## Business and Personal

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A. K. B. will find a recipe for solder for gun barrels on p. 353, vol. 27.—R. S. will find that galvanizing wrought iron is described on p. 346, vol. 31.-A. J. and others will find directions for etching on glass on p. 409, vol. 31.—S. J. F. will find directions for modeling in clay, wax, etc., on p. 58, vol. 24.-S. N. will find directions for making gravel walks on p. 50, vol. 32.—R. J. will find direc tions for filling and polishing black walnut work on pp. 315, vol. 30, and 347, vol. 31.

(1) W. O. H. says: A friend claims that, if balloon could be made so as to sustain the pressure from the outside, and the air were pumped out so as to form a vacuum on the inside, that it would rise. I claim that it would not. Who is right? A. Your friend.

(2) A. J. S. says: Are you aware of any one who has ever actually discovered perpetual motion? If it has not yet been discovered or revealed, do you really believe that perpetual motion, pure and simple, would be of any pecuniary advantage to its discoverer? A. No one has ever discovered perpetual motion. You can judge of the probability of such a discovery if you bear in mind that the principle involved is the same as when one tries to lift oneself in a tub, by pulling at the handles. Some of the perpetual motion inventors put cog wheels or levers between their hands and the tub handles. But the result is the ame. It is always a perpetual no go. No reward has been offered.

(3) G. L. L. says: What use, if any, can be made of old photographic collodion? A. If the solvents have not already evaporated, and the solution contains no volatile acids, the ether and alcohol may be readily removed by subjecting the solution to distillation in a glass retort over a water bath, with a very gentle heat. The solution, however, should not be allowed to evaporate to

(4) H. M. asks: How can I bleach shellac? A. By filtration of the solution over animal char-

What are the average weights of a cubic inch of copper and tin, respectively? A.Copper about 0.32 lb., tin about 0.217 lb.

How is the inside area of a cylinder found? A To find the surface of a cylinder: (circumference of base $\times$ altitude)+twice the area of base. To find solid contents : Area of basexaltitude.

(5) A. S. asks: Is there any solvent besides cyanide of potassium, for sulphide of copper? A. The sulphide of copper dissolves readily in strong aqua fortis (nitric acid) on application of heat.

(6) H. B. C. asks: What kind of a solution should I make to plate with tin, having tin as a positive electrode? A. Electro-metallurgists consider the sulphate to be the best solution for this purpose; but the reduction of tin by galvanism cannot be considered an advantageous process. The best method for tinning metallic surfaces is that of immersing them in a bath of molten tin, the surface of which is kept free from oxide by means of a layer of chloride of ammonium (sal ammoniac). An even and regular coating of the metal is thus obtained speedily and with little

(7) M. S. asks: 1. Are the oxygen and hydrogen, used in stereopticons, dangerous? A. They are explosive only when mixed and ignited. 2. Of what color are the screens that are used for the same purpose? A. White. 3. Are they painted or varnished? A. When intended to remain stationary, they are occasionally covered with an even coating of whiting with a little size.

(8) C. T. S. asks: What process will make ordinary white quartz crystals, resembling amethyst? A. Take borax 5 parts, saltpeter 5 parts, pearlash or fixed alkaline salt, purified with niter, 33 parts, pure white sand, cleansed by washing, 57 parts. First reduce the sand in a glass or fiint mortar to a fine powder, then add the other ingredients and grind them well together. To 10 lbs. of the above add 11/2 ozs. of manganese oxide and 1 drachm of zaffre. Melt in a small clay crucible, and cover the surface of the crystal by immersion.

(9, H. asks: Of what size, and of what cheap material, should a hotair balloon be made to raise a weight of 150 lbs.? A. A closely woven variety of light cambric is best for this purpose. It is not customary (where the proper material is used) in this style of balloon to use any varnish solu ion of boiled linseed oil in turpentine may be used.

(10) G. W. N. asks: Which is the positive ole and which the negative, in a battery? A. In all forms of battery, the binding screw attached to the zinc plate is always negative, and the connection of the opposing element, whether it be copper, carbon, or platinum, is always positive. If a small mariner's compass be placed immediately under a copper wire running north and south, (that is, parallel with the needle of the compass when in a state of rest and not subject to any disturbing influence), over which a current is passing from north to south, the needle of the instrument will immediately be deflected, its north pole moving to the east, and its south pole to the west. If the current be reversed, the needle will move in the opposite direction.

There is a hoat fastened to a dock by a rope. P says that a man standing in the boat will not be obliged to exert so much force to pull the boat to the dock, as one who stands in the dock and pulls the boat toward him. N. says the man will have to exert the same amount of force in both cases Who is right? A. N.

(11) D. A. C. asks: Is there an agent which will bleach or clarify, by burning or fumigation, vegetable substances? I want an agent that will bleach tobacco in the process of curing or drying the plart. Sulphur will do it to a certain extent but it imparts an odor which injures its market value. A. Tobacco may be readily bleached by means of either sulphurous acid or chlorine; but in the operation it undergoes a partial decomposi-tion, new salts being formed. This destroys the properties for which the tobacco is most valued.

(12) J. H. L. asks: For some time past I have been trying to bleach what is called cera de Campeche, a wax made by a large bee near the Pacific coast in the neighborhood of Autlan; it is of a dark yellow color and a strong smell; it becomes quite soft and sticky by working with the hands. How can I do this? A. Beeswax may be bleached by nitric acid: but chloring, though it destroys the color, cannot be employed for this purpose with advantage, for it was observed by Gay Lussac that a substitution of chlorine for a portion of the hydrogen occurs under these circumstances. When candles made from such wax are burned, irritating vapors of hydrochloric acid are evolved. Bees wax has been commonly bleached by exposing it in thin layers to the action of sunlight for some time. Try the action of a solution of chlorine gas in water, or, what is perhaps less objectionable, a solution of chloride of lime (bleaching powder).

(13) A. P. asks: Is there any magnetic needle or other instrument that will show where to dig for water, and where springs exist? A. There is no such instrument in existence.

(14) C. K.asks: What degree of heat is acted apon and absorbed by a liquid, such as an oxyhydrocarbon oil, contained in an iron or copper vessel of about equal width to its depth, heated by live steam of about 40 lbs. pressure? A. As you fail to state the particular oil in question, we cannot give you its specific heat. The temperature of the oil would, in no case, be higher than the steam or hot water surrounding the vessel containing it. Whether the oil vessel were completely or only in part filled with the oil, the conditions being the same in both cases, the temperature would eventually mark nearly the same degree, although in the former case the expenditure of a larger amount of fuel would be required to accomplish such a result.

(15) J. E. H. asks: Is there any known way by which skippers in smoked meat can be destroyed without injury to the meat? A. Try the action of a small quantity of the iodate of calcium or salicylic acid.

(16) T. W. C. says: I have a friend who es a process in which a quantity of water must be maintained at a temperature near to but al ways above the freezing point. To procure this he uses considerable quantities of ice. Could the same effect oe economically produced by the Carré freezing apparatus? A. Yes.

(17) A. B. C. and others ask: Which wheel of a truck slips in going around a curve, the inside or the outside one? A. This question is frequently asked by our correspondents, and is very fully answered by a writer in the Railroad Gazette as follows: That wheel will slip on which the pressure is the least. For a single truck with an equally distributed load, other things being equal, on a fiat track (that is, one in which there is no super-elevation of the outer rail), the inside wheel will slip, for the following reasons: 1. Because the direction of the resultant of the weight and of the centrifugal force is more in the direction of the outer than of the inner wheel. 3. Because, on account of the parallelism of the axles and the play allowed the wheels, the flanges of the latter are against the outer rail and away from the inner one in the passage around the curve, and this is true whatever may be the speed. This brings the point of application of the resultant (corresponding to the loaded point on a beam) nearer the outer than the inner bearing. On a curve, the outer rail of which has been elevated for a given speed, at this speed the resultant above mentioned is perpendicular to the plane of the rails, and hence at that particular speed the first of these causes is inoperative, while the second, remaining in force, causes the inner wheel to slip as before. At any higher speed, the first cause again comes into play, and allows the inner wheel still greater facility for slip-ping, and the more so the higher the speed. On other hand, for a speed less than that for which the rail was elevated, the centrifugal force being diminished, brings the resultant more in the direction of the inner rail than before, and at some speed would make its direction such as to exactly counteract the effect of the second cause, and slip. At less speeds the outer wheel would slip. In the case of a long train, the wheels at the ends sary at first in order to perceive the change as it are nearly in the condition of those of a single truck, while t hose near the middle, being drawn to the inner rail by the action of the forward and rear portions of the train, will sooner come into a condition in which the outer [wheels will slip. In this, the coning of the wheels has been considered as a part of the elevation of the outer rail, either increasing or diminishing it as the fianges press against the outer or the inner rail.

(18) W. X. says: I have two ½ inch pipes, one glass and the other lead, which I wish to unite so that the joint will be neat and bear the pressure of a column of water fifteen feet in hight. In whatway can they be best united? A. Use as a solder the following alloy, which fuses below the boiling point of water: Bismuth 2 parts, lead 1 part, tin 1 part.

(19) E. J. F. says: How can I cut fine edgings on paper, such as the borders on valentines or bouquet papers? A. These borders are stamped by a die cut in metal.

(20) H. P. O. asks: Please give me recips for good and permanent red and black dyes were which I can dye cotton and linen thread? A. ithF | rotating it; and when the quicksilver seems to be

red, use cochineal, lac dye, madder, or logwood with a tin mordant. For black, use logwood or galls with an iron mordant.

How can metal be cemented to glass? A. See p. 27, vol 30.

(21) C. A. F. asks: How can a silk fish line be made waterproof? A. Take 2 parts boiled oil, l part gold size, mix, shake well, and it is ready for use. Apply with a piece of flannel, let dry thoroughly, and apply another coat. Use 3 coats in

(22) C. S. W. asks: What is the best way of preparing starch for use on linen collars, etc.? A. Wheat starch is generally considered the best. It is made as follows: Steep wheat flour in water for a week, draw the liquor off, and wash the residue on a sieve; drain in perforated boxes, cut up into lumps, and dry in the air or on a stove.

(23) J. D. says: Please give me a recipe for wax for tracing designs in hair lines on zinc with a pen, which will protect the zinc from acid used to etch the design on the metal? A. If you use nitric acid, try a mixture of equal parts of asphaltum, Burgundy pitch, and beeswax; melt them in an earthen pipkin, stir well, and pour into cold water. Use warm.

(24) A. L. H. asks: What is a good method of cleaning tin, copper, brass, etc., without scratching the same? A. On tin, use potash lye and rub with a hard substance. On copper and brass, use spirit of tar.

(25) C. E. G. siys: I claim, in arguing the merits of the Keely motor, that water is a spent substance, and cannot again produce power unless the equivalent is laid out on it. A. You are right.

(26) V. H. says: 1. On p. 74, vol. 28, you give correspondent K. W. a varnish for photo paper trays, consisting of a mixture of petroleum naphtha and paraffin. Can the varnish be applied to wooden trays? A. Yes. 2. How many parts of each ingredient should be used? A. Put in paraffin till the petroleum naphtha will dissolve no

(27) W. U. asks: What are the rules for calculating the permutations and combinations of numbers? A. The number of permutations of n things=1×2×3, etc.,×(n-1)×n. The number of arrangements of m things, taken n in a set,= $m\times$  $(m-1)\times(m-2)$  etc. $\times(m-n+1)$ . The number of combinations of m things, taken n in a set=

 $m\times(m-1)\times(m-2)$  etc. $\times(m-n+1)$ 

 $1\times2\times3$ , etc. $\times(n-1)\times n$ .

(28) L. H. R. says: I wish to know whether the following conjectures are probable: Scientists, in giving the hights of mountains, clouds, balloons, etc., say they are so many miles above the level of the sea. Is the level of the sea the same all over the surface of the earth? Is the surface of the ocean at each part of the globe at the same distance from the center of the earth? I think it would be so if there were no revolution of the earth around its axis; but since there is, the centrifugal force thereby produced would cause the ooser particles (water) of the earth to be heaped up at the equator, making the level of the ocean at this part bigher than at parts north and south of it. And further, in my opinion, the water would not only accumulate here, but would ac mulate in proportion to its quantity or mass thereby making the Pacific Ocean of higher lev I than the Atlantic. Is this actually the case? A. If you measure the hight of the sea level by its distance from the earth's center, it is not the same everywhere, but is higher under the equator and ower at the poles. This is called the fiattening of the earth, and is, in round numbers,  $\frac{1}{300}$ , which means that the polar axis is  $_{360} \times 8,000$ , or about 26, miles shorter than the equatorial diameter therefore the ocean's surface at the equator is 13 miles higher than at the poles, and the Mississippi river uns, in a certain sense, actually up hill. The hight of the mountains is always estimated from the nearest sea level. There are, besides this, other irregularities in the ocean level, of which we have treated elsewhere in this issue.

(29) J. C. W. asks: 1. If any one will look teadily for a short time at such an anemometer as is used by the United States Signal Corps, consisting essentially of hollow hemispheres, and will notice the direction in which the cups revolve, he may after a time apparently see the motion reversed, and the cups going in a direction exactly contrary to that in which they really move. A good position to take with reference to the anemometer is about 50 yards from it, and nearly up to the level or horizontal plane in which it moves. No doubtothers have noticed the deception, as it would thus render the wheels equally liable to is very apparent when once observed. A little sary at first in order to perceive the change as it seems to be. A. This optical delusion has been often observed, and is simply caused be the difficulty of deciding which balls are the nearer. If we take the further off for the nearer, the motion of course appears reversed. The same thing may be observed in some windmills, when looked at by the edge of the arms. 2. Another illusion may be produced by a very simple experiment as follows Procure a round paper box about two cr three inches in diameter, and, if its bottom does not bulge upward in the center, make it do so by pressing it in with the thumbs. Any sized round box of almost any material that is not affected by mercury will doubtless answer the purpose, but the kind mentioned is easily procured in the form of a large pill box or a collar box. After pressing the bottom inwards, as directed, pour into the box about one ounce weight of clean bright quicksilver and give the box and contents a rotary motion until the quicksilver revolves rapidly around the circumference of the box in the depression caused by the convexity of the bottom and its junction with the perpendicular walls of the box. It is best to lay the box flat on a horizontal table while