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. Jr. 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 gilding 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. 331, vol. 29.—E. P. M. and S. G. A. will find directions for bronzing on brass on p. 321, vol. 26. 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 kalsomine) 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. 90, 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. 29.—C. E. H. will find a description of a petrifying process, applicable to dead bodies, on p. 22, vol. 29.—G. A. S. should refer to p. 266, vol. 31, for a method of preserving flowers. For directions for crystalizing 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 0°? 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 tun. We can get slack or fine coal for about $2 50 per tun. 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 less 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 braze 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 72 feet wide over all. Would a model, 5 feet 3 inches long, 9¼ inches wide, 3¼ 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. Sweet 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 be down as up, and, that the only proper way is to have the tubes terminate in a chimney. I can see that he 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, ¼ inch thick and 14 inches wide: it travels 2,013 feet per minute, and is 44 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 5·8 parts of the salt. 2. How is the mottled or crystaline 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-metallurgy? 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 zincalone. 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 it's 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 barness, 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 2½ 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 calciminting 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 calciminting, 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 blower wou'd 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, 6.8.9 yards; German long mile, 10,126 yards; German geographical mile, 8,100 yards; German sea mile, 2,025 yards. 2. How long is a German foot? A. Prussian and Danish foot is 1·049722 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 Petalg. (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 answer as 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. 122 vol. 30.

What is the length of the steamship Great Eastern? What is the size of her engine cylinders, and how many tuns 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, 261½ tuns. She indicated, on this journey 7,852 horse power, by both sets of engines.