Notes & Queries

J. J. P. can harden strips of iron by the method described on p. 69, vol. 31.—H. E. Jr. will find a good recipe for mucilage on p. 251, vol. 33.—W. A. B. will find directions for making a rust joint on p. 213, vol. 32.—S. T. C. will find rules for proportioning boats on p. 299, vol. 28.—D. M. will find a good recipe for blacking on p. 283, vol. 31.—Soap-making is described on p. 218 vol. 28.—J. C. McG. will find directions for polishing shirt bosoms on p. 203, vol. 31.—T. T. will find a rule for ascertaining the horse power of an engine by referring to p. 33, vol. 33.

(1) M. C. S. asks: We often have occasion to make a large quantity of an alloy composed of 80 parts of copper to 20 of tin. What is the best flux to prevent the slagging of the metals? The furnace is a large reverberatory one. A. Use a little potash, or a mixture of potash and soda, putting it on top when the metal is melted.

(2) W. B. says: 1. I am building a boat 80 feet long, and will use 13 foot side wheels. What sized hub should I use? A. Two feet in diameter. 2. How many spokes would be best? A. Twenty. 3. What should be the size of the paddles? A. About 18 or 20 inches long, and 8 or 10 wide.

(3) J. S. C. says: Owing to the situation of the earth's aphelion at the present time, the northern spring and summer is seven and a half days longer than the southern spring and summer. Now when the earth's aphelion comes to be situated at a point in the earth's orbit opposite to what it is at present, will the spring and summer for southern latitudes be seven and a half days longer than the northern? If not, what is the difference that will then exist? A. There will be no difference.

(4) N. S. T. asks: 1. How can I describe a circle whose circumference shall pass through one angle and touch two sides of a given square? A. This is the problem of passing a circle through any three points, not in the same straight line, which is given in nearly every work on geometry. We understand you to mean the vertex of the angle, in speaking of the angle. 2. How can I draw the geometrical representation of a circle of any given size and from any given point of vision? A. You will find it fully explained in the "Student's Draftsman's and Artisan's Manual," by Professor Warren.

(5) J. E. W. and others.—We do not know what is meant by an engine of 25 nominal horse power, as this term has no fixed signification.

(6) J. B. L. says: In your issue of January 1874, is an article on cheap telescopes, signed B., in which he mentions a meniscus lens of 1 inch in diameter and 48 inches focus as a proper objective for a small telescope. 1. I propose to get one 1½ inches diameter and 48 inches focus; and would like to know if it would not make a more powerful object glass than the one selected by your correspondent. A. A lens of 1½ inches diameter will not be more powerful than one of 1 inch, if the focal length is the same; but it will admit more light. The form of the larger lens must be very perfect, otherwise the images will not be as sharp. It is for this reason that diaphragms are used to cover up the imperfections of large inferior lenses. 2. Is it a rule that the focus should be any ratio to the diameter? A. There is no rule for focus and diameter; but 1½ inches is a rather small diameter for 4 feet focus, and only highly illuminated objects can be distinctly seen through such a telescope, of which the great defect is want of light. 3. Will a plano-convex ½ inch in diameter and of 1 inch focus make a good eyepiece? A. A plano-convex will make only a tolerable eyepiece. 4. What would be right? A. Have two such lenses in the eyepiece, combined on the Huygbenian principle. 5. What would be the power of the instrument constructed of the glasses proposed? A. The power of a telescope is found by ascertaining how often the focal length of the eyepiece goes into that of the objective. Your eyepiece being 1 inch, its length is contained 48 times in the focal length of the objective: and the magnifying power will be 48. With a ¾ inch eyepiece it would be 64; with a ½ inch eyepiece, 96; and the same eyepiece, used with an objective of 48 feet focus, would give 1,152.

(7) E. G. A. asks: How can I obtain membership of the American Association for the Advancement of Science? A. You have to be proposed by a member at the next meeting, in Buffalo, N. Y., August, 1876, and then you pay $5 initiation fee and $3 annual dues.

(8) W. A. H. asks: 1. Is it possible that any opaque substance may be colorless? A. When opaque substances are colorless, they are white or black. Chalk is white, and coal is black; this means that coal absorbs the luminous rays, while chalk reflects them: if not all, at least equal quantities of each colored ray. 2. Does it follow that opacity of matter is consequent upon laws of color and light? A. Of course opacity of matter as well as transparency depends as much on the laws of light and color as in the material. 3. What constitutes opacity of matter, aside from the general definition of not being transparent? A. Opacity of matter depends on the internal structure of the substance; if it is adapted to transmit light with a certain degree of perfection, it is called transparent; if the light is transmitted only imperfectly, it is called translucent. 4. Why is not colored glass opaque? A. Colored glass may be opaque, and may be made so as well as transparent or translucent; it is used in the imitation of various colored gems, some of which are opaque and some transparent. For instance, the onyx is translucent, with opaque layers, in a variety of colors.

(9) J. M. S. says: I have a small spyglass which magnifies very well, but the view is slightly indistinct. Can anything be done to improve it? A. See if the lenses are clean and not scratched; see if they are put in right, and not reversed, as is sometimes done after cleaning them, which will spoil the best glass. Perhaps the objective needs a diaphragm, a black disk with a hole in the center, placed outside in front of the objective; this addition will often make very inferior glasses more distinct. Make several of these diaphragms, and find out which suits best. The smallest holes give the most distinct images, but admit the least light, and *vice versa*.

(10) W. B. says: I have a double lens microscope; the lenses are 1¾ inches in diameter and 0·2 inch thick in the center. I wish to make a field glass of it; how long a tube should I make? Must I use both lenses or only one? Must I have a smaller lens for the eyepiece, or should this be a plain glass? A. A microscopic lens cannot be used at all for an object glass in a telescope, and it makes a very bad eyepiece. Try an object glass of 17 inches focal length; and if it is of good glass, you may perhaps use the strongest power of your microscope, but you will see everything upside down. The object glass will cost you as much as a whole telescope or field glass. We advise you to leave the microscope as it is, and buy a field glass ready made; it will be the best and cheapest in the end.

(11) H. W. P. asks: 1. How can I construct a celestial eyepiece for a telescope with a 2 inch achromatic objective, of 20 inches focal length, that will magnify 100 diameters? A. Make the proper combination of two lenses, as we have already described, and give it a focus of $\frac{1}{5}$ foot or $2\frac{2}{5}$ inches, as the focal length of the objective divided by that of the eyepiece is equal to the magnifying power. 2. What is the composition of speculum metals, for reflector mirrors? A. Use 66 per cent copper and 34 of tin, or 7 parts copper, 3 zinc, and 4 tin, or 2 lbs. copper and 14 ozs. tin. 3. Is there any work published giving information as to the grinding and polishing of lenses? A. You will find an article on this subject in Ure's "Dictionary of Arts and Manufactures," under the head of "Grinding Optical Glasses." Also read the article "Glass;" it probably contains all you want to know.

(12) J. G. says: We find that we cannot make dry cellars in Louisiana. Will it do to sink a watertight tank 25 or 30 feet into the earth? Would the air become foul at the bottom? A. Tanks, of not too great a diameter, with plank bottoms and with proper cribwork bracing, might be built and used for cellars as you suggest; but if they are to be employed for the storage of fruit, proper means of ventilation would have to be provided. A box tube extending to the bottom and provided at top with a hood, arranged with a vane to open always towards the windward, would utilize the force of the wind for this purpose. After the air is fully changed, the tube could be closed with a valve, when the air confined below would gradually become of the temperature of the earth at that depth.

Our jail being of poor brickwork, prisoners often break out. Would this be a remedy: Build up a single brick wall within the present wall, leaving open space of 6 or 8 inches, and fill this space with dry sand up to the roof? Could any one pass out through the wall till all the sand from above had run out? A. Your plan is an ingenious one, and might answer if the walls were well anchored together. An entirely new wall, however, of stone work, consisting of large stones laid on good cement, would be far preferable if you could accomplish its erection.

(13) H. F. S. asks: 1. Would tungstate of soda do for saturating a rug, to prevent ignition by sparks from a wood fire? A. Yes. 2. How strong should the solution be? A. Dissolve as much as you can of tungstate of soda in hot water sufficient for the rug.

(14) S. W. asks: How do practical opticians give the final adjustment to microscope objectives which are composed of superposed lenses? With two lenses there is no difficulty, as there is only one distance to determine; but with three the trouble is greatly augmented, owing to the innumerable changes which may be made in the distances with that number of lenses. I have tried various formulas, some as published and others original, but I have not found one by use of which I could take an arbitrary distance for two of the lenses, and finding by trial the best position for the other. A. This is a subject on which it is utterly impossible to give satisfactory written explanations; it has been the great problem of such men as Lister, Hartnack, Tolle, Wenham, etc., and to which they devoted a great part of their lives. But you must consider that you can never take an arbitrary distance of two of the lenses and make it all right with the addition of a third; the distances are all determined by the curvature of each lens.

(15) F. G. says: Please describe the process of charging electro-magnets. A. Electro-magnets are charged by surrounding them with helices of copper wire and then passing a strong current from a battery through the helices. Artificial magnets of steel are charged by rubbing them with a powerful permanent or charged electro-magnet, commencing at the center and passing to the ends several times in succession. Care must be taken to use the same end of the charging magnet for one half of the new magnet, and the opposite end for the other half.

(16) J. L. T. asks: 1. What are the elements of a Hill battery? How are they put together, and what exciting liquid is used? A. Copper and zinc. The copper plate, to which is soldered an insulated copper wire, is placed at the bottom of a jar of water in which a little sulphate of zinc has been dissolved. A zinc casting is then suspended from the top of the jar so that it just dips below the surface of the water, after which a handful of sulphate of copper crystals is dropped in and the battery is ready for action. None of the copper crystals should be left in the zinc; care, also, must be taken to keep the blue line from quite reaching the latter. A wire from the zinc and the insulated wire from the copper plate form the terminals. 2. What is a Lockwood battery? A. Same as the Hill, with the exception that a long spiral copper wire is substituted for a copper plate in the latter. 3. How was House's battery made? A. We believe there is no such battery in use. House originally used the Grove battery to work his printing instrument. 4. I often see the diameter of wire given in decimals of an inch. How may this be reduced to the regular gage? A. The diameter of the different gage wires is arbitrary. What is called the Birmingham gage is used in England and, less extensively, in this country, but it varies with the different manufacturers, as no authorized standard has been made. More exact information is therefore conveyed by simply stating the diameter in inches. An American gage was introduced a few years ago, and is much used; with this gage the numbers run in a geometrical ratio. See p. 363, vol. 28. 5. Am I right in making a condenser as follows? I take a strip of silk, to which I stick tissue paper with varnish, and (with varnish) fasten tinfoil to both sides of the silk and paper, covering the sides to within an inch of the edges. I fold this with another piece of varnished silk to prevent metallic contact. After all is folded, must this tinfoil be made part of the primary current of a Rhumkorff coil? A. Yes, but the alternate tinfoil strips must be connected together so that, in reality, there are two large tinfoil surfaces. These are connected to opposite sides of the break in the primary circuit, one to each.

(17) E. T. H. asks: How are the wires arranged in electrical annunciators so that the electricity generated in a few cups is sufficient for all the wires? If they are all joined together, I should think the electric fluid would find the shortest way back to the battery, and so not touch the wires, but pass through their connections. A. Where only a few annunciators are to be worked, they are commonly all supplied by one battery. In other cases, they are divided up and one battery made to work a given number. Every conductor offers some resistance to the passage of the current; and when several circuits are supplied from one battery, the current in each is inversely proportional to its resistance. The proper way, therefore, is to make resistance of all the circuits equal, when supplied from a common battery; the current will then be alike in all.

How are Pharoah's serpents made? A. See p. 347, vol. 28.

(18) S. W. says: My local battery "boils over," leaving a white coating on the top of the inside and all over the outside of the jar. This is a gravity battery. The same thing occurred when