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F. M.'s lightning rod query is answered by anticipation on p. 347, vol. 30.—W. H. M. will find directions for making fusible plugs on p. 266, vol. 26.—D. A. will find a description of a filter for rain water on p. 241, vol. 27.—W.H. S. will find directions for placing a noon mark on p. 234, vol. 29.—J.K.'s query as to using a wider belt is incomprehensible.—W. H. S. will find directions for a walnut wood filling on p. 362, vol. 30, and for green and yellow bronze in the same paragraph.—S. J. S. is informed that making billiard balls of hard rubber is a very old idea—B. F. S. is informed that his device for making a glue joint on thin stuff is not new. —A. Y. and C. R. should consult our advertising columns.

W. C. V. N. asks: 1. How is mesmerism explained? A. By the well known facility with which ignorant and credulous people can be made the victims of charlatans. 2. Does it have an injurious effect on those who are operated upon? A. Yes, by allowing themselves to be deceived. 3. There has been a fellow around who claims to have a power to control which is not mesmerism, but he calls it animal magnetism and "mesmerism improved." Is it not mesmerism? A. They are both humbug.

J. P. asks: 1. What pressure will a boiler, 8 inches in diameter, 24 inches in length, with 3 flues 1¼ inches in diameter, stand, the shell and flues being of galvanized sheet iron 1-32 of an inch in thickness, with 6 hoops of the same iron 21 inches wide? The hoops and boiler are soldered and 'locked together strongly. A. The boiler will safely sustain the 10 or 15 lbs. you speak of. 2. Would such a boiler be apt to burn out in 6 or 8 months, using the boiler 15 or 16 hours a week with wood as fuel? A. Whether or not it will burn out will depend greatly upon the manner in which it is set. 3. Will the boiler make steam enough for an engine 2 inches in diameter by 5 inches stroke, making 150 revolutions per minute, the pressure being 10 or 15 lbs. to the square inch? A. Probably. 4. In case it will stand that pressure, will steam ports ⅜ inch long and ¼ inch wide be large enough for an engine of that size? A. The size of steam ports you mention will answer very well.

A. X. & C. R. ask: What is the best kind of a skin for a banjo head? A. Parchment.

T. C. says, in reply to A. B., who asks in No. 17 for a formula for obtaining the force of the wind at different velocities: Wind blowing one mile per hour exerts a pressure of 0·005 lbs. to the square foot; as this pressure increases as the square of the velocity, the formula is V²×0·005=P. This may be calculated mentally by multiplying the velocity by half of itself and calling the last two figures decimals. For instance: wind blows 16 miles per hour: 16×8=1·28 lbs. pressure per square foot.

W. T. Y. S. asks: Why does a body projected vertically into the air not return to the earth with as great velocity as it had on leaving the earth? A. Because it encounters the resistance of the air in its descent.

S. A. T. asks: 1. What is meant by "parts," that is, in 10 parts, 6 parts, etc.? Does it mean parts by weight? A. Yes, unless otherwise expressed. 2. Can you give me a method by which I can make an attractive light in a store window? A. Use a small carbureter and a silvered reflector. 3. Can you give me a recipe for coloring leather black? A. Use the recipe given on p. 357, vol. 30, leaving out the Prussian blue. 4. I have heard that Russia leather was red because the tanning process gave it both its red color and peculiar odor at the same time. Is this so? A. Russia leather can be dyed to any shade. The odor is due to birch tar, used in the tanning.

N. L. T. asks: 1. Would a candle burn in a boiler with a pressure of steam, provided it did not melt? A. No, because steam extinguishes a candle. 2. I made a plaster cast for a stereotype, which I dried 2 or 3 days on a stove; but when the melted type metal was poured on to it, large bubbles rose and spoilt the casting. What caused them? A. The moisture remaining in the plaster.

G. E. F. says: I wish to ascertain the pressure of the waves on a breakwater placed at right angles to the direction of the sea. Can you suggest a self registering gage that will answer for the purpose, be strong enough to withstand the force brought against it, and not be affected by the water? A. The pressure of the waves is approximately equal to twice the pressure due to their hight. It might be practicable to arrange a piston against which the waves would strike, producing compression of some substance in the cylinder, which would be registered on a recording gage.

A. B. D. asks: What is the best manner of applying the blowpipe to the lamp flame and to the work? A. Apply the tip of the blowpipe to the edge of the flame when a reducing flame is wanted, and insert it a short distance in the flame when an oxydizing flame is wanted.

P. C. says: We have a condensing engine for which we use city water; there is a stream 1,000 feet from us and 10 to 12 feet lower than our condenser. Could we draw the water that distance? If so, what rule would govern as to size of pipe, etc.? A. It could be done, but we scarcely think such an arrangement would be advisable. It might be better to construct a reservoir, near the condenser, lower than the source of supply, and conduct the water to that. We can, of course, give but a meager opinion, knowing so little of the details; and we can assure you that it is generally true economy to entrust a matter of this kind to an engineer.

O. M. asks: Would a galvanized sheet iron boiler, 12 inches high and 7 inches in diameter, be strong and large enough for an engine of 1½ inch bore and 3½ inches stroke? A. The boiler would not be large enough.

E. A. C. says: According to Seydlitz, one degree of the equator is equal to 15 geographical miles. A friend of mine pretends it is equal to 60 geographical miles. Is there a difference between a geographical mile in Europe and in America? A. You and your friend are both right, a German geographical mile being equal to four English geographical miles. It is to be observed that the length of a degree of longitude referred to is the mean length at the equator.

J. P. S. says: 1. I am driving light machinery from a countershaft driven by a three inch belt. What sized engine shall I require to do the work? A. You have omitted one very important particular, the speed of the belt. 2. How can I get rid of insects on garden peas? A. We advise you to change your seed.

A. A. A. asks: 1. Why is dried beef called jerked beef? A. It appears to have no connection with the original roots from which the verb "to jerk" is derived, and the etymology throws no light upon it. 2. What property of water is removed when it turns to ice? A. A portion of its heat, which is rendered latent or hidden when water changes from the solid to the liquid condition, and is given out again when it changes from the liquid to the solid state. 3. Why is ice lighter than water? A. Because, in freezing, water expands. 4. Do you know of any way of making vinegar from a material so that the vinegar will cost from 3 to 10 cents per gallon? A. See p. 58, vol. 30.

F. O. G. says: 1. I put a little nitrate of silver in some water, and then I put in some ammonia and some muriatic acid, and there was something in the bottle resembling chalk. Can you tell me what it is and what it is good for? A. It was a precipitate of chloride of silver. It is good for sensitizing photographic paper, when suitably applied. 2. What substances mixed together will make a blue color? A. Perchloride of iron and yellow prussiate of potash, both in solution.

A. S. asks: 1. What would be the effect of lightning striking a boiler under a pressure of steam? A. None, if the lightning is carried off by proper connections with the ground. 2. Is it dangerous to be about machinery during thunderstorms? A. There is thought to be danger in the presence of large quantities of metal. 3. Has a boiler ever been known to be exploded by lightning? A. We know of no instance of this.

J. E. E. says: I have in my possession an autograph letter written by Charles Sumner more than one year ago. By the use of a solvent (spirits of turpentine) I succeeded in making two dim press copies, barely readable. Every trace is perfect on the paper. Is there any process by which the ink colors can be brought out so as to be more prominent and readable? A. Cover the letters with solution of ferrocyanide of potassium, with the addition of diluted mineral acid (muriatic); upon the application of which the letters will change to a deep blue color. To prevent the color from spreading, the ferrocyanide should be put on first, and the dilute acid added upon it.

F. O. B. asks: 1. What is the surest method of preserving eggs for a period of 6 or 8 months? A. Mix together in a tub or vessel one bushel of quicklime, thirty-two ounces of salt, eight ounces cream of tartar, with as much water as will reduce the composition to a sufficient consistence to float an egg. It is said that this treatment will preserve the eggs perfectly sound for two years at least. 2. Is there any work published on the art of preserving meat, fruits, etc.? A. We know of none. 3. Has vegetable charcoal the same properties for purifying and preserving as animal charcoal? A. No.

T. J. P. asks: What chemical, if any, is best calculated to clarify sugar cane sirup during its manufacture? A solution of common lime has been used in South Carolina, but without much improvement in the transparency of the sirup. A. The method mentioned is the one generally recommended. But care should be taken to add the lime in quantity just sufficient to neutralize the free acid, which is known by its no longer reddening litmus paper.

J. H. K. asks: 1. Of what dimensions ought a boat, to carry from four to six persons, to be light, run fast, and be easily managed, to be? Can I make a propeller to be worked by hand and to be easily removed from boat when not in use? A. We could not answer this question without an extended article, and you can doubtless obtain all information from a builder. 2. Will a cistern 10 by 25 feet hold water enough to run a 12 horse power engine for 3 months? A. No. 3. Could a pipe be connected with the escape pipe of the engine so as to condense the steam and lead it back to the cistern? A. No.

K. asks: 1. What is the reason that American lathes are made with a fine-threaded leading screw (of 8 or 10 threads per inch) while the English ones have a screw of 2 or 4 threads per inch? A. It is easier to secure accuracy by making the pitch fine. 2. English change wheels (Whitworth) are 22 in a set, ranging from 20 to 120 teeth by 5. The American lathes appear to have only 14 wheels. What is the reason of this difference? Will the American lathes cut as fine and as great a variety of threads as the English ones? A. If the pitch of the lead screw is finer, it will not require so much intermediate gear for fine work, and for the same number of variations.

T. S. R. asks: Does a column of mercury measure 2 4-10 inches to the pound, which, in order to get 200 lbs. pressure, would require a hight of 40 feet? A. It is approximately correct to allow 2 4-100 inches of mercury for each pound of pressure. For nice operations, corrections for temperature and for the pressure of the atmosphere should be applied.

L. P. O. says: My circular slide valve cuts off the steam at ⅛ stroke. The length of stroke is 24 inches, and the exhaust closes 2 inches before the stroke is completed (that is, at 22 inches) and opens at 23 inches. Is this an economical arrangement, or is there any well settled point at which the exhaust should close and open to give the best results? A. You do not send sufficient data; but if your engine works smoothly, the arrangement probably answers very well.

T. P. says: 1. I am about building a stump machine in which I wish to hitch the horse to a 20 foot lever, so that he will have to go three times around with the sweep while the stump lifts two feet perpendicularly, the change of motion to be got by bevel cogs. How many horse power will a machine so constructed give? How large should the cogs be to stand the strain? How many pounds would the machine lift? Of what size should the shaft that bears the weight be? The latter will not be over 3 feet long. A. You can readily calculate the theoretical lifting force of the machine by the relative distances passed over by the horse and lifter, which are about as 94 to 1. Of course, friction and other prejudicial resistances will prevent the lifting of a weight 94 times as great as the tractive effort of the horse. But you can design your machine on this supposition. 2. Which is best for a person when angry, to keep his rage pent up within him or (to use a common phrase) to "spit it out?" I refer to the effects upon the health or body. A. We believe that Mr. Meagles' advice to Tattycoram, to take time, when she was angry, and count five-and-twenty before acting, is applicable in most cases.

H. C. asks: 1. How can I produce on small articles of malleable iron the coppery appearance or finish like that on curtain fixtures? A. By a bath of sulphate of copper. 2. Where can fluor spar be had? A. See our advertising columns.

R. S. F. asks: What is the rule for calculating centrifugal force? Would 1 lb. on the periphery of a wheel 1 foot in diameter, running 100 revolutions per minute, have the same centrifugal force as the same weight on a wheel twice as large running half the number of revolutions in the same time? If I place 1 lb. on the periphery of a wheel and 2 lbs. on the opposite side, half way between the periphery and center, would the wheel be in running balance? If not, why not? A. Divide the weight by 32·2, multiply this quotient by the square of the velocity in feet per second, and divide by the radius expressed in feet. Calling r the radius, v the velocity in feet per second, w the weight, the expression for the centrifugal force is $\frac{w \times v^2}{32 \cdot 2 \times r}$. By the application of this rule, you can readily answer your other questions.

J. K. W. asks: How can I find, on the surface of a revolving cutting iron, the exact shape for striking any given molding? A. Double a piece of paper, cut out the form of a section of the given molding, then open the remaining paper, which will have the shape of a section of the cutting tool.

H. H. D. asks: 1. Is a carbon battery more effectual with nitric acid in the porous cell than with the usual bichromate solution? A. Yes. 2. Please give me instructions for constructing an induction coil. A. See answer on n x: page. 3. To which current should the condenser be connected, and how many square feet should it contain? What effect does it produce? A. To the induced. Some of the large coils contain as high as seventy-five square yards. It intensifies the effect. 4. Would not eight layers of the primary wire produce greater intensity of the secondary current than a less number? It would certainly develop more magnetism in the core. A. Probably; you can easily try it. 5. Which is most effectual as an insulator, paraffin or shellac? A. Paraffin. 6. Is the insulation of the primary coil with shellac or paraffin as important as the careful insulation of the secondary? A. It should be thoroughly insulated, and is quite as important. 7. Should the fine wire be wound from end to end of the bobbin, or only in the center? A. From end to end. 8. Would it not be a good plan to wind the primary coil only at the ends of the core, thereby enabling the secondary to approach nearer to the magnet? A. It would not answer.

H. A. asks: 1. How can I make lemon sugar? A. To one quarter lb. sugar add about one half oz. tartaric acid. 2. Is Dr. Ure's "Chemical Dictionary" an American or English work? A. English. See our advertising columns for booksellers' addresses. Fowne's "Elementary Chemistry" is published by Blanchard & Lea, Philadelphia, Pa. In answer to your other question: We cannot recommend you to use any drugs which are dangerous in inexperienced hands.

H. H. G. asks: What is the best material or preparation to line or cover the interior surface of a wooden tub for silver plating, to prevent the wood from absorbing the cyanide solution, and leakage? The material must be durable and not affect operation of plating. A. Paraffin varnish will answer.

J. N. P. says: In Auchincloss' treatise on "Link and Valve Motions," on p. 27, he says: "The circle from remote ages has (though not wisely) been divided into 360 equal parts," but he fails to say why it is unwise. Will you be kind enough to do so? A. Because if the divisions were made on a decimal system, so that there were 100 degrees in the circumference, 100 minutes in a degree, 100 seconds in a minute, reduction would be much easier. For instance, to reduce degrees to minutes, it would only be necessary to annex two ciphers, and so on.

J. H. P. asks: What is the best sized pipe for an engine placed a hundred feet away from the boiler, the engine being of 10 inches bore and 18 inches stroke? The boiler is 42 inches in diameter and 10 feet long. I contend that we can get the most power through a 2½ inch pipe, but my employer says that we can get more power through a 2 inch one. Which is right? A. It is well to use as small a pipe as can be employed without reducing the pressure. If the pipe is too small, you lose power. We would recommend the 2½ inch pipe in your case. 2. What is the difference between a low and a high pressure engine, and why does it take less steam for the low pressure than it does for the high? A. One condenses the exhaust steam, and the other does not. If there be less back pressure, as in the case of the condensing engine, of course less steam will be required to produce the same mean effective pressure.

H. W. S. asks: 1. What is the rule for calculating the revolutions of engines of circular saws? A. There is no rule; but a counter can be attached that will register the revolutions. 2. How can I calculate the revolutions of saws, run from countershafts? A. If you know the speed of the first shaft, multiply it by the diameter of the driving pulley, increased by the thickness of the belt, and divide by the diameter of the driving pulley increased by the same amount. This will give the speed of the countershaft. Then consider the driving shaft, and find the speed of the saw, etc. in a similar manner.

T. F. H. asks: 1. What are the ingredients for making the best lubricator for large bevel gears exposed to the weather? A. Black lead and tallow will answer very well. 2. What is the best material for preserving timber exposed to sun and rain? A. Bethel's process of forcing the vapor of creosote into the pores of the wood is largely employed for the preservation of railroad ties and wooden superstructures.

A. V. K. asks: Is there any way to condense steam without using a continuous stream of some cold liquid? A. The steam must come in contact with something having a temperature lower than its own. Possibly a solid, such as ice, might be employed.

G. W. H. says: 1. What is the power required to pump 2 gallons of water per minute? A. You do not say how high the water is to be lifted. Ordinarily, it is well to allow at least twice asmuch power as would be required to lift the water only, neglecting friction and other prejudicial resistances. 2. What is the power produced by one of the best turbine wheels? A. About 75 per cent of the power of the water.

A. R. asks: How can I turn grooves in soft rubber rolls? A. It might possibly be done with a file, if the rollers are hollow, and could be revolved at a high speed.

W. F. asks: 1. What is the proper temperature of water when fit for bathing? A. A few degrees below the ordinary temperature of the human body. 2. What can I use to make wood adhere to glass? A. Diamond cement.

W. C. D. asks: How can I procure a perfect vacuum in a common bottle for an experiment? A. This cannot be obtained with a common bottle alone. As near an approach to a perfect vacuum as can be obtained by mechanical means can be effected by connecting the bottle with an air pump. The method resorted to in certain physiological laboratories in Germany when a so-called perfect vacuum is desired is to fill a large jar with mercury, invert it (the rim of the jar always remaining below the surface of the mercury), and then, when the mercury has fallen to the hight in the jar at which it would be sustained by atmospheric pressure, to connect a bottle, or other vessel in which it is desired to produce a vacuum, with the vacuum thus produced.

J. S. asks: 1. How can I make an electro-plating battery? A. See answer to A. P., on this page. 2. Please give me a formula to make photographs. A. Consult *Science Record* 1873, p. 214. 3. What is a good remedy for a fogging negative silver bath? I have had much trouble with fogging baths, and can find no remedy. A. Fogging may occur from so many causes that any general rule cannot be given. Sun, filter, bring to proper strength and give proper re. action, and then the trouble will probably disappear.

T. S. asks: How can I make a fluid ink eraser? A. One such fluid is said to consist of chloride of lime solution, to which are added a few drops of muriatic acid.

A. E. P. says: I have a barometer in which the mercury has become separated. How can I get it together again? A. By inverting the barometer with great care, filling it entirely with pure mercury, and then restoring it to its proper position, taking precaution not to admit the smallest bubble of air.

H. E. B. asks: I make great quantities of chips impregnated with oil. I extract part of the oil by means of steam, but still a great deal is lost, and what is drained off is sometimes so thick with iron rust and scalc as to be almost useless. I have also great quantities of oily waste, that I have found it impossible to clean in a thorough manner. How can I use bisulphide of carbon for the above purposes? A. The bodies to be cleaned are to be treated in closed tanks into which the bisulphide of carbon is drawn.

W. B. asks: Is there a marking fluid which is not affected by rain? I wish to use it on stone. A. It is customary for this purpose to use any good black paint.

B. M. H. asks: I find that old car springs are the best rubber I can obtain for erasing lead pencil marks. Do the properties that make it so belong to that kind of rubber, or do they result from the mechanical action, compression and vibration, to which it has been subjected? A. This is due to the quality of rubber used.

R. W. H. asks: I. What are the chemical properties of common sorghum molasses? A. It is cane sugar in a non-crystalizable condition. 2. What is the chemical process of converting sorghum molasses into sugar? A. The conversion of the non-crystalizable into the crystalizable cane sugar. 5. What is the best process of making vinegar without apples? A. By the purification of wood vinegar, a body which is obtained by the dry distilation of certain woods.

J. L. C. asks: Is the electricity generated by an electrical machine of a kind to form an electro-magnet, and is it generated in sufficient quantity to keep it magnetized? A. No.

W. D. M. asks: Can you tell me what kind of an electric battery I should construct, that will be permanent for some time, say six months at least, and have power enough to run an electric alarm bell, such as is used in the burglar alarm telegraph? A. Into a porous cup about 5 inches high and 3 inches in diameter place a plate of carbon, such as is used in the ordinary Bunsen. Fill the cup with best manganese peroxide and seal with asphaltum. Place it in a small jar half full of strong solution of sal ammoniac in water, into which also place a rod of amalgamated zinc. In this battery the action is wholly upon the carbon, the zinc remaining unaltered and constituting the negative element of the battery. When the fluid becomes milky, add a few crystals of the salt. Two or three such cells will answer your purpose. When properly set up, it will run for from 6 to 12 months.

J. S. asks: 1. Please give me a simple process of silver plating articles with a battery. A. See p. 170, vol. 28. 2. Would an engine with a cylinder 1x2 inches, running at 150 revolutions per minute, with steam at 50 lbs. pressure, be sufficiently powerful to run an ordinary sewing machine? A. Yes.

J. D. S. asks: 1. Does crude petroleum, as it comes from the earth, contain anything poisonous or injurious to the human system if introduced through the blood? A. No. 2. What is the difference between crude petroleum and lubricating oil? A. Crude petroleum consists of a mixture of numerous oils of different densities and boiling points. Lubricating oil consists of the heavier oils which are left after distilling off certain of the volatile constituents.

C. asks: How can rubber tissue be made? A. Ordinary gum rubber has a stratified composition. Rubber manufacturers say that rubber tissue is made by simply separating these layers.

A. B. asks: 1. What two or three metals or alloys expand longitudinally the most in a given degree of heat? A. Zinc, lead, and tin, zinc expanding 0·00001. 29417 of its length for each degree centigrade, when heated between the freezing and boiling points of water; lead 0·000028575, and tin 0·00002173. 2. Is the molecular rotation sustained in high and low degrees of heat alike? A. No.

J. A. H. asks for information on the subject of carbureting hydrogen gas. A. Hydrogen gas, the chief constituent of coal gas, upon which our large cities depend so much for their light after sunset, has, as is generally known, no illuminating power of its own, but depends wholly for its value asan illuminator upon the amount of carbon associated with it; and attention has long been directed to the subjectof supplementing with carbon the already partially carburetted coal gas, and to the problem of carbonizing the hydrogen obtained from peat and from the action of acids on some of the metals. The result is that hundreds of patents have been granted for various devices and machines for carbureting, carbonizing or enriching hydrogen and common coal gas up to the full measure of its light-giving quality; but if supersaturated, the light becomes smoky, and consequently disagreeable. This latter trouble has been one of the drawbacks. The discovery of petroleum has afforded an apparently inexhaustible supply of cheap gas-producing or carbonizing material in the form of highly volatile mineral hydrocarbon oils, such as gasolin, naphtha, benzole, etc., of specific gravities ranging from 0 664 to 0·785. The usual method of carbonizing is that of dividing the liquid into a minutely separated condition, so as to present as large a surface as possible. For instance, a large metallic receiver is constructed and filled with pumicestone: it is then made perfectly airtight, and a quantity of gasoline or one of the other oils spoken of is poured on to the pumicestone until it is thoroughly saturated. Connections are now made in such a manner that the gas to be carbureted passes directly through the pumicestone, emerging from the machine saturated with the heavy hydrocarbon vapor. Another and perhaps a better method is that of suspending a large quantity of wicking, in a suitable receiver partly filled with the fluid to be used, and carefully closing all joints. The action here is the same as in the preceding, except that the wicking is kept saturated by the action of capillary attraction. The vapor from these oils is much heavier than the air, and for this reason it sometimes forms in layers in the lower partof rooms where the oil has been standing or used, and when mixed with air forms a terribly explosive mixture. If by any means an ignited match is thrown on the floor in a room containing or that has contained any of this liquid gasoline, it is sufficient to explode the mixture with disastrous consequences. The principal danger of using these carbureters, then, lies in the highly explosive character of the material used to accomplish the desired result. The only safeguard against accidents seems to be in the rule: Never attempt to fill or charge these machines or reservoirs within doors, or in the vicinity of fire of any kind, but place them underground or at some distance from the house.

A. F. S. asks: 1. Can you give me a recipe for a glue that will not soften in moisture? A. Take glue 12 ozs., water sufficient to dissolve it; add 3 ozs. rosin, melt down together and add 4 parts turpentine or benzine. This should be done in a carpenter's glue pot, to avoid burning. 2. Do you know of any way of constructing a good and cheap frictional electric battery? A. Perhaps the cheapest instrument of this character is Volta's electrophorus, consisting of a plate or cake of resin, set in a wooden mold lined with tin foil. A metallic plate with an insulating glass handle serves to collect the electricity.

B. F. B. Jr. asks: How can I dye silk a light slate or drab color? A. For 100 yards silk, boil together 4 lbs. fustic, ½ ozs. cudbear, and 6 ozs. logwood. Cool to 2 0° Fah., enter the goods and winch for 20 minutes, air out and repeat: take a little of the liquor from the boiler, dissolve in it 1½ ozs. copperas, reduce it to handling heat with water, and give one or two shots through it as the pattern requires.

G. T. B. says: 1. I want to make an induction coil to use with a small Daniell's battery, to take shocks with. What number of wire and how many feet should I use in the secondary and primary coils? A. Use No.37, about 500 feet for secondary current and about 100 feet for primary. 2. How long should the coil be? A. About 9 inches. 3. How large should the bobe be? A. About one half inch. 4. What size of soft iron wire should I use in the core? A. No. 20 will answer. 5. The zinc plates of my Smee battery are 2½x3½ inches square and a half inch thick. How large a piece of silver should I use? A. As large as your zinc plates.

J. W. C. asks: Does the water of the Mississippi river run up hill? A. No.

J. A. S. says: I took hydrochloric acid, and added small pieces of crayon. A portion of the solid crayon should have passed off in the form of a gas, but it failed. I then added chalk to try the experiment, and it worked successfully. What is the chemical difference between chalk and crayon? A. If the crayon were chalk it should have dissolved with effervescence. If you send a piece which will not dissolve, we shall have it analyzed for you.

T. W.—You can find a full description of ice machines in *Science Record* for 1874, pp. 132-155.

M. C. B. asks: 1. What is the process for metalizing non-metallic substances for electroplating? A. Coat them with graphite or black lead. 2. What is the best hand book on metallurgy? What book gives the best description of the different modes of silver mining? A. "A Practical Treatise on Metallurgy," by Crookes & Röbrig.

A. P. asks: 1. Which is the best battery for plating and what is the simplest method of constructing the same? A. For small purposes, the Daniell will answer very well. It may be constructed as follows: Take for the outer jar, one of earthen or stoneware filled with saturated solution of sulphate of copper; for the inner porous cell, a common brown pot with the hole stopped or sealed. Fill this with water and place it inside of the larger jar. Place a rod of amalgamated zinc in the inner cell, and the sheet copper in the outer, so as to surround the porous cell. A few drops of sulphuric acid added to the water in the porous cell will suffice to develop the full power of the battery. The battery most used by electroplaters is that known as the electropoion; it consists of the ordinary Bunsen, the exciting fluid being a solution of bichromate of potassa and sulphuric acid. 2. What is the best book on the subject? A. Roseleur's "Galvanoplastic Manipulations."

J. S. McK. asks: Is there any known method of obtaining the exact square root of any number other than the perfect squares? Could they be expressed in numbers? A. To both questions: No.

A. B. O. says: An inveterate tea drinker complains that the last tea bought gives her a burning sensation in the throat after drinking, and thinks it must be adulterated. Is there any way to detect the adulterations of tea? A. Yes, it is possible to detect the adulterations. In the very little specimen which yousent we fcund none, but it was too small a quan tity for a satisfactory examination.

G. W. D. asks: 1. What is the difference between carbonate of potash and hydrate of potash? A. The first is a compound of carbonic acid and potash, the second of water and potash. 2. What is the crude potash of commerce? A. Impure carbonate of potash mixed with sulphate and silicate of potash, chloride of potassium, ash, organic matter, etc. 3. What waterproof composition will adhere to elastic rubber and at the same time to the cuticle? A. Melt together in an iron pot equal parts of common pitch and gutta percha, kept liquid under water, or solid to be melted when wanted.

C. H. M. asks: 1. Is electricity employed especially in any chemical works for inducing, accelerating, or aiding crystallization? A. No. 2. Does any application of electricity promote or hasten the crystallization of substances? A. Yes.

A. A. B. says: 1. I have a kerosene lamp using an argand burner; after it has been burning 30 or 45 minutes, it becomes very hot and begins to puff and sputter so that we cannot use it. What is the cause? A. The burner is so badly arranged that it allows the heat to be conducted to the contents of the lamp. 2. What shall I use to stick gold or bronze leaf on glass and on paper? A. A solution of isinglass in water. Still better: for fixing gold leaf on wood, paper, etc., use a solution of linseed oil and lead plaster in oil of turpentine. This is made by first saponifying linseed oil with caustic soda or potassa, and precipitating the aqueous solution of the soap with a solution of sugar of lead, the lead soap thus formed being next dissolved in oil of turpentine. 3. What is the best varnish to use on very white wood, such as basswood, that will not stain or discolor it, but leave it clear and white? A. White picture varnish. 4. What is the best filling to be used on black walnut before putting on oil? A. Beeswax hardened with sealing wax and colored with umber maybe used.

J. P. D. asks: What will prevent the dampness from rising in brick walls? Will three or four courses of brick laid in cement or a strip of galvanized iron, the width of the wall, prevent it? A. Lay two courses of brick in melted asphalt and two courses upon these in hydraulic cement, covering the exposed surfaces well. A layer of zinc is also a preventative.

W. asks: What length of time does it take to rip a piece of spring steel 6 feet long by ¼ inch thick with a toothless saw, made of soft iron? How should such a saw be made? A. The periphery of the saw should run about 20,000 feet per minute, and ought to melt (as it really does) through at least one foot in length per minute. The saw must be perfectly balanced and hammered very open in the center. that is, so that the center will be loose, in order to allow the periphery to expand by centrifugal force caused by its own velocity.

J. H. says: You state in your paper that plaster of Paris mixed with 8 per cent marshmallow root, powdered, would harden in one hour, and could be rolled out into plates and polished. I have tried this with hot and cold water several times, and it will not harden at all; it will set somewhat, but will crumble away if you handle it. What is the matter? A. Experiment demonstrates that: 1. The only effect marshmallow root seems to exert upon gypsum is to retard its setting or hardening. 2. That when set or hardened it becomes very brittle: and where a large percentage of marshmallow root is used, it either fails to a powder or crumbles when touched.

S. F. M. says: 1. I am making a foot lathe and do not understand laying out cone pulleys. The driving wheel faces are 24 and 25 incæs diameter. I want the driven pulley to be 3 inches diameter for the smaller face; what should the other be? A. See p. 134, vol. 11. 2. What width of belt would be most suitable? A. Make the belt from an inch to one and a half inches wide.

B. says: I wish to drain the bottom of a cellar, on which I propose to lay a concrete floor. The method I have adopted is to sink longitudinal trenches 10 inches x 12, and fill loosely with bats broken about the size of a hen's egg; then to cover the whole with concrete. The trenches start near the footings of the party wall. Do you think this will effect the object? If not, can you advise something? At certain points in the foundation bottom, several springs and quicksands have been discovered. A. The plan you have adopted is a good one, provided that you connect the main trenches with lateral ones, and discharge the whole into a main drain leading away from the house.

S. B. McC. asks: What is the solid content of a stick of timber, the base of which is 14 inches square and the top 10 inches square, and length 20 feet? What is the rule for obtaining the same? A. This stick is in the form of a frustrum of a right prism, with the two bases parallel. The rule for calculating the solidity is as follows: Add together the area of the lower base and the area of the upper base; extract the square root of the product of these two areas. Multiply this sum by one third of the perpendicular distance between the two bases. Applying the rule to the case in question, we have area of lower base, 14x14=196; area of upper base, 10x10=100. Square root of the product of these areas, $\sqrt{196 \times 100} = 140$. Perpendicular distance between the two bases, 20x12=240 inches. Contents of timber, (196+100+140)x80=314,880 cubic inches. Contents in cubic feet, 314,880÷1728=20.4.

J. B. H. asks: What is the method of balancing the reciprocating parts of an engine, for which Mr. Main received from the Secretary of the Navy the sum of $600? A. As we understand the arrangement, it is not a true counterbalance, but consists of weighting one of the cranks, which can hardly be considered novel. Indeed it is said to give so little satisfaction that these so-called counterbalances are being removed from the cranks of many marine engines.

C. M. asks: What is dry steam? A. Steam of such heat that it will absorb moisture from any damp substance placed in it.

P. J. asks: How can I dissolve gutta percha so as to make a thin waterproof varnish, capable of being laid on with a brush? A. Take 4 ozs. clean gutta percha, dissolve in 1 lb. rectified resin oil, and add 2 lbs. linseed oil varnish, boiling hot.

S. D. asks: What will restore the color of or clean colored leather? A. Use 1 oz. oxalic acid dissolved in 1 pint distilled water.

G. L. M. says: I lately read a statement that Dr. Huggins has discovered that the star Arcturus is approaching the earth at the rate of about fifty miles per second. 1. Is this true? If so, in what part of the heavens can the star be seen at night? Can the star be seen with the naked eye? Does the star appear to grow larger? How far distant is the star from the earth at the time that this letter reaches you? A. Yes; Arcturus is a bright red star of the first magnitude, in constellation *Bootes*, overhead at 9 P.M. Its proper motion is 54 miles per second toward the earth, and it is light, traveling 185,000 miles per second, takes more than twenty-six years to come here. 2. What is the greatest depth that man has ever attained, and where? A. One of the deepest holes we recollect is the "Road to Heaven" silver lead mine, near Freiberg, Saxony, 2,000 feet down to the sump.

S. says: I wish to construct a telescope for a rifle. Can you inform me how many lenses will be required, and what the diameter and focus of each lens should be, and in what manner they must be mounted on the rifle? A. Object glass half an inch diameter focus 24 inches or as long as convenient. Eyepiece may be a single lens of low power with cross spider lines fixed in its focus. The target will then appear inverted. The lenses are enclosed in a brass tube with a hinge or ball joint at the breech or eyepiece end, and slides at the muzzle, to depress the object glass, for increased elevation. The two points of attachment to the barrel are the same as for ordinary fore-and-leaf sights.

T. S. C. says: In your answer to N. L., you say that "the shrinkage of wood endwise is very slight, if any." It is probable that if the wood were perfectly straight grained, there would be no shrinkage endwise I have seen planks in board fences where the board was displaced endwise 3 inches from where it had been originally nailed; and I have seen the top rails (2x4, oak) in picket fences drawn apart 8¼ inches in a fence 150 feet long. I have, however, always attributed this to the lumber not being at all times sawn parallel with the grain of the wood.

J. M. says, to help B. and J. out of their trouble of bubbling in casting zinc: Do not overheat it; but when melted, pour at once, and you will find you can get a sharp model in quite moist sand. I stir with a pine stick until all the metal is thoroughly liquefied. I have used various sizes of zinc, and since follow ing the above directions I have had no trouble.

R. S. says, in answer to A. A. W.'s query as to breaking gage glasses: If you get good flint glass tubes, and your gage cocks are set true, they will last a long time. Instead of taking them out to clean them take the nut off the top cock and pour a little oil down the tube; it will remove the scale.

W. H. S. says, in answer to J. A. McC.'s Jr. s question as to the tube and disk of paper: A number of years ago the Royal Society offered a gold medal and one hundred guineas for the explanation of the phenomenon mentioned byhim. The following was the explanation which received the prize: Supposing the diameter of the disks to be to that of the hole as 8 to 1, the area of the former to the latter must be as 64 to 1. Hence, if the disks were to be separated (their surfaces remaining parallel) with a velocity equal to that of the air blast, a column of air must meanwhile be interposed, sixty-four times greater than that which would escape from the tube in the same time; consequently, if all the air needed to preserve the balance be supplied from the tube, the disks must be separated with a velocity as much less than that of the blast as the column required between them is greater than that yielded by the tube. It follows then that, under the circumstances in question, the disks cannot be separated with a velocity greater than one sixty-fourth the blast. Of course all the force of the blast will be expended on the movable disk and the ring of air between the disks; and since the aforesaid disk can only move one sixty-fourth the velocity of the blast, the ring of air must receive nearly all the force of the blast, and be driven out in currents radiating from the common center of tube and disks.

C. H. M. asks: I have several times read that in order to make it possible for some birds to talk their tongues have to be split, or that after their tongues were split they could talk. Among common birds, this has been asserted of the crow and jay. Is this true, and if so, how is the splitting done? How far would the bird's tongue have to be split? I cannot see how this operation would enable them to speak.—X.X. O. asks: How can I make a burnishing liquid to produce a lightstraw coloron sole leather?—H. M. D. asks How can I dye aniline scarlet on mixed goods?