Business and Personal.

The Charge for Insertion under this head is **$1** *a Line.*

Notes & Queries

E. R. would like to know how to soften pearl shells, and how to stain them in any color.

O. C. W. asks: Which is the easiest, to make steam with high water or with low water in the boiler?

P. asks: What is the best oil to keep patent leather from cracking?

D. & Co. ask: 1. Is hemp preyed upon by any insect? Is it offensive to insects other than its parasites; and if so, within what radius? Might it be made efficacious in protecting cotton from the ravages of the cotton worm? Could any other plant be utilized in this way?

J. M. R. asks: Why the images of objects, being reversed upon the retina of the eye, are yet apparent to us in their proper positions?

W. J. M. asks: How many gold fish can I keep in a tank holding 32 gallons of water, and how many plants will I need?

A. S. Jr. asks how to make the so-called scintillettes, or Japanese parlor fireworks.

Answers to Correspondents

J. K. S. can remove rust from steel articles by following the directions given on p. 26. vol. 25.—The process of polishing shirt bosoms, collars, etc., asked for by J. A. M., is given on p. 114, vol. 24.—A. W. can obtain Stölzel's work on metallurgy through any of the booksellers who advertise in our columns. The book, we believe, has never been translated into English.—E. S.'s query about preserving vegetables and fruits is too comprehensive to be answered in these columns. Apply to some one who is a preserver by trade.

E. B. G. says: 1. We have had two very dry seasons during 1871 and 1872, only a third or one half of our usual rain having fallen; consequently the wells became very low, and some entirely dry. When the ground froze, about November last, we had only five or six inches of water in our well. From that time, the ground being constantly frozen, the water began to increase; and at the time of the spring thaw, about the middle of March, the water measured five feet, and after the spring rains about six feet. How is the rise of water to be accounted for? 2. We have recently put up a 10 horse portable engine and boiler. I wanted the firebox end next the door (it was necessary to place it crossways of the shop, or athwart ship, in sea phrase,) but my partner says: "No, the firebox must be in the middle of the shop," thereby getting about five feet additional length of belt. Will that compensate for carrying the coal in and the ashes out? 3. I am boring out a cylinder of a steam engine that was originally 10 inch bore and 20 inch stroke, but it has been reboredso many times that it is now 11 inches inside; consequently the cylinder is only about five eighths of an inch in thickness, and, when finished, will probably be only half an inch in thickness. Will it be safe to run the engine so, and was the cylinder of an engine ever known to burst from the pressure of steam? Answers: 1. The well may be supplied from a distant source, which is subject to different climatic influences. 2. You do not send sufficient data to enable us to answer this question. 3. Cylinders have been known to burst when the engines were working. Your cylinder will be deficient in stiffness, and will have a tendency to become oval. You can stiffen it with bands, and it will then be safe for a reasonable pressure of steam.

C. G. van P. asks: 1. Is there any sheet metal more pliable and not much more expensive than galvanized iron, on which any design can be pressed with a drop press, to a hight of ⅜ inch, without cracking? It is to be used for roofing purposes. 2. What is the Francis metal, from which life boats are made? Answers: 1. Zinc possesses greater malleability and ductability than iron, and its price is less than that of galvanized iron. 2. The Francis life boat is constructed of corrugated iron.

T. P. asks: In arranging a dwelling warmed by hot air from a furnace, where should the ventilator be placed, near the floor or the ceiling? Or should the egress for vitiated air be at both points? Is it as well to take cold air for the furnace from the hall as from the outside of the building? Answer: A complete system of ventilation, to operate properly both in summer and winter, requires ventilating registers both at the floor and at the ceiling. In winter it is preferable to have the upper one closed, so that the heated air may not too readily escape, and the vitiated air be driven out of the lower one by the pressure of the warm air from the furnace. In summer, by opening the upper one, the warmed air will escape in that direction, and the fresh air be most prevalent at the lower part of the room, where it is most available for use. A similar duplex arrangement is desirable also in respect to the supply of air to the furnace. There should be a cold air shaft arranged to draw the pure air from the exterior of the house, and this should be the usual source of the supply; but on occasions of extreme cold weather, the heating of this very cold air may be beyond the capacity of the furnace, and it may then be admissible to feed the furnace from the interior air of the house, which may thus be warmed a second time; but the healthier way is to draw the air from the outside of the house.

J. W. S. asks (1) for a recipe for making matches. 2. Is the invention of the friction match patented? 3. Is not a steam engine that has no condenser called a high pressure engine? Answers: The mixtures actually used in the trade are kept secret, but the following recipes give some idea of the composition: Phosphorus 8 parts, dissolved in a sufficient quantity of bisulphide of carbon, glue 21 parts, peroxide of lead 24 parts, nitrate of potash 24 parts. Another contains phosphorus 3 parts, gum senegal 3 parts, peroxide of lead 2 parts, fine sand and smalts 2 parts. The following composition was recommended by Wiederbold: Chlorate of potash 7·8 parts, hyposulphite of lead 2·6 parts, gum Arabic 1 part. The latter are known as non-poisonous matches, being free from phosphorus. 2. Some kinds are, others not. 3. A high pressure engine has no condenser and carries over 15 lbs. of steam.

J. P. L. says: 1. Suppose a hot air engine is working the air at a temperature of 500° or 600°, and I inject a very small or proper amount of water in the cylinder with the hot air, at each stroke of the engine or piston, this water to be hot and forced in as a spray. Would it be beneficial as to power, or would it be liable to create any explosive or dangerous gases? 2. Why have not the various hot air engines met with success as moters? 3. At about what degree of temperature do the Roper and other hot air engines use the air? Answers: 1. The effect of injecting the water would probably be to cool down the air, without producing a corresponding gain. The air would need a much higher temperature, to form steam from the injected water. In any case, the injection of water into the cylinder of an air engine would have a bad effect; because an air furnace is much less efficient than that of a steam boiler, and consequently if steam were to be used, it would be better to form it in an ordinary boiler. 2. Air engines have been moderately successful, when working within the limits of temperature which the cylinder and valves can sustain. 3. The temperature of the air used in different forms varies greatly. Joule's engine uses air at 600° Fahr., and Wenham's, described in a late number of the SCIENTIFIC AMERICAN, employs air at a temperature of more than 1100°.

S. S. C. asks: What is phosphoric acid lime? Answer: The acid phosphate of lime has, in modern chemistry, the formula $Ca(H_2PO_4)_2$; in old chemistry $CaO,2HO,PO_5$. This is generally known as superphosphate of lime. When burned bones are treated with sulphuric acid, a portion of the lime is combined with the sulphuric acid to form gypsum, and the soluble superphosphate remains, which is employed as fertilizer and in making phosphorus. $Ca_3(PO_4)_2+2H_2SO_4=2CaSO_4+Ca(H_2PO_4)_2$.

A. asks: Can you inform me how (1) sulphate of nickel and (2) protochloride of tin are made? Answer: 1. Sulphate of nickel is easily prepared by dissolving the metal or its oxide or carbonate in dilute sulphuric acid. If it be concentrated by evaporation, it will crystallize in beautiful emerald green crystals. 2. Protochloride of tin is formed by dissolving metallic tin in hydrochloric acid. To avoid the formation of any of the bichloride, it is well to employ an excess of metal, and only a moderate heat.

J. B. asks if any quality of glass is or can be manufactured that will withstand heat and cold as well as cast iron, and which, when heated and cooled suddenly by water or otherwise, is no more liable to crack than cast iron? What other transparent substances are there that will bear sudden and great changes of temperature, and where are they found? Answer: We do not know for what purpose you wish to use the glass; but if very well annealed, it will probably stand the tests you mention. We do not give addresses in this column.

A. B. C. asks how to make a noon mark to obtain the correct time. Answer: See p. 154, vol. XXVII The meridian can be obtained pretty nearly by suspending two plumb lines in an open field or on a house top, several feet apart, and placing them so that the two lines range with the north star. Of course, the sun is sometimes fast and sometimes slow.

S. C. says: Suppose that two upright tubular boilers are placed 30 feet apart, and connected with 2½ inches wrought iron steam pipe, and two horizontal tubular boilers 175 feet distant are also connected to same pipe. Each has its own steam gage and they are correct within 3 or 4 lbs. Why is it that we cannot fully equalize the pressure? To a certain extent we do; but the horizontal boilers will blow off at 75 lbs. on their gage, and the uprights will also blow off at the same time, but the gages on the uprights will indicate 95 lbs. Why is this? Answer: We cannot give a decided opinion, in a case of which we do not know more particulars than our correspondent has given in his letter. It may be, however, that the horizontal boilers steam much more rapidly than the upright, so that the steam issues with much greater velocity from the first, and backs up the pressure in the latter.

T. M. E. says: In your answer to J. E. P., who asked what the effect of putting two pumps to work on the same discharge would be, the conditions of both pumps being the same, you say: It will force more water through, increase the pressure, and throw the water farther. Does not the pressure depend on the weight of water in the column and the quantity of water discharged? Will not the pressure be the same on both pumps and consequently will not the motion be reduced to one half, each pump discharging one half the original quantity of water? Answer: Attaching a second pump, of exactly the same size and under the same conditions as the first, would be precisely similar to the effect produced by doubling the size of the first pump; and of course more water would be discharged, under these circumstances.

P. V. C. wants to know what power can be given to an electro-magnet that is about 18 inches across the poles; also what sized battery it will require, and what will be the probable cost of the chemicals to work it. Who has the best work on electro-magnetism, and what does it cost? Answer: A straight bar electro-magnet, with a core 18 inches long and 1 inch in diameter, with 200 feet of No. 16 insulated copper wire in the helix, and excited with the electricity from a single cell of Grove's battery, would hold about 1½ lbs. of wrought iron, placed in contact with either pole. One cell of Grove's battery will cost about $2.50. Mercury nitric and sulphuric acids, sufficient to last two weeks, 50 cents. Davis' "Treatise on Magnetism" is well recommended.

S. S. asks: What is the strength of wrought iron shafting? We have now in operation a 3½ inches wrought shaft conveying 110 horse power. Is it large enough to give 160 horse power, or will a 4½ inches shaft be better? Will it be strong enough under all circumstances? The length of the shafting is 130 feet. Answer: You do not tell us the speed at which you desire to run the shafting. Send this and also the diameter of largest pulley on the shaft, and we will answer your query. Neither the 3½ nor the 4½ inch shaft would be strong enough under all circumstances.

J. A. S. says: In the practical working of a small steam engine, that will do all our work with 40 lbs. of steam, I find that our wood fire will vary in spite of all we can do, so that we often have 80 lbs. steam blowing off at the safety valve, during a considerable portion of the time. This fact has raised the enquiry in my mind: Why not have a "governor" to do for the fire what the regular steam governor does for the engine, namely, keep it steady? But how? This led to the invention of a plan, or at least to a theory, which is to attach a pipe, to the safety valve pipe, that would discharge into the firebox, so that (when the gage was set, say at 50 lbs., and a fire going that would soon carry it up to 50, if not discharged) the surplus in the form of steam might be turned into the fire box; my theory is that it would check the fire just enough to lower the steam, and so soon as the steam was down to 50 lbs. the valve would close, and let the fire brighten up again; and so on continuously. Is the idea new or old, or a chimera? If you know it to be the latter, will you so inform me? If new and not absurd, what is your view of the invention? Answer: We should be afraid that the surplus steam would occasionally do its work too thoroughly, and put the fire out altogether. Ordinarily the common damper regulator is efficient in cases of this kind. Another plan that has been proposed is to place a pipe in the steam space of the boiler, that is supplied with water by the feed pump. This pipe is to have a number of small holes drilled in it, so that when the valve is opened a fine spray of water will be thrown upon the steam, and condense it.

C. E. C says: I have water power sufficient for about 9 months in the year, and have a steam engine to use when the water gives out. The boiler (30 horse) I now have is not of sufficient capacity to drive the engine and do the other work required, but is large enough when I use water power. Shall I throw out the old boiler and put in a larger one (say 70 horse) or put a 40 horse boiler by the side of the old one, and use one when using water and both when using steam? Answer: We cannot give a definite opinion, without knowing the age and condition of the old boiler; but if it would be serviceable for some years, it would be best to retain it. We advise you to consult a reliable engineer, who will inspect your boiler, and can then tell you what is best to be done.

A. G. asks: 1. Why is it that a vacuum gage shows 26 lbs. or inches when the vacuum is only 13? 2. Why should the grate bars of a steam boiler be lower at the end next the bridge wall than at the front? Haswell says that they should be, but does not say why. Answers: 1. Mercurial gages were formerly used, almost exclusively, to indicate the vacuum. A column of mercury, one inch cross section and about 2 inches high (more accurately, 2·04 inches) weighs one pound. Hence it became customary to speak of "inches of vacuum," and spring gages are graduated to conform to this nomenclature. 2. Principally for ease and convenience of firing. In a long furnace, with a small door, it would be very difficult to keep the back of the fire in proper condition, if the grate bars were level.

G. E. R. says: 1. I have tried the formula for connecting rods given in your issue of May 24, but I cannot obtain the correct result. 2. How do you determine the length of a rocker arm for a locomotive? 3. How do you obtain the length of a lever for a rotary valve? Answers: 1. We will assume the following data: Diameter of cylinder=24 inches. Maximum steam pressure=80 pounds. Length of connecting rod between centers=7 feet. Applying the rule: Square of diameter of cylinder × steam pressure × square of length of rod is $576\times80\times49=2,257,920$, which $+20,000=112,896$. Fourth root of $112,896=3·26$. $3·26+\frac{1}{16}$ of $24=3·56$ inches = about $3\frac{9}{16}$ inches. This is the proper diameter for the rod at the center, according to the rule. 2 and 3. The lengths of arm will depend upon the relation between required throw or angular movement of valve, and given throw of eccentric. Thus, suppose the eccentric has a throw of 6 inches, and the valve must travel 4, the relative lengths of eccentric and valve levers will be as 6 to 4, or as 3 to 2.

A. K. says: 1. How can I make a glue for sticking leather or cork firmly to iron? 2. How can I make the best invisible ink? Sal ammoniac requires too much heat to bring it out. Answers: 1. See pp. 347 and 363, vol. 28. 2. There are several varieties of sympathetic inks. A very weak solution of green vitriol (or ferrous sulphate) is invisible until brushed over with a solution of yellow prussiate of potash or nut galls. The former produces a blue, and the latter a black. If the writing is done with a weak solution of chloride of cobalt, it is invisible when cold, and blue when warm This ink possesses the advantage of becoming invisible every time it gets cold, and hence may be used for secret diaries as well as correspondence. This is due to the absorption of hydroscopic moisture when cold, which is expelled by heat. Common ink, bleached out by oxalic acid, can usually be restored by ferrocyanide of potassium, and thus alterations in legal documents are discovered.

G. W. M. H. asks: Does the frost all come out of the ground, or part come out and part descend into or be absorbed by the earth? Answer; The frost is not a substance, but only the effect produced by the absence of heat; it follows that, whenever heat enters the soil, it counteracts the effects previously due to its absence. The frost can be said to be annihilated. The opinion that frost goes down is due to the fact that frost is found at a distance below the surface where absent near the surface, and also that the earth sometimes freezes to a greater depth after a thaw sets in. Evaporation produces cold, although itself caused by hea