No. 3. How thick would you make the non-conducting coating? A. From ¾ to 1 inch.

(40) S. asks: What is the rule by which shipbuilders calculate the carrying capacity of vessels, and find the weight of a ship as she stands in the water? A. The rule is too long for insertion in these columns. You should consult a standard treatise on shipbuilding.

(41) E. M. asks: 1. How can I use and make dipping acid for cleaning gas fixtures? A. Use sulphuric acid diluted with about 5 parts of water. 2. How can I put on the bronze powder used on zinc covering pipe? A. Use boiled oil as a size. 3. How can I make lacquer used after bronzing? Can any kind of clear transparent varnish be used? A. Use shellac in alcohol.

(42) J. K. says: 1. We have an upright tubular boiler of the following dimensions: Shell 8 feet by 3 feet, plates ⅜ inch thick, single riveted, having 51 tubes each 6 feet long by 2¼ inches diameter. Firebox or furnace is 30 inches by 23 inches high. Heads ⅜ inch thick; and the boiler is made of best iron. The water space around firebox is 2 inches. How many horse power (at 20 feet heating surface per horse power) do you consider this boiler to give? A. About 7½. 2. What pressure per square inch should it be worked up to? A. From 80 to 100 lbs.

(43) A. P. H. says: We have two 60 flue boilers, 14 feet long and 60 inches diameter. They were tested with 100 lbs. cold water pressure and did not leak. But as soon as we started fire under them they began to leak in the seams over the fire on top; where the fire did not strike them they were perfectly dry. We calked them, and that stopped the leaks for a day or two. We tried the calking over again several times, but with the same result. When we had run about four weeks, all the flues in the back end of one of the boilers began to leak. Why did the flues in one boiler leak and not those in the other? A. We judge from your account that the boilers have been badly built, badly managed, or both, the probability being that they are very poorly constructed.

(44) J. H. N. says: I need a 6 horse power steam engine to do my work. Can exhaust steam from an engine be used to warm a house, through pipes, after the manner of heating now in use? If so, what increased capacity of power would be required to warm an ordinary village residence? A. With properly arranged heating apparatus, the increase of steam required will not be more than 10 per cent.

I prepared gummed labels with a solution of gum arabic; these labels rolled up, resembling little pipes. What can I use to prevent this curling up? A. Mix some refined sugar with your gum solution.

I am using an incubator for hatching queen bees' and hens' eggs. I need a temperature governor. What metal or substance in the form of a bar is most susceptible to and expands most by heated air? In liquid form, mercury is most expansive, is it not? If mercury is confined in a cylinder by a close-fitting piston, will it exert considerable power or will it compress like air? A. Mercury inclosed in a tube will answer very well. Zinc and lead are among the most expansible solids.

(45) W. E. N. says: I have a small copper boiler 18 inches high and 12 inches in diameter, made of ⅛ inch copper. The heads are of $\frac{1}{16}$ inch copper. What size engine will it run? A. You can use an engine 1½ x 3 inches.

(46) J. H. T. asks: 1. I have a 10 horse power engine which ordinarily works well, but when at heavy work it will (while pumping water into boiler) overflow the exhaust pipe in smoke stack, when I have scarcely two gages of water. What is the cause of it? A. We presume, from your account, that the boiler has not sufficient steam room when the engine is working at full capacity. 2. What is the best paint or varnish for boilers? A. A black varnish made from petroleum is sold for that purpose, and answers very well.

What is the rule for finding the number of revolutions per minute of certain pulleys? A. Divide the diameter of the driving pulley by the diameter of the driven pulley, and multiply the quotient by the number of revolutions of the driving pulley.

(47) J. S. W. asks: What number of blades should a propeller wheel have to be used on a small yacht, model and power being able to give the highest speed, and length being from 24 inches to 38 inches? A. Three.

(48) W. N. R. says: 1. Will you explain the process of laying very thin veneers? A. The veneer having been cut to the proper shape, the surface to which it is to be applied is coated uniformly with glue and the veneer is directly placed in position. The exterior surface of the veneer is then sponged over with warm water to prevent its curling. 2. What is the meaning of the word "caul," as applied in this process? A. If the surface to be veneered is a plain one, the caul is simply a plain smooth board, covered with canvas, and clamped on over the veneer to insure its perfect contact in every part with the glued surface until the glue has properly set. If the surface is uneven, the caul is made up of canvas to which thin slats of wood have been previously glued to give it the required shape.

Please give me a recipe for aquarium cement? A. Beat up a small quantity of pure caustic lime in fine powder with a sufficient quantity of white of egg to form a thick paste, and fill the angles of the aquarium with this immediately before it sets. When perfectly set, give the seams a coating of fused paraffin.

(49) W. A. M. says: I have a quantity of nitric acid of 30° Baumé. How can I increase its density to 50° Baumé? A. Distil it with a quantity of strong oil of vitriol in a large glass retort.

(50) W. L. R. asks: How much will eight span of horses pull in one wagon, provided one span will pull 20 cwt., all other things being in proportion? A. Where the horses are accustomed to work together, 8 spans will pull about 8 times as much as 1 span. But if 8 separate spans were hitched to the same wagon, even though they might all pull well when working in single spans, it is doubtful if they would pull more than 5 or 6 times as much as a single span, and the aggregate pull might fall even lower. The same thing may be noticed in the effect produced by gangs of men when pulling, pushing, or lifting.

(51) R. L. H. says: 1. How large should a current wheel be, and what should be the shape of the paddles, to realize 15 horse power in a current running at the rate of about 5 miles per hour? A. Make the wheel 15 feet in diameter, with floats at an angle of 15° to the radius, each float being 3 feet deep and 18 feet long. 2. How should the current wheel be geared to give a speed of about 350 revolutions to a 24 inch corn mill? A. Ordinary bevel gearing and cogwheels will answer.

(52) W. B. P. asks: How is the ribbon for the type writers, and for the ordinary ribbon stamps, made? A. It is saturated with a solution of one of the aniline dyes, alizarine, or alcoholic extract of madder, in glycerin.

(53) C. C. F. asks: How is the so-called French kid, made from goat skins and used in ladies' shoes, worked out and tanned? A. The process is that known as tawing. It is too long for publication in detail here. The skins, having been soaked in water and scraped on the flesh side (the hair being loosened and removed by soaking in lime water and plucking), are passed through singly, and then digested for about 10 minutes in a boiling bath composed of 12 lbs. alum, 2¾ lbs. salt, in 12 gallons water: 15 lbs. wheat flour, and the yolks of 50 eggs are then added to the warm alum bath, and the skins are soaked in this for a day or more. The proportions here given are for 100 skins. The skins are then stretched in lofts to dry for a week, when they are soaked in water for a few minutes, softened by stacking, and ironed.

(54) W. D.—Referring to the reply given to W. D. (No. 16, p. 203, vol. 36), who asked about the use of galvanized iron pipes, for conveying spring water, etc. Our Professor was in error in advising the use of galvanized iron pipes. Probably a better material would be pipes of wood. With some waters, the use of galvanized pipes has proved disastrous, and the safer rule is to banish them altogether. Perhaps we cannot do better than to repeat the inquiry and reply we gave on this subject on p. 251 (No. 4), SCIENTIFIC AMERICAN of October 16, 1875:

J. G. W. asks: Will galvanized iron tubing in a bored well be durable? Would the water from such a well be wholesome? A. The use of galvanized iron pipes for family water supply is not desirable. For a short pipe, if the water is pure, and the precaution is taken not to use water that has stood too long in the pipes, perhaps no bad effect would result. But there have been repeated examples of poisoning from the use of galvanized iron conducting pipes. In a case at Portsmouth, N. H., a family of four persons were thus poisoned, and Dr. Jackson found four grains of oxide of zinc in the water. In another case, near Boston, where the house was piped with galvanized iron pipes, one of the young members of the family died, and a *post mortem* examination revealed the presence of oxide of zinc in the stomach and other organs. Death was directly attributed to the use of the above pipes. They are made by heating and dipping the iron pipes in melted zinc.

See also the letter of Mr. Balch given on another page of this issue.

(55) W. A. E.—The temperature of ignition of dry pine is about 800° Fah., of oak 900°. The temperature of ignition of charred wood, if perfectly dry, is not sensibly different from the above. Wood or charcoal, perfectly dry, generally requires the actual contact of a spark to produce ignition.

(56) C. G. D. says: I read the following: "Venus is twice as near the sun as the earth is, and consequently receives four times as much light and heat as we do, and the average temperature of the earth being 77° Fah., the average temperature of Venus would be four times 77°, or 308° Fah., etc. Now as the zero point is not at the true zero—the point of absolute cold—heat cannot be multiplied except by indicating it, as five or ten times as much, never expressing the amount in degrees. This can be proved by comparing the results of the temperature of Venus by the two most common scales, the Fahrenheit and the centigrade. The result given by Fahrenheit is 308°; on the centigrade scale 25° corresponds to 77° Fah.; so, by that scale, the temperature would be 100°, or that of boiling water, which is 96 Fah. degrees lower than the first result, a considerable difference. By means of freezing mixtures, an artificial cold of — 220° Fah. has been reached; placing this as the zero point of a new scale (and it is unquestionably nearer the true zero than the zeros now in use), the temperature of Venus would be 968° Fah., a much greater difference than ever. So, we see, the result varies with each scale with a different zero; Réaumur and centigrade, starting from the freezing point of water, give the same result. If my reasoning is incorrect, what is the temperature of Venus, our temperature being 0° Fah.? or — 10° Fah. ? A. Your reasoning is based on correct principles; and the absolute zero, which must be taken to obtain the same results when multiplying temperatures on different scales, is fixed by theory at about — 219·2° Réaumur, — 275° centigrade, and — 461·2° Fahrenheit.

(57) N. L. R. asks: 1. How much water will I have to turn on an overshot wheel, 20 feet in diameter, to get six horse power? The water will flow on the wheel from a trough. I will not have any head of water at all. A. About 230 cubic feet a minute. 2. Will it take less water if I have a head of five cubic feet above the wheel, that is, just over the wheel? A. Yes.

(58) J. A. B. asks: 1. Is 18 inches too long a beam for an engine whose stroke is 4½ inches? A. It will answer very well. 2. In a parallel motion, does the cylinder require to be under the ends or the center of the arc described by the end of the beam? A. Under the ends of the arc. 3. What power can be obtained from two engines, 3½ by 4½ inches, making 300 revolutions, with steam at 120 lbs. in boiler? A. Between 8 and 9 horse power. 4. Would one of them give half the power? A. Yes.

How will an ice boat make 60 miles per hour, the wind having a velocity of 15 miles per hour only? A. This matter has been frequently referred to in recent back numbers.

(59) E. B. K. asks: What pressure does a column of mercury, of 1 inch area, give in ascending 1 inch in the tube? A. About ½ lb.

Is there not an expeditious method of cutting firebricks other than by chipping them with a hammer? Are there not saws made for the purpose? A. We are not sure. If there are such tools, some of our readers will, we hope, send us word.

(60) G. A. R. asks: Is a pine log lighter when it is frozen than when it is thawed, or not? A. There is little or no difference in the weight of timber under such conditions. Ice is lighter than water, volume for volume, but 1 lb. water when converted into ice will weigh neither more nor less than 1 lb.

(61) R. C. says: 1. I wish to make an incubator heated by horse manure. I filled a box three feet square with fresh manure; it heated in about a week, and in two weeks it was as cold as when I put it in the box. How can I retain the heat for three weeks? A. Moisten the manure with a little molasses water, and keep covered with sawdust. 2. Will quicksilver placed in a glass tube work a stopper in the tube resting on the quicksilver, as a regulator of heat? A. If the tube is provided with a proportionately large reservoir or bulb at the lower extremity, it will answer well enough for the purpose, but it will be necessary to make a table for it by comparing the indications with those of a good thermometer.

(62) N. R. asks: What is the best preparation for restoring hair to its natural growth? A. Make a strong aqueous solution of Liebig's extract of beef, and add about 2 per cent of neutral citrate of iron, and a little wine. Take a few spoonfuls of this every day.

(63) W. C. M. says: Please give me a cheap process for clarifying vinegar, either before or after acetification has taken place? A. It is usually purified by distillation in large tinned iron vessels. This is the cheapest method.

(64) G. S. says: 1. I have heard of a newly discovered light, besides the electric and the calcium, the latter of which I am in the habit of using for the magic lantern. Is there something new in this line? A. A. The lime or calcium light, the magnesium light, and the argand gas and oil lamps, are the only sources of illumination that have thus far proved of any practical value for projection with the magic lantern. 2. Can the zoötrope be used in connection with the magic lantern or the wonder camera, so as to throw the motion of figures on the screen? A. Modifications of the instrument you name have been used in the magic lantern. The pictures are painted or photographed on glass disks, which are rotated before the condenser with the interposition of a similar opaque disk, bearing the slits, which is simultaneously rotated in the contrary direction.

(65) A. B. G. says: I have a quantity of oxide of zinc. How can I convert it to the metallic state again? A. Mix with an excess of powdered charcoal and a little molasses, pack into black lead crucibles, cover with a luting of fire clay, and heat strongly. Consult Bloxam's "Handbook of Metallurgical Operations."

(66) T. J. M. says: I have an engine ⅛ x 1 inch bore, with 2 flywheels 5⅛ inches in diameter, weighing together about 1½ lbs. Boiler is upright, 5 x 8 inches inside, with two 1¾ inches copper flues. Boiler heads are cast, ¼ inch thick, and shell is of $\frac{1}{16}$ inch iron, riveted. How can I steam it? A. We think you can use a lamp with two burners, one for each flue. The best forms of lamps used for heating purposes are patented, and we advise you to purchase one in preference to making it.

(67) R. A. J. says: 1. Our town is situated on a river. At the back of the town and about one mile from the river is a bluff, on which is a cemetery. I wish to know whether the close proximity of the cemetery will injure the water in the wells in that part of the town which is close to the cemetery? The water in the wells runs in a direction from the cemetery to the river. The cemetery has been there for over twenty years. A. It is improbable that this will, in any way, affect the quality of the water. 2. How can I test for impurities in the water? A. Make a dilute solution of permanganate of potassa in water, and add to a sample of the well water a little of this solution, just enough to impart to it a perceptible tint. If the color thus imparted disappears, even after an hour's standing, the water may be considered unfit for drinking purposes.

(68) P. A. T. asks: What size of boiler of the firebox locomotive kind and what size of engine do you recommend for a boat 65 feet long by 18 feet beam, and 3½ feet depth of hold? The said boat is to be a high pressure sternwheel and the engine double. A. Make a boiler 4 feet in diameter and 12 feet long, cylinders 10 x 20 inches, with a steam pipe 3 inches in diameter. Feed pump 3 x 20 inches, pipes 1 inch. 2. How many cords of wood ought said boat to be able to carry? A. Capacity of boat, 60 to 70 cords of dry wood.

(69) T. C. B. says: 1. I would like to build a model locomotive of the following dimensions: Cylinders 1½ inches in diameter, stroke 1⅝ inches, steam ports ⅛ x ⅝ inch, and exhaust ports ¼ x ⅝ inch, with a plain D slide valve. Drivers are to be of 4 inches diameter, and four in number, coupled. Front or swing truck is double with 4 wheels. Boiler is of ⅛ inch copper, diameter 4½ inch, and length, including smoke box, 15 inches. Firebox has a height of 4 inches, length of 4½ inches, and width of 4 inches. Pump has a bore of ¼ inch connected to crosshead. Injector has a discharge diameter of ¼ inch. Will these proportions do? A. We think your proportions are generally very good, and we are glad to publish this letter for the guidance of others. 2. What would be the best for fuel, charcoal or cannel coal, a blower being conducted to stack? A. It will be best, on several accounts, to use charcoal for fuel.

(70) C. S. says: 1. I wish to build a cider press. I intend to use a single cast iron screw, of about 4 feet in length. What should be the diameter of the screw to support a pressure of 100 tons? A. Make the screw large enough to have the area of the thread in the nut equal to 25 square inches at least. 2. What would be the friction, supposing the nut to be placed in the upper end of the screw, and the lower end of the screw to turn on a flat metal surface? The screw will, of course, be well lubricated. A. Friction will probably not exceed 10 per cent of the force applied to the screw.

(71) J. F. says: 1. We have not got enough natural draught for our stationary boiler. We propose putting on a fan blower. Would it do as well to let it blow up through the stack as under the grates? Our exhaust goes into the stack, but our engine does not run continually, and we see that the exhaust has but very little effect on the draught or fire. A. The arrangement of blower which you suggest will answer very well. 2. We have also a ¾ steam pipe running into the stack, which, when steam is let through it, creates a terrible roaring fire. It uses a great deal of steam, but it is a long way ahead of the exhaust. Will not our exhaust create more draught if the nozzle was closed to the top of the stack? A. We do not think any gain will be realized by carrying the exhaust pipe as proposed.

(72) D. M. M. says: 1. I have an iron tank for supplying water to a steam boiler 4 feet long by 20 inches diameter. The shell is of ¼ inch boiler plate, and the ends are cast iron, having a rod passing through the center. Can I insert 40 two-inch tubes by drilling holes through the cast iron ends of sufficient size for the tubes without weakening the strength of the tank? The tank is guaranteed to stand a pressure of 60 lbs. per inch, or will it be better to have the ends replaced with boiler plate? A. It will be better to use wrought iron heads. 2. What is the comparative power for water and air to absorb heat, both being of the same temperature? A. The amount of heat that will raise the temperature of 1 lb. of water 1°, will do the same for about 4 lbs. of air.

(73) R. J. asks: 1. How can I dissolve rosin in large quantities in something that will evaporate and leave the rosin hard? A. Turpentine, naphtha, benzole, etc., are solvents for rosin, and will deposit the same upon evaporation. 2. How can I dissolve rubber? A. Use bisulphide of carbon mixed with 6 or 8 per cent of best alcohol. 3. Can old rubber shoes be dissolved? A. Vulcanized rubber may be dissolved in the above mixture by heat, pressure, and agitation, in strong vessels of boiler iron. The solution, however, is somewhat difficult, and, owing to the volatility and inflammability of the solvents, not without danger when the operation is conducted by inexperienced hands.

(74) T. J. C. asks: Will a circular saw with 16 teeth cut better and more easily in hard wood generally than one with 24 teeth, each saw being 54 inches in diameter? A. This depends upon the thickness of the saw and the amount of feed to each revolution. For a 54 inch saw of No. 8 gauge, cutting 1 inch at each revolution in hard wood, I should say that, if the teeth were spread at the points in place of bending each alternate tooth for the set, 16 teeth would be better than 24. All of the conditions should be given in order to permit a definite decision to be arrived at.—J. E. E., of Pa.

(75) C. D. R. asks. What is the reason that tubes in an upright boiler do not burn out at the top

where there is no water? A. The steam in the boiler ordinarily reduces the temperature of the products of combustion to a point where they will do no damage to the iron.

(76) E. C. asks: 1. Will a portable engine rated at 6 horse power do more work in a day than 6 horses? A. Yes. 2. Is an upright boiler as durable as a horizontal one? A. Ordinarily, yes.

How many revolutions should the cylinder of a thrashing machine make, the diameter being 13 and length 30 inches? A. This depends on the construction of the machine. You should address the manufacturer.

(77) B. A. W. says: Given a propeller with a 24 foot keel and 7½ feet beam, rather flat on the bottom at midship, with an upright boiler, with two inch tubes and shell 2 feet by 4 feet; which is best, an engine 3½ x 6 or 3½ x 5 inches? or is there a better size than either? A. Use one 3 x 5 inches. 2. What size and pitch of wheel, and how many blades are necessary? A. Use a propeller of 3 blades, 24 inches diameter, of 3 feet pitch. 3. Where should the boiler be placed to allow a cabin to be built in front, projecting at the sides on the guards 5 inches each side, the roof covering the whole boat? A. You do not send sufficient data to enable us to determine the position of the boiler; but probably it can be placed 12 or 14 feet from the bow. 4. What speed would such a boat make? A. Probably 6 miles an hour.

(78) S. L. S. says: I have a forebay or penstock to a mill; it is 8 by 10 feet, and the water is 6 feet deep. In the center of the forebay I wish to place a wheel, with a gate 17 by 18 inches. How many lbs. pressure of water will thus be on the gate at the bottom of the forebay? A. About 2½ lbs. per square inch, as we understand the question.

(79) G. W. R. says: A man is using a hydraulic pipe, with a 22 inch pipe at the head or penstock. He takes out the 22 inch pipe at the head, and puts in a 36 inch pipe. Will the pipe throw the water further from the nozzle, and will the pipe take more water than before? A. Your question is rather incomplete; but, as we understand it, the change will make no material difference in the discharge.

(80) A. W. F. asks: 1. How many lbs. of anthracite coal would an upright tubular boiler, measuring, say, 4 feet high by 34 inches diameter, with ordinary grate surface and draft, consume? Boiler carries from 30 to 110 lbs. steam, and engine runs at 300 revolutions per minute. A. Such a boiler would probably burn from 40 to 50 lbs. per hour. 2. What should be the proportionate depth of a steam yacht to its length, and how high should a boat of 30 feet long rise out of water at its bow, the boat being used where the water is oftentimes quite rough? A. Draft, from $\frac{1}{12}$ to $\frac{1}{15}$ length. The boat in question might rise from 24 to 30 inches at the bow.

(81) L. M. C. asks: How can I prepare color, such as red, blue, green, etc., to mix with a glue size, to be used on cotton cloth, which, when stretched on a frame and dry, will look clear and transparent, and be smooth and free from streaks on the flat surface? A. The aniline colors will give the best satisfaction. You can obtain them with instructions from almost any druggist. They are brilliant and economical. Some of the vegetable dyes would answer; but it would require too much space to give you the various methods for their extraction here.

(82) D. W. says: A very singular phenomena recently occurred in a mill, run by an eight horse power steam engine. The upper stone is stationary, the lower stone standing on a 1⅜ inch spindle, resting on a step. This step is movable, so as to gauge the rate of feed. The spindle is of hardened steel, resting immediately on a steel plate, ⅜ of an inch in thickness and 2 inches square, resting on a cast foot, in a square bed, secured against revolving. Above this bedplate is a loose collar of cast iron resting in the step plate surrounding the spindle in a manner to secure stability of motion to the spindle. The foot plate is of hardened steel, its upper surface being flat, and the point of the spindle resting on this plate is slightly oval. A few days ago, while the mill was running at its usual velocity with a full head of steam, the stones stopped instantly, the belt sliding in the pulley until steam was shut off. The miller supposed that something had got between the stones, and at once set to work to raise the upper stone from its bed, but only the ordinary amount of grain was found between the stones. The lower stone was then lifted from its bed, and the spindle was found firmly attached to the steel foot plate in the step. An attempt was made to drive this foot plate off, the corners projecting sufficient to give a full blow with a heavy hand hammer, such as blacksmiths usually use. The corners of this plate were bent down by repeated blows, without any effect on the attachment to the spindle. The spindle was then taken to a smith's forge, heated and cut off above the step plate, so as to leave a small portion of the spindle attached to the step plate. On close inspection, a small portion of the outer surface of the end of the spindle was found not attached to this step plate. Oil was found above the step plate and collar around the spindle, in sufficient quantity, and no evidence of heat or unusual friction could be found. And yet the spindle was firmly welded to the step plate. This process of welding must have been instantaneous, as no abatement of speed was noticed by those standing about. All the above facts can be verified by testimony. Can anyone explain this fact? A. We prefer to throw this open for general discussion. If our correspondent can conveniently forward the corroborative testimony of which he speaks, we would be glad to see it.

(83) W. H. says: 1. Why is it that, in winter or spring, when it is warm enough to cause slush ice to break up and follow the current of the streams, at night some of the lightest of this slush will sink to the bottom of the stream and freeze to rocks, etc.? A. Your account is not sufficiently detailed to enable us to answer your question. 2. A pump used for pumping water from a river often refuses to take water on account of this slush freezing to the strainer of the suction pipe, but it is only at night; and as soon as the sun rises we do nor have any trouble with it. A. Probably the trouble is caused by the manner in which the strainer is located. In general, stoppages of this kind are more influenced by atmospheric conditions than by the time of day.

(84) W. D. P. asks: If I were to put a piece of vulcanized rubber (such as combs are made of), 10 inches wide, 32 inches long, and ½ inch thick, into a hydraulic press (the box of the press fitting the rubber), how much pressure would it stand without breaking or altering its shape? A. It would probably stand several tons; but we have no data on this subject.

(85) A. L. E. asks: Do you know of any chemical compound or method by which the hair on the head can be turned permanently gray or white without injury to the scalp or skin? A. We do not know of anything of this nature that we care to recommend. All such agents are more or less injurious.

(86) R. L. D. asks: How can I harden the shell of a hen's egg without impairing the egg? A. We do not know of any practicable method of accomplishing this.

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

J. W. B.—They are small, well formed garnets.—C. C.—If the colors constituting the pattern of your carpet are not affected by the solvents, the green stain may be removed by means of a little warm alcohol and ammonia (aqua ammonia). Otherwise it is not advisable to attempt the removal of the stain.—W. H. H.—It is a sand consisting of iron pyrites. See p. 7, vol. 36.—W. L. W.—It is a small fragment of quartz ose rock, containing bright specks of iron pyrites. See p. 7, vol. 36.—E. P. C.—No. 1 contains lime, magnesia, alumina, silica, sesquioxide of iron, and iron pyrites. The cubes of No. 2 are crystals of sulphide of iron—pyrites. See p. 7, vol. 36.

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It has been our custom for thirty years past to devote a considerable space to the answering of questions by correspondents; so useful have these labors proved that the SCIENTIFIC AMERICAN office has become the factotum, or headquarters, to which everybody sends, who wants special information upon any particular subject. So large is the number of our correspondents, so wide the range of their inquiries, so desirous are we to meet their wants and supply correct information, that we are obliged to employ the constant assistance of a considerable staff of experienced writers, who have the requisite knowledge or access to the latest and best sources of information. For example, questions relating to steam engines, boilers, boats, locomotives, railways, etc., are considered and answered by a professional engineer of distinguished ability and extensive practical experience. Inquiries relating to electricity are answered by one of the most able and prominent practical electricians in this country. Astronomical queries by a practical astronomer. Chemical inquiries by one of our most eminent and experienced professors of chemistry; and so on through all the various departments. In this way we are enabled to answer the thousands of questions and furnish the large mass of information which these correspondence columns present. The large number of questions sent—they pour in upon us from all parts of the world—renders it impossible for us to publish all. The editor selects from the mass those that he thinks most likely to be of general interest to the readers of the SCIENTIFIC AMERICAN. These, with the replies, are printed; the remainder go into the waste basket. Many of the rejected questions are of a primitive or personal nature, which should be answered by mail; in fact, hundreds of correspondents desire a special reply by post, but very few of them are thoughtful enough to inclose so much as a postage stamp. We could in many cases send a brief reply by mail if the writer were to inclose a small fee, a dollar or more, according to the nature or importance of the case. When we cannot furnish the information, the money is promptly returned to the sender.

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J. C. R. asks: What is the greatest depth ever attained by a diving bell?—G. G. asks: How can I mend a stiff hat with a tear in it?—B. A. F. asks: Can you give me information concerning the dark day said to have occurred in New England at the commencement of this century? It was not occasioned by an eclipse or any other explainable cause.

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## COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On a Demand for a New Business. By H. D. R.
On Patent Rights and Wrongs. By J. R. R.
On Diphtheria. By S. S. S.
On Perpetual Motion. By D. H. M.
On the Bourdon Gauge. By A. B. W.
On Cartesian Physics.
On Trisecting an Angle. By H. C.
On Theories of Light. By P. S.

Also inquiries and answers from the following:

M. C.—M. A. F.—S.—J. B.—A. C.—W. M. K.—H. P.—W. P. E.

## HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Whose is the best generator, for the manufacture of vinegar? Who are the largest steel mannfacturers in the United States? Who makes cast cast-steel? Who sells stamped tissue paper? Who makes machines, actuated by weights or springs, for raising water? Who lays narrow gage railroads, and what is the cost per mile? Who sells electro-plating materials?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

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**March 13, 1877,**

**AND EACH BEARING THAT DATE.**

[Those marked (r) are reissued patents.]

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## DESIGNS PATENTED.

9,848.—GLASSWARE.—D. Barker, Pittsburgh, Pa.
9,849.—STOVES.—C. H. Castle, Quincy, Ill.
9,850.—SPOONS, FORKS, ETC.—J. M. Culver, Wallingford, Conn.
9,851, 9,852.—CARPETS.—E. D. Daniels, Paris, France.
9,853.—CARPET.—T. J. Stearns, Boston, Mass.
9,854.—KNIFE HANDLE, ETC.—J. Seymour, Syracuse, N.Y.
9,855.—TRIMMING.—A. Sturm, New York city.
9,856.—TOWEL BORDER, ETC.—T. Webb, Randallstown, Ireland.

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