W. J. R says: 1. I have always had a taste for machinery and mechanical engineering; I have studied several books pertaining directly to these subjects, as well as understanding geometry quite thoroughly, and algebra as far as cubic equations. I am now trying to get into a machine shop as an apprentice, believing that the theoretical knowledge I can gain from books, backed by the practical, obtained in the shop, will fit me much better for a mechanical engineer than the former alone. Would you advise me to do as I propose? If not, what course do you think I should pursue? A. We think that your plan is a very good one. 2. What are the best works to perfect me as a mechanical engineer? A. We can recommend all Bourne's works on the steam engine. You should also have a good work on physics, such as Ganot's or Deschanel's, and a reliable treatise on workshop practice, such as Knight's "Mechanician and Constructor," or the "Machinist's and Millwright's Assistant." You will also need a work on drawing.

T. H. C. asks: Can you give me the actual number of pounds of power which constitute a horse power? A. The horse power of an engine or a machine is a unit, originally adopted by James Watt, and now generally accepted by engineers. It is the amount of work required to raise 33,000 pounds one foot high in one minute, or, as it is commonly stated, a horsepower is 33,000 foot pounds. 2. Is there any given number of pounds, tested by dynamometer, that will equal the actual power of the horse? A. A. See p. 320, vol. 28.

G. D. R. asks: 1. Would there be a gain in power in making a three cylinder steam engine, by putting the three cylinders equidistant in a circle and attaching the piston rods to the same crank? A. Such an engine is manufactured in England, and has been described in our columns. See p. 291, vol. 29. 2. Is there any simple test for detecting adulteration of linseed oil? A. It should have a specific gravity of 0·9395, at 55° Fah.

V. says: Let there be given two boilers, A and B. A has two cylinders attached to it, the diameter of each of which is 6 inches. B has one, of which the diameter is 8·486 inches. All other things being the same, would a combination of the power of the steam that issues from the cylinders of boiler A be less, equal to, or greater than the power of the steam that issues from the cylinder of boiler B? The areas of the two cylinders of the boiler A, taken together, are just equal to the area of the cylinder of boiler B. A. If you mean to ask which will use the most steam for a given power, or alcohol can be attached to the other end of the cord, the single or the double engine, we would say the latter.

B. F. W. says: A friend of mine built a mill with an overshot wheel 18½ feet in diameter; and instead of running the water over it in the ordinary way, it comes to the top of the wheel and makes a half turn, thus running backward or toward the flume instead of running from it. Is there not a loss of power in running it in this way, by suddenly changing the course of the water? If so, how much? A. There is a loss of power corresponding to the loss of velocity occasioned by the turn.

G. D. F. asks: How can I raise a quarter ounce weight half an inch high, by mercury or alcohol put in a bottle or a tube? A. We do not get a very clear idea of what you mean. If you intend to have the weight suspended by a cord over a pulley, some mercury or alcohol can be attached to the other end of the cord, to raise it. By means of a bent tube, the weight placed in one legcan be raised by the preponderance of mercury or alcohol in the other leg.

N. O. B. asks: 1. Has the magnet ever pointed due north? How much does it vary now? A. The variation differs, and is constantly changing at different points of the earth's surface. There are points in which there is no variation. 2. Is there any person who makes a business of making poetry, and where can I find him? A. We think that the editor of nearly any paper devoted to general literature can give you the address of a number of such persons. 3. Is there any pump that will pump water enough to drive itself? A. No.

W. D. S. sends an insect which has excited considerable curiosity, as to its origin and what it eventually turns into. It was first seen in a small stream of clear water. which runs only in wet seasons. The insect looked like bright red blood; but on close inspection it proved to be a small worm. The worms accumulated until there was a mass which sparkled and glistened in the sun. I cleaned out the stream, but the next day another mass had accumulated. They are constantly in motion in the water; and when out of it and left dry, they soon die. I send a sample in a bottle. A. The insect is a specimen of *canthocamptus*, a genus of *monostraca*, of the order *copepoda*, and family *cyclopidæ*. Characteristics: Foot jaws small, simple; inferior antennæ, simple; ovary single. Four species, one aquatic, three marine. *Canthocamptus minutus*: Thorax and abdomen not distinctly separate, consisting of ten segments successively diminishing in size, the last terminating in two short lobes, from which issue two long filaments, slightly serrate on their edges; antennæ short, seven-jointed in the male, nine in the female; inferior antennæ simple, two-jointed, the first joint with a small lateral joint, terminated by four retæ; feet, five pairs. Common in ditches,color reddish, length about 0·66 inch. "Micrographic Dictionary," Griffith & Henfrey. Dr. Parnell states that the Lock Leven trout owes its superior sweetness and richness of flavor to its food, which consists of small shellfish and *entomostraca*. These animals abound in both fresh and salt water. The ova are furnished with thick capsules, and imbedded in a dark opaque substance, presenting a minutely cellular appearance, and occupying the interspace between the body of the animal and the back of the shell. This is called the ephippium. The shell is often beautifully transparent, sometimes spotted with pigment; it consists of a substance known as chitine, impregnated with a variable amount of carbonate of lime, which produces a copious effervescence on addition of a small quantity of acid; and when boiled it turns red, like the lobster. Sometimes it consists of two valves united at the back, and resembling the bivalve shell of a mussel others are simply folded at the back, so as to appear like a bivalve, but are really not so; or they consist of a number of rings or segments (c. minutus, for instance). All the *entomostraca* are best preserved in a solution of chloride of lime.—(Hogg's "Microscope," pp.557,558,559.) Not useful for a coloring matter.

W. F. M. asks: Why is it that in some steam engines the eccentrics are set in such a manner that, when the full throw of one is up, that of the other is down; and in others again, when the throw of one is up, that of the other is half way? A. When the eccentrics are set with centers opposite, generally one is for moving the valve when the engine is going ahead, and the other is for the backing motion. When the center of the eccentric is 90° away from the other, the second eccentric ordinarily moves the cut-off valve.

J. H. asks: What are the objections to the caloric engine? A. It is too large and heavy, on account of the low pressure generally employed.

W. B. asks: What is used to fill and make cast iron smooth before painting? A. It is generally sufficient to give one or two coats of red lead.

R. F. B. says: I wish to build a sail boat for use on a small pond, where there are some spots of low water. Which will be the best, a centerboard or a keel boat. and of what dimensions shall I make it? I want it about 16 feet long and to be a swift runner. How shall it be rigged and of what shall it be built? A. We would recommend a center board boat, cat-rigged, from 6 to 7 feet beam.

J. L. K. asks: Which runs the easier, a wagon with 4 foot wheels or one with 3 foot wheels? A. The former.

C. W. K. asks: How can I calculate rolling friction, for instance, the resistance to the movement of a car wheel on the track? Is there any work which treats on this subject? A. It must be determined by experiment. See Morin's "Mechanics," Clarke's "Railway Practice," Pambern's "Treatise on the Locomotive," Colburn's "Locomotive Engineering," and the scientific periodicals.

R. J. J. —You do not send sufficient data. The best waterwheels utilize about 75 per cent of the power applied by the water.

E. W. A. asks: Why is the name live oak applied to the tree of that name? A. The name of live oak was no doubt applied to this tree on account of its great durability, as the following quotation from Downing's "Landscape Gardening" (6th edition, p. 126) shows: "The live oak' (*quercus v rens*). This fine species will not thrive north of Virginia. Its imperishable timber is the most valuable in our forests; and, at the South, it is a fine park tree, when cultivated growing about 40 feet high, with, however, a rather wide and low head. The thick oval leaves are evergreen, and it is much to be regretted that this noble tree will not bear our northern winters."

C. R. P. asks: What is the power of a steam engine with cylinder 16 inches in diameter and 24 inches, with steam at 30 lbs. per square inch, slides cutting off at 9 inches, and running at 75 revolutions per minute? A. As we have frequently pointed out in former replies, questions of this nature cannot be answered with any degree of certainty, unless further data are given, that can only be determined by experiment. For instance, in the present case, although the pressure of steam in the boiler is 30 lbs., we can only guess at the initial pressure in the cylinder; and although the point of cutting-off is given, we cannot decide, except by experiment, whether wire-drawing also takes place. Lastly, we can only estimate the back pressure. If the case is of much importance, you had better call in an engineer.

T. J. says: I have a small bath boiler, 10 x 36 inches, to run an engine 1¾x3 inches; the fire is below one end and the heat goes up around the boiler about half way. A coal fire will run the engine slowly, but a wood fire increases the speed to about double that of the coal. I would like to know how to fix it so as to run the engine with a coal fire. It can be done by bricking the boiler in and exposing almost all of the surface to the fire; but that is not practicable in this case, as the boiler is in the third story. The engine exhausts into the chimney and is about 5 feet from the boiler. A. We do not understand whether or not you are troubled about the draft. If not, it might be well to raise your grate. If the draft is bad, probably there is something wrong with the chimney, or the manner of connection.

P. S. asks: 1. What can I saturate or paint a cubic foot of 1¼ inch boards with, to make it much harder and durable for iron to rub against? A. Timber impregnated with corrosive sublimate, resinous matters, or creosote is said to be harder than before. 2. Will it do to have a cistern sunk in the cellar of a house for holding the water from the roof, without damaging the water? Of course, I will have a drain for the over plus. A. Such cisterns are very common. 3. Is the water for roofs fit for drinking and cooking purposes? A. Yes. 4. Which is the cheapest and best for a siphon to be used for water for drinking and cooking purposes? A. Galvanized iron will answer very well.

C. McC. says: I am running an engine in a mine; the boilers are 2,500 feet from the engine. We have lately cove ed our steam pipe from boilers to engine; it takes the same pressure at boilers to do the work as before we covered pipe. J. C. thinks I had ought to run with less steam on account of the pipe being covered. I claim that it makes no difference as to pressure, but that steam can be made and kept up with less fuel on account of less condensation. Which is right? A. You do not send enough details. As a general rule, the loss of pressure is less with covered pipes than in the case where they are exposed.

A. D. P. asks: Is there any compound for removing scale in boilers, which it will be prudent to use under any and all circumstances? We are obliged to use water from various localities, and the impurities with which we have to contend are, of course, constantly changing. A. We do not know of anything of so general a preventive character.

W. C. says: 1. I have a small boiler that leaks badly under the firebox. What would be the best remedy to stop it? The boiler is 6x6½ inches, and is connected with a small cylinder, 1x2¼ inches stroke. A. A rivet or patch, if the sheet is cracked; caulking, if the joint leaks. 2. I have constructed a telescope like that described on p. 7, vol. 30, and I use a double convex lens for the eyepiece. Would a plano-convex lens magnify more? A. No.

W. S. W. asks: 1. What is the correct definition of sound? A. Sound is a peculiar sensation excited in the organ of hearing by the vibratory motion of bodies, when this motion is transmitted to the ear through an elastic medium. 2. If there were no ear, would there be any sound? A. Not as we understand it. 3. Is not sound produced only in the ear and nowhere else? A. Yes. 4. About what size are the pieces of skin which are grafted? A. See p. 312, vol. 30. 5. Is the function of the spleen known positively? A. We believe not.

W. T. W. asks: Which is the proper way to put a burr on a bolt, with the flat side towards the head, or the beveled edges toward the head? A. So that the convexity is toward the head.

W. P. S. asks: Can you tell me what course of study in mechanical engineering is necessary after leaving college, and on what terms are learners taken into machine shops and engineering works? What time is necessary to learn the trade? A. If you go into a machine shop, the pay will be merely nominal, say fifty cents a day. Many young men pursue this course with very good results.

S. P. B. asks: Upon what conditions are road steamers permitted to run on common roads, in the States where they are now being used? A. We believe that in general matters of this kind are settled by the township or county authorities.

J. H. O'K. says: A friend of mine has a 15 horse engine of about 3 feet 6 inches stroke and 6 inches bow; the engine itself runs well enough, but it "whoops" in the exhaust so much that it can be heard for nearly a mile. I contend that, if you reduce the exhaust pipe to one half its diameter and dispense with a bell which is on the top of pipe, it will avoid all "whooping." Am I right? If not, what will prevent it, as it annoys me and my neighbors very much? A. It seems probable that your plan would stop the noise, which, however, seems to give indications of a very perfect exhaust. It might increase the back pressure slightly, to make such a change as you propose.

F. D. says: 1. In the cab of a locomotive that had the vacuum brake, I saw something shaped like two long-neck squashes, joined together at the top. The firemen says that there is an arrangement inside such that, when steam is let on, it draws the air out and forms a vacuum. What is that arrangement, and is it patented? Is it as economical as a vacuum pump would be in the use of steam? A. It works on the principle of the ejector condenser, or the steam siphon. Probably it is not as economical as an ordinary pump, but it is more convenient. 2. Would not an engine fitted for steam run if the exhaust pipe were kept in a vacuum and the supply pipe opened into the air, without using steam? A. Yes.

P. W. D. asks: What kind of wire gauze is used for miners' lamps? A. Usually brass gauze, made of No. 20 wire, with 36 meshes to the inch.

F. H. D. asks: If it takes a certain amount of steam to drive a piston six inches, will it take as much again to drive it twelve inches, with the same pressure upon it? What is the proportion of steam between a long stroke and short stroke of piston with the same pressure upon each? A. If, as we understand your question, the full pressure of steam is admitted in each case, it will take as much more steam in the second case, as the length of the second cylinder exceeds that of the first.

P. D. R. asks: 1. Why will a spoon in a glass jar or tumbler prevent its being cracked when hot water is poured in? A. Before we attempt to give an explanation, we desire to satisfy ourselves of the fact, whether or no a tumbler, that will break if hot water is poured into it when there is no spoon present, will not break when the spoon is in it. But in attempting to make the experiment we encountered the following dilemma: If the tumbler does not break without a spoon, when hot water is poured in. what use is there of trying the experiment with a spoon. If it does break, without the spoon, our tumbler is gone, and we cannot try what might have happened with the spoon. It is evident that one and the same tumbler must be used; it will not do to compare different tumblers. If our correspondent will get over this difficulty and prove the fact, we shall repeat the experiments and work out the explanation. 2. What metals transmit heat and cold the quickest? A. Silver,gold, and copper.

A. P., of Vienna, Austria, says, in reply to A. M., who asks how to find the weight of a person's head without cutting it off: I put the person (of course naked) on a balance and get the weight of the whole body. Call this P. Have a castle large enough for a person to sit in, still leaving space over the person's head within the basin. Have a perpendicular line drawn on one side of the basin, and mark it with a scale so that you can tell, by experiment, how many cubic feet of water you have in the cask. Put water into the cask up to half its hight, and mark the place on the scale. Let the person sit in the water so deep that his head will be just out of water; mark again the place on the scale, and the difference of the two places will show exactly the cubic volume of the body without head; let us call this v. Let the person plunge entirely into the water, so that the head also is under water, and mark again the place on the scale. The difference of the number marked the first time and this number will show the cubic volume of the entire person including the head; let us call this V. Now, of course, different volumes of the body belong taken, their weights must be in proportion to their cubic volume, and therefore V : (V—v) : : P : x, where V is the cubic volume of entire person and v the cubic volume of person exclusive of the head; therefore, V—v= the cubic volume of the head, and P= the weight of the entire person: and therefore x, that is the weight of the head, is very easily found.

W. D. M. says that A. L. can make artificial honey as follows: To 10 lbs. sugar, add 3 lbs. water, 40 grains cream of tartar, 10 drops essence peppermint, and 3 lbs. strained honey. First dissolve the sugar in water, and take off the scum; then dissolve the cream of tartar in a little warm water, which you will add with some little stirring; then add the honey; heat to a boiling point, and stir for a few minutes.

C. C. G. says, in reply to J. W. T. S., whose chickens suffer from cholera: Put assafœtida into their drinking water, and I think you will have no further trouble with chicken cholera.

H. A. says: In explanation of the difficulty of blowing a disk of paper from a similar disk placed on the end of a tube as illustrated in a recent number of your journal, I send the following solution, suggested by an article in the *Popular Science Monthly*, entitled "The Atmosphere as an Anvil." In blowing through the tube, the force exerted on the paper disk is confined to the area of the internal diameter of the tube, the actual increase of power given by the breath being comparatively small. This column of air, in order to displace the paper, must move a column in front, and equal to the area of the paper. The disk of card is of use only to steady the paper, so as to keep it in a perpendicular position and to keep the forces exerted in parallel lines. The stronger and more sudden the blast through the tube, the closer will be the adherence of the paper to the card.

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

O. D. R.—It consists of carbonate of lime, carbonate of magnesia, carbonate of iron, and silica —D. B.—It is sulphuret of iron.—M. S.No.1 is black oxide of manganese. If this was found at the place where your letter was written, it is interesting as being the first found in Virginia, and showing another of the few localities in the United States where manganese is found. If there is a quantity of the ore you should have it fully analyzed and reported upon. No. 2 is galena or sulphuret of lead. —W. J. C.—Shall be glad to report on the character of the specimens you send, and, if truly valuable, to say so. —R. D.—They are garnets of different colors and varieties.—H. B. R.—Send on your specimens.—J. H. C.—It is galena or sulphuret of lead.—F. B.—No. 1 is hepatic pyrites. No. 2 is iron pyrites.—D. P. S.—The specimen contains some magnetic oxide of iron disseminated through a quartzose matrix, but no silver was found on assay.—J. M H. writes from New Iberia, La., and sends some specimens found on Petit Anse island. where the Louisiana salt mines are situated. The topography and formation of the island is rather curious, being a succession of hills and valleys, rising suddenly from an endless salt marsh which surrounds it. The specimens were taken from a deep run through one of the hills. The lead-looking particles in the sandstone exist in considerable quantity. They have excited much curiosity. A. The bright crystals of black color and metallic luster are rhombohedral crystals of specular iron ore. Much of it is attractable by the magnet, and can be picked out from the sand by running a strong magnet through it. Some of it contains a certain percentage of titanium. The minute crystals are delicately tinted pink crystals of quartz.

C. H. F. asks: What is slater's cement composed of?—T. M. P. asks: How can I construct a simple and cheap dry house for drying fruit on a small scale?—O. J. T. asks: 1. How can I case-harden breech actions of breech loading guns, to give them the clouded appearance? 2. How can I color twist and laminated steel shot gun barrels to make them show the twist, as we see in imported ones?—S. H. R. asks: From whom did the negroes spring, and what causes their black color?—R. P. asks: How can I make paper impenetrable to linseed oil?—B. F. B. says: There is a problem which some one has found in a work published many years since which is as follows: "A man at the center of a circle 560 yards in diameter, starts in pursuit of a horse running around its circumference at the rate of one mile in two minutes; the man goes at the rate of one mile in six minutes, and runs directly towards the horse in whatever direction he may be Required the distance each will run before the man catches the horse and what figure the man will describe." I hardly think it admits of a solution under the above conditions: but were they reversed, that is, if the man were running at the rate of one mile in two minutes, and the horse one mile in six minutes, what would the answer be?

COMMUNICATIONS RECEIVED.