Notes & Queries

R. W. S. asks: How are toy balloons made?

P. W. asks: What two metals cause frictional electricity with very little rubbing?

W. J. asks: Where can the photometrical apparatus of Erdmann be seen, or where is it described at full length?

C. S. says: In building the dome for a new telescope, I desire to make it exceedingly light, so that it may revolve more easily. Over a light ash frame, I glue thin pine boards, and, on the boards, canvas. The dome will be very rigid. I want some reasonably cheap material to cement on the canvas, so that, in case rain gets through any crack in the paint, the canvas will not come off. The dome is to be of 22 feet diameter and 10 feet high.

Answers to Correspondents

P. W. should read Noad's "Student's Manual of Electricity." See our advertising columns for books on mechanism.—A. D. W. will find a recipe for paste on p. 170, vol. 24.—B. J. will find directions for repairing rubber garments or boots on p. 155, vol. 26.—C. S. will find a recipe for glue impervious to moisture on p. 202, vol 28.—O. A. D. can mold india rubber by the method described on p. 283, vol. 29. Wood can be fastened to rubber with glue.—R. L. W. and J. E. R. should refer to p. 299, vol. 28, for a blackboard composition.—C. A. K. will find instructions for bleaching sponge on p. 379, vol. 28.—J. R. W. should read the article on p. 258, vol. 29, for instruction as to a substance that will ignite in contact with the water.—S. will find a recipe for jet black drawing ink on p. 10, vol. 25.—W. B. will find directions for making plastic (not imitation) rubber on p. 283, vol. 29.—J. C. should try the recipe for cement for meerschaum on p. 202, vol. 27, on his broken ivory. Read Lyall's "Manual of Geology."—C. H. S. should consult our advertising columns for books on mechanism.

C. A. T. asks: Which do you consider the most efficient wheel to be used for a flat bottomed boat with a sharp bow and a scow stern? Her sides are perpendicular; size of boat is 5 x 25 feet. Should I use side wheels, paddle wheel at stern, or the Fowler wheel? The draft of boat does not exceed 10 inches. Which do you consider will drive the boat the fastest? We can not use a screw to any advantage with such light draft. With sufficient power, what speed could we get from the best wheel? Answer: You might get a speed of from 5 to 6 miles an hour, by using a stern wheel; and if it was made with feathering floats, it might be quite small.

F. H. J. says: I am about to construct an engine with 4 inches stroke x 2 inches bore. Would steam pipe of ½ inch internal diameter and exhaust pipe ⅝ inch internal diameter be large enough? 2. Would a boiler 20 inches long x 12 inches diameter x ⅛ inch thick, of iron, furnish enough steam to run such an engine 150 revolutions a minute? How many pounds steam would a boiler of the above description stand, and how many pounds would it take to run the engine 150 revolutions a minute? Answers: 1. The following table, taken from W. S. Auchincloss' valuable work on "Link and Valve Motions," will doubtless be of interest to many of our readers:

Speed of piston, in feet per minute.	Area of steam pipe.	Area of exhaust pipe.
200	0·025 area of piston.	0·040 area of piston.
250	0·032 " "	0·047 " "
300	0·39 " "	0·055 " "
350	0·046 " "	0·062 " "
400	0·053 " "	0·070 " "
450	0·060 " "	0·077 " "
500	0·067 " "	0·085 " "
550	0·074 " "	0·092 " "
600	0·080 " "	0·100 " "

The engine of our correspondent is to have a piston speed of $150 \times 4 \times 2 \div 12 = 100$ feet per minute, so that the areas given in first line of the table will be more than sufficient. These would give a steam pipe a little over five sixteenths of an inch in diameter, and an exhaust pipe nearly seven sixteenths. 2. This question cannot be answered definitely, as our correspondent does not state how much power he wishes to produce. If the engine is well constructed, it should give 150 revolutions per minute, running light, with a very low pressure of steam. Probably it would be well to proportion the boiler with about 20 square feet of heating surface per horse power.

W. Y. C. asks: 1. Are the yearly differences in the variation of the magnetic needle always the same for New York city? 2. Are the differences from year to year always the same for any place? 3. If not, is there any place which has an equal yearly difference, and what is it? 4. If the answers to 1 and 2 are affirmative, then are the yearly differences of any two or all places alike? 5. What is the relation between the differences of places, if any? 6. Is there any rule for finding the variation of the needle for any year, at any place? If not, what are the variations for January 1, 1873 to 1877? 7. If the yearly difference varies, what is the rate of variation? 8. What are the extremes of the variation east and west, what is the length of time between them, and when will the next extreme be reached? 9. Does the line of no variation extend around the earth? If so, does it all lie in a plane? Is this plane the plane of a great circle, and does the line joining the extreme northern and southern points of this great circle make a fixed angle with the axis of the earth, and, if so, what is that angle? If the angle is variable, what is the rate of variation, and what is the angle at present? 10. Where does the line of no variation run on the surface of the earth at present, and what is its rate of progression at the equator? 11. What are the fusing and decomposing points of solidified nitrate of silver and nitrate of copper, or do they fuse before they decompose? Answers: 1. No. 2. No. 3. Extended observations would seem to indicate that there is no such place. 4. The yearly differences of many places, situated on lines of equal variation, are nearly the same. 5. If you mean by this the general law, probably there is none, as the magnetic variation is affected by climatic influences, and other variable elements. 6 and 7. Empirical formulæ have been established for various stations, based on a number of observations, but it is not certain that they are correct. In New York the annual variation seems to increase or diminish at the rate of one minute in ten years. 8. This is by no means accurately determined. 9 and 10. There appear to be two agones, or lines of no variation, one in America and the other in Asia. Neither line lies in a plane. 11. Nitrate of silver is fused at 426° Fah., without decomposition. Nitrate of copper decomposes before the melting point is reached.

J. P. asks: 1. Can one or two spinning jennies or mules be profitably operated by gin gearing, so that any farmer who has the means may spin his own cotton before it leaves the gin house? In other words, can one or two such machines be worked economically? 2. How many spindles are run by one frame, and what is the cost per spindle, or what is the cost of all the apparatus necessary to convert the lint into thread? Answers: 1. Probably not as economically as they are used in a large manufactory. 2. You had better address a dealer.

P. F. D. asks: If a model bridge 10 feet long bears 100 times its own weight, will one 100 feet long (having all its dimensions correspondingly increased) bear 100 times its weight, supposing both to be equally well constructed? You say that models are generally stronger than structures; is this because they are better built, or why? Answer: It does not follow because a model bridge of 10 feet will support 100 lbs., that a bridge of ten times the length and ten times the size in its parts will support ten times that load. Models of bridges are generally stronger in proportion than large structures because the materials are subjected to less proportional strain. The load that a bridge can sustain becomes less and less as the span is increased.

A. L. R. asks: 1. Are not inside cylinder passenger locomotives more expensive than outside cylinder engines, or why is it that so many more outside cylinder engines are now built in this country than inside cylinders? 2. What is the chief objection to inside cylinder engines? Answer: Outside cylinder engines are better adapted to sinuosities and irregularities of the track, which is probably the reason why they are so largely used in this country.

A. F. H. says: I have lately constructed an electric or telegraphic clock, and find difficulty in reversing the current. I employ platinum cups filled with mercury and platinum points for immersion. The platinum points will oxidize and, in course of time, stop connection. Is there anything to prevent this? Hard friction I cannot well employ. Answer: We know of nothing that will prevent the oxidation of the platinum points by the continual succession of electrical sparks. You might use a break in the form of a slider, as in Bain's electric clock. This slider is worked by the pendulum rod, and ought to offer little friction.

R. K. asks: Why does a locomotive engine cut her guides in running backwards, and not in running ahead, even in wet weather, so that it cannot be from dust arising from the ground? It is not from lack of oil. We have two engines that will do it nearly every time. Answer: We see no reason why this should occur in general. We infer from your remarks that such action only takes place in two of your engines; from which it would seem as if the trouble might arise from imperfect fitting.

J. W. asks: 1. When, where, and by whom was lead ore first discovered? 2. Has volcanic action anything to do with the formation of true fissure veins? Answers: Lead is one of the metals most anciently known, being mentioned in the books of Moses in the Bible. 2. Geologists do not agree in regard to fissures which now constitute veins. Some attribute them to unequal support in different parts of the same mountain, in consequence of which the unsupported part sinks; others ascribe them to drying and cracking of the strata; while others, and perhaps most at the present day, declare their origin to be due to earthquakes and subterraneous fire or volcanic action.

G. H. W. asks: Are the very small wax tapers dipped, or run in molds? Answer: They are cast in molds.

G. W. H. asks: What acid will cover new cast iron with a thick coat of rust, in from 10 to 12 hours, so as to destroy its porosity? How strong should it be used? 2. Is it possible to force water from a boiler up and into radiating pipes, if the pipes do not contain a vacuum? Answers: 1. Probably a solution of sal ammoniac will be the best thing to use. 2. We should suppose not, under ordinary circumstances.

C. asks: Is there any thing that will give sausage skins a sweet smell, as they are sometimes quite offensive? Could anything be made to give them the flavor of white wax? Answer: We would recommend packing your skins, fresh or immediately after pickling, in common molasses or a mixture of molasses and vinegar. Coating them with a thin film of wax might answer as regards the flavor, but would probably be too expensive.

M. J. F. asks: How can I color wax? I want to produce green, red and yellow, and also the intermediate shades, such as are used in the manufacture of wax flowers. The colors used must stand heat sufficient to melt the wax, in which I dip the molds to secure proper shape for leaves, etc. Answer: Stir into the melted wax the following pigments, in quantity until properly colored, thoroughly incorporating the ingredients. For green, Schweinfurt green, the aceto-arsenite of copper. For red, vermilion. For yellow, chrome yellow. Use more or less coloring matter according to the shade required.

C. R. asks: How can I prepare the best and cheapest fireproof paint for wood? Answer: Soluble glass, sometimes called water glass, makes a good fireproof varnish. You might use ocher or other pigment to give body. To make soluble glass: fuse together 1 part silica (fine white sand) and 2 parts carbonate of soda. Use boiling water as a solvent.

A. B. says: I claim that the Monitor was the first turret ship ever built. A party claims that the first one was built in England. Answer: We think you are right, although it is claimed that several models for this class of vessels had previously been made.

N. W. asks: 1. Is there any way in which water can be intermixed with coal oil, and stay mixed? 2. Can you tell me how to make lemon extract? Answers: 1. It is possible to make an emulsion or mechanical mixture of coal oil and water. Take any convenient quantity of coal oil, and add from 10 to 20 per cent of water, according to the specific gravity of the oil; the greater the specific gravity, the more water. Churn the two together thoroughly, by stirrers or heaters, adding during the operation from 2 to 5 per cent, of the water used, of caustic lime. 2. Steep dried lemon peel in hot water; then filter the liquid and evaporate to dryness.

W. J. S. asks: 1. How can I tin a soldering bolt? 2. How can I make Seidlitz powders? Answers: 1. Clean the bolt, heat it, apply nitric acid, and rub it on the solder. 2. Seidlitz powders are generally put up in different colored papers, white and blue. The blue paper contains 2 drams of the double tartrate of potassa and soda, and 2 scruples of bicarbonate of soda; and the white paper, 35 grains of tartaric acid.

H. S. asks: 1. How are brass castings bronzed? 2. How is brass purified in the crucible? 3. Can the metal be overheated in the melting? 4. What metal will wear the best in fresh water on a screw wheel steamer outside bearing, 1 to 6 copper and tin, or 1 to 8 copper and tin? Answers: 1. Dissolve 2 drams of sal ammoniac and ½ dram of binoxalate of potash, in 14 ounces of clear vinegar; apply the mixture to the brass, first heating the latter slightly. 2. The impurities generally rise to the surface. 3. Yes, the zinc may be volatilized. 4. Probably Babbitt metal will do as well as anything.

T. C. E. asks: 1. How is shellac dissolved in borax to make the cement for amber? What will dissolve the gum of the peach tree? Alcohol will not. Water will only soften it. 2. How is Indian ink made? 3. Can you give me the algebraic formula for finding the area of a pipe to convey the steam necessary for any horse power? 4. Please give me a formula for finding the power exerted by a given bulk of water, having a given depth, on a suction water wheel of a given diameter. 5. To raise any given amount of water to a given hight, what proportion of applied power does a centrifugal pump require, as compared with any other pump? 6. How can I temper brass springs? Answers: 1. Shellac and borax are both solids. Probably either will dissolve the gum you speak of. 2. Indian ink is mostly, if not entirely, manufactured in China. It has been analyzed, and appears to be composed of lampblack and animal glue. 3. See article on efflux of steam, page 113, current volume. 4. We do not understand what you mean. 5. It depends on the hight to which the water is to be raised. Within certain limits, the centrifugal pump is more economical than a direct acting steam pump. 6. By hammering them.

S. W. asks: 1. How many square feet of canvas will give a horse power on sailing vessels? In using windmills on land, does it require a much larger number of square feet of surface to average a horse power than on the water? When the windmill is placed in a favorable position, how many feet of surface are required to give a horse power? 2. At what angle should the sails of a windmill be set to give the best results? 3. Why do not the mechanics oftener use wind power? 4. Where does the common house fly have its nest or breeding place? 5. In Georgia there is a small fly which gets into a person's eyes and ears, and is, in this wet season, a great annoyance. It is very small, has a yellowish body, and does not bite, but it will go right into the eyes or ears; a very little wind will drive it away. Where does it multiply? Answers: 1. The force of the wind in pounds per square foot, as given below, approximately for different velocities:

Velocity in miles per hour.	Force in pounds per square foot.
1	0·005
4	0·079
5	0·125
10	0·492
15	1·107
20	1·968
25	3·075
30	4·429
35	6 027
40	7·875
50	12 300
60	17 715
80	31·490
100	49 200

2. This depends on the relative velocities of the wheel and wind. 3. They could, if the wind would accommodate itself to their wants. 4. In cracks or crevices. There are so many varieties of flies that we could not attempt to describe them. 5. We cannot tell.

J. A. M. asks: How do electricians calculate the resistance on a telegraph wire, and how do they determine where a rupture has taken place? Who is the best author on the subject? Answer: To ascertain where a break has occurred in a telegraph wire, the charge of electricity which the wire from either station will contain is first measured; and if the charge per mile is known, the amount actually observed will give the distance of the break. A galvanometer is used for this purpose. Consult Noad's "Electricity."

W. R. H. says: I wish to build a small steam boat, about 30 feet long and 6 feet wide. 1. What should be the size of her engine and boiler? 2. What should be the diameter and pitch of screw wheel? 3. What would be about the cost of her machinery, complete? 4. How many persons could she carry conveniently? 5. When loaded with as many as she can hold what would be her speed on still water? 6. Are there any regular builders of such small steamers; and if so who are they? Answers: 1. Cylinder 6 x 9. boiler with 125 square feet heating surface. 2. Diameter 2 feet pitch 3 feet. 3. From twelve to fifteen hundred dollars. 4 From fifteen to twenty. 5. Seven or eight miles an hour. 6. Yes. Insert a notice in our Business and Personal columns.

N. asks: Can you give me a delicate test for the pressure of citric and tartaric acids? 2. Also the composition of the onion, and tests for the same? Answers: 1. Citric acid is frequently adulterated with tartaric acid. To detect this, dissolve the acid in a little cold water and add to the solution a little acetate of potash. If tartaric acid be present, a white, crystaline precipitate of cream of tartar will be produced on agitation. Citric acid is soluble in water and alcohol, and the precipitate from its aqueous solution, by acetate of lead (citrate of lead), is dissolved by nitric acid. Tartaric acid is slightly soluble in alcohol, and a solution of potash causes a white granular precipitate of cream of tartar, soluble by agitation in excess of the precipitant. 2. Onions contain gum, sugar, and an oil containing sulphur.

M. B. asks: What are the ingredients of vulcanized rubber, and their proportion? Answer: Vulcanization of rubber is effected by combining it with sulphur or the mineral sulphurets. The process is differently conducted in different manufactories. Caoutchouc combines with from 12 to 15 per cent of sulphur, and vulcanization can be affected by dissolving the rubber in naphtha, charged with a sufficient quantity of sulphur to become a compound solvent of the rubber 10 to 12 per cent of its weight of sulphur is then added to the naphtha paste and thoroughly incorporated. The article is then molded into any form required. The temperatures for vulcanization by the common method range from 320° to 330° Fah.

J. C. G. asks: Can you tell me of a good elementary book upon electricity, and a good practical and scientific work on telegraphy? Answer: Apply to any good bookseller for Noad's book on electricity, and for Pope or Culley on electric telegraphy.

G. F. asks: Is there an instrument for finding buried gold and silver? Answer: No.

F. S. asks: How can I galvanize, or tin, or otherwise make brilliant and rust proof, a flat polished surface of cast iron? Answer: Dip the plate first into muriate of zinc, and afterwards into a tin bath.

P. S. A. asks: How do lapidaries drill quartz and hard stones? What kind of tools do they use? Is any kind of grit or quartz required? Answer: They ordinarily employ steel drills, with either diamond dust or the dust of the stone that is to be drilled.