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E. A. C. will find a rule for proportioning cone pulleys on p. 180, vol. 26.—H. G. R. will find particulars of the reward offered for a car coupler on p. 161, vol. 29.—G. K. R. should consult a physician.—J. F. can galvanize cast iron by the process described on p. 59, vol. 24.—M. M. will find directions for gliding mirror frames on p. 75, vol. 28.—J. F. F. and others will find S. Hughes' book on "Gas Works and the Manufacture of Coal Gas" useful.—W. W. D. should consult p. 215, vol. 30, for directions for extracting essential oils.—P. H. can case-harden iron by the process described on p. 281, vol. 27.—J. M. W. and J. G. should refer to p. 140, vol. 31, for a description of the "horse hair" snake.—T. U. S. will find full directions for bronzing on brass on p. 231, vol. 29.—E. P. M. and S. G. A. will find directions for bronzing on brass on p. 32, vol. 25.—A. Balloon (gutta percha) varnish is described on p. 279, vol. 30.—M. A. C. will find a recipe for bronze lacquer on p. 331, vol. 29, and verde bronze on brass on p. 283, vol. 31.—C. L. D. should refer to p. 212, vol. 26, for a method of tinning cast iron.—F. G. S. will find a good recipe for calcimine (sometimes spelt calomine) on p. 351, vol. 24.—J. B. will find a recipe for a cement for leather on p. 138, vol. 25.—O. M. L. can waterproof cotton cloth by the process described on p. 30, vol. 30, and prevent mildew by the recipe on p. 138, vol. 27.—H. R. J. and C. G. J.'s rules for finding the radius of a circle, chord and arc being given, are correct, but neither is the solution that R. O. B. asked for.—J. S. E. will find full directions for proportioning gears on p. 187, vol. 23.—C. E. H. will find a description of a petrifaction process, applicable to dead bodies, on p. 24, vol. 29.—G. A. S. should refer to p. 266, vol. 31, for a method of preserving flowers. For directions for crystallizing them, see p. 283, vol. 31.

(1) A. H. D. says: A friend of mine has recently purchased a 10 horse engine and boiler, in which the feed water of the boiler is heated by live steam taken from the dome on the boiler. The manufacturer recommends him, for economy's sake, to heat the feed water by the exhaust. Please give your opinion. A. It is more economical and usual to heat the feed water with the exhaust steam.

(2) T. D. says: 1. Given a piece of watch spring steel, 11 feet long, tightly drawn and securely fastened at both ends, at 110° Fah. What will be the contraction at 60°? Will the spring return to its original length at 110°, provided the fastenings have meanwhile been undisturbed? A. It seems to us that the spring would break if cooled under the given conditions. 2. Will steel wire deteriorate from constant contact with rubber, pure or vulcanized? What remedy, if any, can be used to prevent such deterioration? A. We think not; but in any event, a coat of varnish will act as a protection.

(3) G. asks: 1. Has there ever been a locomotive constructed with only one cylinder? A. We do not know of any. 2. Could a locomotive be worked with only one cylinder, and would there be anything objectionable in such construction? A. A locomotive can be worked with one cylinder, as is evident from the fact that it is done occasionally, in case of accident. The principal objection to a single cylinder engine is the difficulty of starting and reversing.

(4) J. S. McK. says: I live in longitude 20° 30' W. from Washington, and in latitude 32° 30' N. What is the proper variation of the magnetic needle at this point? Is there a general rule by which I can find the variation of the needle at any point, knowing the latitude and longitude? On what degree of longitude is the variation 0°? A. The variation must be found by observation. It is not constant at any one place, so that the agonic lines, or lines of no variation, are continually changing their position.

(5) J. C. W. says: In Pennsylvania and elsewhere, we use large quantities of soft coal for steam purposes, costing from \$3.50 to \$5 per ton. We can get slack or fine coal for about \$2.50 per ton. We have tried several times to use slack, and as many times have failed to make it work satisfactorily. We have come to the conclusion that we do not know how to construct our furnaces and manage our fires, and we would be pleased to have your views on the question. A. Such coal requires a strong draft, and grate bars with small interstices. Steam is sometimes admitted beneath the ash pit. There are several patented devices for burning coal dust and slack that are well spoken of.

(6) G. H. G. & S. M. C. say: 1. We wish to conduct steam from boiler to engine, distance 350 feet. What would be the loss per cent of fuel by the condensation of steam in traveling that distance, and what sized pipe would be required to supply a 30 horse power engine under the above circumstances, provided the pipe be well packed? A. The loss would be inappreciable if the pipe was well covered and trapped. Use a pipe 3 inches in diameter. 2. What would be the cost of an air pump sufficiently large to furnish 30 horse power? A. Four thousand dollars. 3. Would additional distance require additional pumps? A. No, for a reasonable increase of distance. 4. Should a stationary engine have a slide valve set with lead or lap, and how much of either? Should it be set so that the instant it passes the center the port will open? A. The steam port should commence to open just before the end of stroke. There is no general rule for the best amount of lap. 5. With what would you bronze the bell of a steam whistle made of thin sheet copper? A. It is not probable that you can repair it successfully.

(7) W. S. H. says: I wish to make a model of a steamboat 248 feet long, 37 feet wide, 13 feet deep, and 12 feet wide over all. Would a model, 5 feet 2 inches long, 9 1/4 inches wide, 3 1/4 inches deep, and 18 inches wide over all, be in the right proportion? A. The proportions are correct.

(8) J. B. says: Please give me a formula for making best sewing machine oil. A. Sewing oil will probably answer this purpose better than any manufactured compound.

Having Brazil wax in powder, I wished to form it into tablets, and applied heat, but failed to accomplish the desired object. What will cause the particles to adhere? A. We think that the proper degree of heat would accomplish the desired result.

(9) C. M. A. says: I propose to ventilate my house by means of wooden tubes, starting from near the floor, passing inside partitions, and debouching at the roof. The house is warmed by a furnace. I am told by a builder that the draft in these tubes will be as likely to bedown as up, and that the only proper way is to have the tubes terminate in a chimney. I can see that they may be correct so long as the temperature inside the house and outside is equal, as in summer; but would not a very slight addition of heat to the air of a room cause a current to pass up the ventilator? A. Yes. You are correct; experience proves that your tubes will work very well.

(10) E. asks: My driving pulley is 6 feet in diameter, and driven pulley is 9 inches in diameter. My belt is of India rubber, 3/4 inch thick and 14 inches wide; it travels 2,033 feet per minute, and is 41 feet long. How much horse power am I using? A. You do not send enough data. The distance between the centers of the pulleys and the tension of the belt should be given. Probably the most satisfactory mode of settling the question would be to make a test, if the matter is of any importance.

(11) E. H. asks: 1. What should be the strength of a nickel solution? Do the salts merely require to be dissolved in water, or is cyanide required? A. If the salt you speak of is (as is highly probable) the double sulphate of ammonia and nickel, 100 parts of water at 60° Fah. will dissolve 58 parts of the salt. 2. How is the mottled or crystalline appearance given to galvanized iron, particularly that used for making ice water coolers? A. By the action of dilute nitric acid. 3. What is the latest and best work on electro-metalurgy? A. Roseleur's "Galvanoplastic Manipulation." 4. Is there any way of coating cast iron goods, such as door knobs, hollow and made of malleable iron, so as to prevent them from rusting? Plating with copper and nickel did not do in all cases, as the iron is porous, and electro-plating will not fill up all the small holes. A. Try Japan varnish.

(12) B. H. asks: What is the metal used, and what is the process of making galvanized sheet and other iron? A. The iron, after being cleaned and washed with muriate of zinc, is dipped into a bath of zinc with a little mercury, or zinc alone. A little potassium or sodium is sometimes added to the amalgam.

(13) H. K. asks: If the normal temperature of air is 65° Fah., and it is compressed to 50 lbs pressure to the square inch, what will be its temperature? A. Nearly 350°, if there be no loss of heat by radiation or conduction.

(14) R. T. asks: Will a thin steel spring, such as is employed on harness, lose its temper in the process of tinning? A. No.

(15) O. K. asks: What will be the working horse power of a boiler whose dimensions are 24 feet diameter, 9 feet length, with 32 two inch tubes, and of an engine of 5 inches bore by 10 inches stroke, with 60 lbs. pressure per square inch? A. About 6 or 7 horse power.

(16) J. J. T. says: 1. I have a double chimney, each chimney of which is 4 by 20 inches, and 45 feet high. Sometimes I use one of them for a ventilator, and the smoke will go up the chimney and down the other into my room; at other times the draft is down both chimneys. What is the difficulty? A. The arrangement is bad. The ventilating flue would be better on the other side of the room. 2. Where is the proper place to put registers for ventilating a room, at the top or bottom in the sidewall? A. At the bottom, with some exceptions. 3. Does one chimney or ventilator interfere with the other in the same room? A. Yes, more or less.

(17) J. S. asks: Is the idea that powerful engines may be driven by compressed air in place of steam practical? A. The change would not be economical.

(18) A. V. asks: Has the low pressure pound of steam more volume and power than the high pressure? A. If the pressure is only 20 lbs., it must act upon 4 times as much area of piston as steam of 80 lbs. pressure, to produce the same effect, other things being equal.

(19) C. M. Q. and others.—The most important magneto-electric machines have been fully described, in many cases with appropriate illustrations, in these columns.

(20) W. H. asks: When, in painting walls, two or more coats dry spotted, is it caused by the unequal troweling in plastering, leaving some parts more porous than others, thus producing an unequal absorption of color? A. It is most probably caused by a greater amount of plaster having been incorporated with the lime in some places than in others. 2. What is the best preparation for coating the walls prior to painting to obtain an even gloss? A. It is usual to repeat the coats of paint until the pores are well filled and an even gloss is obtained. Sometimes as many as five coats are necessary. The first and last application should be the paint. 3. In calcimining walls that are very porous (or, as some call them, lime burnt) the color is so quickly taken up as to prevent its being put on evenly, and dries shaded or clouded. A glue size will not stop the suction. What will? A. In calcimining, the walls should be first thoroughly washed; when dry, a coat of glue sizing may be put on; if the latter is of the proper consistence, the calcimining will finish of an even tint.

(21) J. F. asks: What is a simple way to line shafting? A. By running a fine line through the boxes, so adjusting them, and then putting up the shafting.

Are there any slide valve engines that can be reversed? A. Yes.

I have a spyglass with two glasses. The large glass is flat; would it not be better to grind it to a convex? A. Yes, if it is properly done. We do not think, however, that the glass is flat.

(22) J. D. W. says, in reference to A. Z.'s difficulty with his blower: My brother would not blow when it was finished. Your answer to A. Z. was "that he had probably made the fans so that they only kept the air in the case in motion instead of forcing it out." How should a blower be made so as to force out the air instead of simply giving it motion? A. It is a good plan to arrange the fans in the case so that the air is slightly compressed after reception, and allowed to expand on reaching the discharge openings.

(23) S. asks: If it be true that a candle fired out of a shot gun will go through a board, what would happen if the candle was still and the board sent against it with exactly the same force as is required to shoot the candle through the board? A. By parity of reasoning, the board should go through the candle, if the "wicked" part of the candle were not strong, enough to resist it.

Which way would a compass point if it were placed exactly over the north pole? A. If freely suspended, it would, no doubt, point to the north pole.

(24) F. S. Jr. says: 1. How long is a German mile? A. German short mile, 6,894 yds.; German long mile, 10,115 yds.; German geographical mile, 8,100 yds.; German sea mile, 2,025 yds. 2. How long is a German foot? A. Prussian and Danish foot is 1.06732 English feet; Austrian foot is 1.037128 English feet; German foot 0.971 English feet.

(25) I. P. McD. asks: 1. Which has the more resistance to electricity, a relay or a sounder, and why? A. Commonly speaking, the relay, because of the greater number of convolutions of wire in its coils. In some main line sounders, the resistance is equal to that of the ordinary relay. 2. Will electricity separate in any degree, or travel in two different directions? A. Yes. 3. Is not electricity attracted to some extent by the north pole, and will it not take a northerly direction in preference to a southerly one? A. No. 4. Is water a conductor or non-conductor? A. Water is a conductor of electricity, although a poor one. 5. Will it form a good ground wire when not connected directly with the ground or earth? A. No. 6. Have the pores in any substance anything to do with its power of conducting electricity? A. Conductivity has been shown to vary with the density of metal conductors. 7. Do you think telegraphing a good business to follow? A. Yes.

(26) R. O. S. asks: How much nitrate of silver could I get by dissolving a silver dollar in nitric acid? A. The nitrate of silver will weigh a little more than half as much again as the coin. 2. Would it be sufficiently pure for photographic purposes after being fused and re-crystallized? A. You would probably have trouble. 3. In what sort of a vessel would the fusing have to be done? A. Fuse it in a silver dish. Your coin is probably made of an alloy of gold. The inscription signifies John V. King of Petaig, (untranslatable abbreviation). "In hoc signo vinces" means "by this sign" (the cross) "thou shalt conquer."

(27) N. A. W. says: My housekeeper went in the dark for some sugar, and came running back, saying that a witch, a wizard, or the devil was in the sugar barrel. "I considered myself equal to all three, and boldly went for them. The frightened housekeeper told me to stir the sugar; I did so, and to my astonishment it produced a white light resembling the light from electricity. Will you give an explanation?" A. It is well known that, when two pieces of sugar are rubbed together in the dark, a sort of electrical phosphorescence may be observed, due probably to the friction of the particles. Attention has been called to it in our columns.

(28) G. C. W. asks: How do astronomers calculate the distances of the sun and stars? A. The sun's distance is calculated in various ways, as by observing the time it takes for light to travel from the sun to the earth, by noting, from proper points on the earth's surface, the time occupied in the transit of Venus, etc. The distance of the stars is estimated from parallax.

1. What are meteors composed of? A. Principally of iron, nickel, hydrogen, and certain minerals. 2. What gives them velocity? A. Their orbital movement.

1. Which has the strongest attraction, an electro-magnet with one half inch core, containing fifty feet of copper wire weighing one half pound, or one of the same size containing one hundred feet of copper wire weighing one half pound? A. The latter. 2. What weight will an electro-magnet, containing 50 feet of copper wire, No. 22, with one half inch core, with one cell of Bunsen's battery, hold up? A. We can give you no general rule for determining magnetic energy in this manner.

What is the origin and chemical analysis of the aerolites? A. They are supposed to be of planetary origin. For analysis, see answers to meteor, above.

What is the rule to find the convexity of a circle, such as the earth, reckoned from a level? A. See p. 123 vol. 30.

What is the length of the steamship Great Eastern? What is the size of her engine cylinders, and how many tons of coal did she consume in 24 hours? A. Length 692 feet; cylinders of paddle wheel engines 74 inches diameter by 14 feet stroke; cylinders of screw engines 84 inches diameter by 4 feet stroke; coal consumed per diem in her voyage to New York in 1860, 261 1/2 tons. She indicated, on this journey, 7,352 horse power, by both sets of engines.

(35) W. O. says: My engine appeared to blow through when running light, or with little or no work on. The valves and piston work smoothly, and appear to be steam-tight. The question arises: What is the cause of this blowing through? The indicator diagrams exhibit an unusual amount of back pressure or compression; and although I did not have an opportunity of taking a diagram when running light, it is reasonable to suppose that the compression is the same as when in full work. The compression, which begins at half stroke, is equal to the initial pressure of steam at the end of stroke, the steam being cut off sharply. The forward pressure gradually runs down until, during the latter half of stroke, there is a point where the back pressure overbalances the forward pressure (namely, the pressure above the main valve, or between piston and cut-off valve), which forces the main valve up and allows the steam to escape during the latter half of stroke, the engine being carried over by the momentum of the fly wheel. It is necessary to state that the steam is regulated by a variable cut-off governor, which relieves the main valve of undue pressure. Am I correct? A. Your explanation seems plausible according to the diagrams, but we do not get a very clear idea of the arrangement of the valves. If the valve lifts on account of too much cushion, change it. The first thing to determine, however, is whether or not the valves are tight; as it is only when this matter is settled that the engineer can properly begin to theorize about the indicator diagram.

(36) R. M. says: I have been round Cape Horn and the Cape of Good Hope several times, and I have been round the globe twice in a sailing ship, but it is slow travel. I propose to make my next voyage around the globe in 24 hours. By going up in the air high enough to clear the current that follows the globe round, remaining there 12 hours, I will let the earth do the traveling; then I will descend, and the mails in China, across the United States, mail, ascend for 12 hours more, then come down and land the China mail in New York. I believe this can be done and will be done yet. A. We do not understand what you mean by the current of air that goes round with the earth, unless it is the atmosphere; in which case, we do not think that you will get out of it.

(37) I. L. T. says: I read that, after a house was struck by lightning, a tin cup had a tendency to adhere to the kettle spout, and finally the spout would suspend the whole weight of the tin cup. Upon further investigation, it was found that any nail in the house would suspend a common dining needle. Can you explain it? A. If the statement is reliable, the fact that every particle of iron about the premises was found to be temporarily polarized is a fine illustration of the power of the induced currents liable to be generated on the instant of the passage of the discharge.

(38) W. M. W. asks: How can I prepare heavy cotton cloth to prevent the evaporation of alcohol? I want to cover over open barrels, and would like some preparation that will be pliable. A. Melt paraffin with 5 percent of linseed oil, and run into cakes for use. When needed, melt, and spread the mixture over the cloth with a brush.

(39) F. W. D. says: I attempted to make the phosphorized oil light (described in a back number of the SCIENTIFIC AMERICAN) by placing a piece of phosphorus of the size of a hazel nut in a four ounce phial, filling one third full of boiling hot olive oil; but it and would not operate. Was the phial too large? What kind of phosphorus should I use? A. Use a larger proportion of phosphorus. The phosphorus should be that known as clear. The red variety will not answer the purpose.

(40) H. C. W. says: In the SCIENTIFIC AMERICAN of October 21 you state that a gallon of water will produce a gallon of steam if confined in the same space. I think you have made a mistake, as I do not think that it would produce steam at all, but would remain water. A. Have you any authority for your opinion? 2. Please give me a rule for finding the sizes of the pulley in the head of the lathe, to fit a fly wheel, so that the belt will be tight on each of them? A. See p. 93, vol. 22.

(41) P. H. asks: Is there any method of hardening steel so that it will drill a file or hardened steel? A. Heat the steel to cherry red and quench it in mercury.

(42) R. R. asks: 1. What is the best way to mend an overshoe that is all rubber? How can I mend one that is rubber and cloth? How can I mend a leather shoe without sewing a patch on, using cement prepared for the purpose? A. A solution of pure gum rubber in naphtha will answer these purposes. 2. Can the gum of an old overshoe be dissolved in any way to make it useful as a cement? A. Owing to the large amount of sulphur in such rubber, we do not think it would pay you to try the experiment.

Once saw a fire lighter of the shape and size of an egg, with a wire fastened in it, to be dipped in coal oil to kindle fire; can you tell me how to make it? A. Ordinary potter's clay is mixed with sulphur or other inflammable substance, molded into the desired form and thoroughly burned. It will then be found to be exceedingly porous and will then absorb, by capillary attraction, a large quantity of oil.

Is there any kind of preparation that will make any kind of goods waterproof without injuring the goods? How is it prepared and used? A. Ten pounds of alum and a similar quantity of acetate of lead are dissolved in sufficient warm water, and the mixture allowed to stand till the precipitate of sulphate of lead has settled down. The clear solution, acetate of alumina, is poured off, and mixed with water in which dissolved fine glass is stirred up. The articles to be made waterproof are steeped in this mixture for twelve hours, after which they are dried and subjected to pressure. This process will render the cloth both water proof and moth proof.

(43) J. V. R. asks: What is carbolate of iodine composed of? A. This is not a chemical compound, known as such to chemists.

(44) J. H. M. says: 1. In looking over the back numbers of the SCIENTIFIC AMERICAN, I find a question by W. B. N. about the rack and pinion and eccentric set works for sawing lumber. There appears to me the greatest difference imaginable between the systems. In the first place, the rack and pinion block has a uniform motion throughout the whole of its movement; the first and last 1/2 of an inch is made at precisely the same speed as any of the intermediate parts of an inch, provided there is a uniform speed of the lever. Therefore, in order to set correctly and not throw a small log too far away from the knee, you are compelled to stop the lever very gradually, and at an exact point. If not, your lumber will be too thick or too thin, which is not the case with the eccentric head blocks. While the lever is being moved at a uniform speed, the motion imparted to the knee by the double

eccentrics is an accelerated and retarded motion, until the knee actually stops while the lever is still in motion, so that it is not necessary that the lever should be moved to any fixed point in order to make even number. With the eccentric block you have only to go through with a certain manipulation to get certain and accurate thicknesses. The manipulation need not be accurate, but the lever may vary two inches in one movement as compared with another. Another advantage is that, while the lever is moving either backwards or forwards, the knee always moves ahead. Therefore you can set as quick as you can with the rack and pinion, for you have only to go through with the same process. A. There are various devices for operating the rack and pinion set works, also for operating the eccentric set works. By a sudden or quick jerk on the lever, either device is liable to throw a light log too far away from the knee unless it is fastened to it. There are several effective devices for accomplishing the latter. The only liability, then, is to the extent of slack which may exist in the working parts. 2. In our mill, we have a cog wheel and pinion to drive 5 gangs and 2 large circular saws. This gear is driven by two 18x40 inch cylinders. The cog wheel is 10 feet in diameter with 7 arms, depth of rim 5 inches, width of rim 6 inches, size of mortice for cogs 1 1/2 x 12 inches, diameter of hub for shaft 16 inches, length of hub 12 inches. The cogs of said wheel are made of maple, well fitted and driven hard and fastened with dovetailed keys. The rim of this wheel has been broken; and in order to mend it we took two wrought iron rings, 1 1/2 inches square, and out them on bot, to shrink the rim together. Would there be contraction enough to the shaft wheel to prevent our taking out the shaft? A. A shrinking of the bands on the blank cog wheel would undoubtedly diminish the size of the center hole, proportionately to the extent of pressure and size of wheel, causing it to grip the shaft.

(45) M. M. asks: In what months do the winds blow the strongest, and what are the prevalent directions? A. In February and March. From S. W., W. by S., and N. W.

(46) B. says: Some zinc castings are to be exposed to the weather; but as they are of an ornamental character, I want to wash them with some chemical that will oxidize them to some extent and give them a better color. I have tried ammoniac, but find that therein will run down on the castings in a milky stream, giving them a streaked appearance. Can you tell me what will oxidize the castings with a color that will stand exposure, or, in other words, what will hasten natural oxidation? A. Your best plan would probably be to try a series of experiments on the subject, by using the various acids beginning with nitric, and making them of various degrees of strength and different temperatures until the object in view is accomplished.

(47) R. C. asks: Is there any instrument to test the sourness of vinegar, so as to tell when it is fit for market? Is there any instrument to test the sweetness of cider, to tell if it will turn into vinegar quickly? A. The means employed require more apparatus and care than could be employed by one who is not a chemist.

(48) C. F. O. says: I have some very nice books which have been handled by careless persons. How can I clean off the finger marks and dirty spots? A. We do not know of any other method than the use of rubber.

(49) C. H. asks: What will clean hammered granite after it becomes dark or dingy? A. Try careful washing with a moderately strong acid.

(50) W. D. asks: How can I color paraffin yellow, red, blue, black, etc., so that it will retain the coloring when in a melted state? A. Except with black, we believe this has not yet been accomplished. By continued experiment you might possibly discover the true method.

(51) Z. C. B. asks: Is there a composition with which the insides of vinegar tanks, made of spruce lumber, can be painted to make them tight, which the vinegar will not affect? A. Pitch is used for this purpose.

(52) C. H. M. asks: Why are the brilliant jewels, that so much resemble diamonds, called paste? A. The ingredients (white sand, pearlash, niter, arsenic, manganese, etc.) are first made into a paste with red lead, which, after the mass has been fused, imparts to the glass beautiful prismatic colors.

Upon what does the magnetic tension of a helix depend, upon the number of turns of the wire, or upon the volume of electricity flowing through it? Which would induce the more magnetism, a helix of small wire composed of 400 spirals with 3 cups to excite it, or a larger wire of 200 spirals and 6 equally strong cups to produce the current? A. It depends upon the number of farads per second, and the compactness of the helix, for the inductive influence is inversely as the square of the distance from the core. As to electricity and crystallization see p. 187, vol. 31.

(53) G. H. H. asks: 1. Is there any test besides experience by which we may know that a room on the ground floor should not be used as a sleeping apartment, on account of dampness? A. The hygrometer is used for this purpose. 2. In ventilating a room, should the fire open near to the ceiling or near to the floor? A. Near the floor in many instances, but no general rule can be given. 3. Is the lightest air necessarily the purest? A. No.

(54) O. B. says: From philosophical works, I find that gold as a conductor of heat is set down at 1,000, silver 972, tin 308, firebrick 11. Earthenware is composed of a substance that ranks it as a conductor with firebrick. From the above figures then, it appears that silver is more than 88 times a better conductor than firebrick or earthenware; yet Professor Tyndall in his work on "Heat as a Mode of Motion," in speaking of the comparative radiation of a silver teapot and an earthenware one, both being filled with boiling water, says: "The silver produces but little effect, while the radiation from the earthenware is so copious as to drive the needle to 80°." Why is it, then, that in practice tin is always preferred for hot air pipes to flues that are smoothly plastered? Of course, some advantage would be derived from the superior smoothness of the tin; the ascending air currents would not encounter so much friction, but this advantage would not compensate for the difference in the conducting capacity of the two substances, tin being more than 27 times a better conductor than the plaster. Please explain. A. Good radiators are good absorbers of heat, that is, the surfaces which can easily communicate motion to the ether are equally capable of accepting it from the ether. On the contrary, a bad radiator, such as a metallic surface, is a bad absorber, and therefore a good reflector. Hence, the thinnest metallic film upon a surface powerfully protects it from the action of radiant heat.

(55) L. O. asks: What is a test for lard oil? A. The operation of determining the quality of the oil is one of considerable difficulty, and cannot be advantageously employed by one who is unacquainted with chemical operations.

(56) M. A. asks: Why do the leaves of one tree turn yellow and fall, while the rest are still bright and green? A. It is probably due to some accident that has befallen the tree, which has caused the premature change in the color of its foliage.

(57) W. A. C. asks: How can I make a good burnishing ink for the heels of boots and shoes? A. Take soft water 1 gallon, extract of logwood 1 oz.; boil them until the extract is dissolved, then remove from the fire and add copperas 2 ozs., bichromate of potassa and gum arabic, each 1/2 oz., all to be pulverized. This makes a cheap and good color for shoe or harness edge; but for cobbling and for new work, upon which you do not wish to use the hot kit, but finish with heel ball you will find that if, as you pour this into the bottle to use, you put a tablespoonful of lampblack to each pint of it, it will make a blacker and finer finish. It makes a good color for cheap work, but for fine work, nothing will supersede the following: Alcohol 1 pint, extract of logwood and tincture of iron each 1 oz., nut galls, pulverized, 1 oz., sweet oil 1/2 oz. mix.

Will insects preserved in a solution of arsenic have any injurious effects if kept in a sleeping room? A. We think not. Arsenic is not a volatile poison.

Where can I obtain a *Naut. Cal. Almanac*? A. Of any dealer in nautical instruments.

Can you furnish back numbers of your paper? A. Generally. Send us a list of what you require.

How can I make a cheap telescope? A. See p. 186, vol. 30.

(58) M. K. asks: Do you recommend coal tar as the best preservative for the bottom of red cypress fence posts in the ground? A. Tar dipping is very good; solutions of chloride of zinc and of corrosive sublimate are also extensively used for this purpose. Another good method is that of slightly charring the ends of the posts, as charcoal is very unchangeable, resisting perfectly the action of both air and moisture. Timber and grains of wheat and rye, converted into charcoal 1,600 years ago, at Herculaneum, remain as entire as if they had been charred but yesterday.

(59) G. says: I have a glass 55 inches long with 2 1/2 inch objective. It is a ship glass, with a power of only fifty times. You state that a glass with that sized objective may be made to magnify a hundred and fifty if it is to be used for an astronomical glass, which I often want to do. Can I have a stronger eyepiece, that I can use for such purposes? A. Yes.

What metal in common use would answer for a faucet for vinegar, and would not be affected by it? A. Block tin might be used, but faucets of wood are by far the best for this purpose.

What is the best to use on a boat to prevent its water-soaking? A. Try coal tar.

(60) S. J. L. says: I learn that Professor Bischoff, of Glasgow, filters water for drinking purposes through spongy iron and powdered limestone. The iron is procured in a powdery, spongy state by the reduction of an ore without fusion after the extraction of sulphur and copper by heat. Can you give me such information as will enable me to do this? A. Iron may be obtained in a finely divided state as the hydrated sesquioxide, by using nitric acid as the solvent and precipitating it with ammonia, decanting the supernatant liquid, and washing the precipitate several times with water.

(61) W. H. F. asks: What is best for filling such woods as walnut, butternut, oak, etc., previous to varnishing, and how is it applied? A. Boiled linseed oil and carbonate of lead is used for this purpose.

Can toy balloons be made by blowing the rubber into bubbles? A. No.

Wood expands with water, but a cord which is of woody fiber shrinks. How is this? A. Wood does not expand longitudinally, but transversely. This swelling, as in the case of the cord, causes it to twist very tightly, which accounts for the longitudinal contraction.

How can I gild or bronze the inside of a cocoa-nut shell that I have made into a bowl? A. First apply two or three coatings of boiled linseed oil and carbonate of lead. When quite dry, lay on a thin coat of gold size. This is prepared by grinding together some red oxide of lead with the thickest drying oil that can be procured, mixed, previous to using, with a little oil of turpentine, till it is brought to a proper consistence. When the size has sufficiently dried, the gold leaf is applied upon the point of a fine brush, and gently pressed down with a ball of soft cotton. The dextrous application of a camel's hair brush sweeps away the loose particles of the gold leaf without disturbing the rest.

(62) I. G. C. asks: I am making a hollow glass prism for liquids. Bisulphide of carbon smells too badly to suit me. I am informed that oil of cassia has a still higher dispersive power. Is this true? A. Yes. 2. What cement or varnish can I use, that is not permeable to or soluble in that liquid? A. Take a quantity of common shellac, dissolve in alcohol, expel the solvent by evaporation, and melt. Apply hot.

(63) G. asks: 1. Does the nickel plating process without the use of a battery, devised by Professor Stolba, give as substantial a covering as the one with a battery? A. It gives a fine covering, which is quite durable. 2. Does the Stolba process deposit any of the zinc used in the solution? A. No.

How are chloride of nickel and sulphate of nickel made? A. Chloride of nickel is formed by dissolving the oxide in hydrochloric acid. Its solution on evaporation yields green hydrated crystals. Sulphate of nickel is obtained by dissolving metallic nickel, or its oxide or carbonate, in sulphuric acid. It crystallizes in green, rhombic prisms, which require 3 parts of cold water for solution.

(64) J. P. asks: How can iron stains be eradicated without damage to the fabric? A. Wet the spot with lemon juice, sprinkle with salt, and lay in the sun to dry. Repeat the application until the stains are removed.

(65) J. T. V. asks: Can you inform me of a process for making sensitive paper? A. See p. 314, vol. 30.

What chemical is used for preparing the automatic telegraph receiving paper? A. If a current be made to pass through paper soaked in iodide of potassium, iodine will be separated at the positive wire, and a brown stain will be produced. It is more convenient to employ a mixture of equal parts of saturated solutions of ferrocyanide of potassium and iodide of ammonia, diluted with an equal volume of water, one part of each solution to two parts of water. Any kind of fine, white, unglazed paper will answer the purpose.

(66) Q. asks: How is the crystallized or frosted appearance on galvanized sheet and cast iron produced? A. Immerse for a short time in dilute nitric acid.

(67) E. E. P. asks: What is the best sizing to apply to outside brickwork before painting? A. A 1/2 boiled linseed oil and carbonate of lead.

(68) J. D. asks: Is there any liquid substance as subject to capillary attraction as water, and not so easily evaporated? A. We know of no such liquid.

What would be the result if an irresistible came in contact with an immovable? A. The supposition is absurd, for there can be neither except as mere metaphysical conceptions.

(69) M. B. asks: 1. Where should a tree one hundred feet high break, in order that the part broken off may reach from the top of the stump to a point on the ground fifty feet from the root of the tree? A. A 137 feet 6 inches from the ground. 2. Will you please give me a rule by which all such examples can be worked? A. See Euclid, Book I, Prop. 47. "The square of the hypotenuse of a right-angled triangle is equal to the squares of the sides which contain the right angle."

(70) A. G. Jr. writes to correct statements made in our answer to A. F. on p. 135, current volume, in regard to the Leclanché battery, which were founded on misconceptions of its real action. In the Leclanché, the conditions of ordinary batteries are not changed. In this, as in all other forms of battery where it is used, zinc is the electro-positive element, or one acted upon. The electromotive force of a Grove being 100, this is 75 and Daniell's 50; or 3 cells of this battery are equal to 4 of the Daniell's. It cannot be driven to do more than a limited amount of work (running down in a very short time if kept on closed circuit), and therefore continues its usefulness for a very long time.

(71) H. C. W. says, in reply to W. F. S., who asked as to the action of oils on rubber: Some time ago I put some kerosene oil in a bottle, closed it with a rubber stopper, and laid it down on its side, so that the oil came in contact with the rubber. In a day or two, I found the oil had swelled the rubber to about twice its original size, and forced it out of the bottle, spilling the oil. On drying the stopper, it took its original size and shape.

(72) H. P. says, on producing musical tones from thin globes: I hear that it is now very difficult to find glasses which will produce a clear musical tone. Fine glass of old manufacture is lead glass, and has a beautifully brilliant appearance; and when struck, it gives a very clear note. If the edge is thin, it is very easily thrown into musical vibration. But very little of this glass is now made; a year ago there were but two manufacturers of it in this country, and one of those gave it up during the past year. The manufacture of lime glass has been so very much improved within a few years that it is taking the place of the more expensive lead glass, and it is sometimes difficult, even for an expert, to tell by the eye which is which, but when the glasses are struck, there is longer any doubt. The lead glass gives a pure clear tone, in comparison with which the sound from the lime glass is weak and harsh; and no amount of rubbing will bring a note from the edge of the lime glass.

(73) J. H. G. says, in reply to H. H. M., who asks: "What will burn coal so that the heat of the steam will not cause it to run or melt?" I have an old fashioned steep shingle roof that I had covered with English roofing felt; then I had coal tar applied (about five feet square at a time) and then I sprinkled clean coarse sand on the tar. So far it has made a good, cheap roofing, which does not run. The roof is quite a steep one, and the tar was applied last August.

(74) J. K. says, in answer to C. M. C.'s question as to thumping in an engine: I think the center of piston and the center of crank pin are not in a straight line, and that the crosshead is too loose.

MINERALS, ETC.—Specimens have been received from the following correspondents and examined with the results stated:

G. F. F.—It is an impure quartzose rock, colored by sesquioxide of iron.—A mineral sample with the same oradness contained galena.—E.—It is a quartzose pebble, with a seam coated with oxide of iron.—I. B. P. L.—Both specimens are chiefly microscopic crystals of magnetite, together with crystallized fragments of zircon and quartz.

P. B. asks: How can I get rid of rats, otherwise than by poison or traps?—M. A. H. & B. ask: 1. Will an 18 inch ourstone mill grind corn into good meal? 'The mill is an under runner, tung stiff on the spindle, with a dress quite deep at the eye but shallow at the skirt; speed from 400 to 600 revolutions per minute. Some old millers say that such small stones have to be set so close that the meal will heat, and the speed is so high that the grain will be thrown out before the grinding has been completed. They also declare that such a mill will take more power than an upper runner of 48 inches diameter. Is this so? 2. We have a horse water power; how much corn ought this to grind per hour?—B. G. B. asks: Of what material is the reed of the euphonic whistle, sometimes called the prairie whistle, made?—W. W. B. asks: What is the mode of operation for isochronizing the hair or balance spring of a watch?—A. F. W. asks: How shall I make a good article of caney, of various flavors?—T. S. M. & Co. ask: How is manganese converted into manganite?—J. McD. asks: What is the best method of drying corn and corn meal on a small scale, so that the meal may be shipped without danger of heating? Is it better to dry the corn or to dry the meal?—W. H. R. asks: How can I make muriatic salts of nickel?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On a Sliding Face Plate. By E. B. W.
On a Siphon Ram. By B. F.
On the Sun and the Earth. By W. L.
On Copper in Mineral Springs. By J. N. P.
On Scientific Truths. By A. M.
On the Squares of Numbers. By E. B. W.
On Lacing Belts. By C. McC.

Also enquiries and answers from the following:

K. L.—I. D. I. S.—C. W. C.—C. S. B.—G. W. B.—E. L.—J. S. J.—H. I. M.—J. K. P. W.—C. E. S.—L. S. H.—J. C. K.