

(25) W. A. W. asks: 1. How thick ought a cylindrical boiler of cast iron to be, to sustain a steam pressure of 5, and 6, atmospheres? The cylinder is about 10 inches diameter. A. If not more than 12 inches in diameter, make it from  $\frac{3}{8}$  to  $\frac{1}{2}$  of an inch in thickness; but better still, do not make the boiler of cast iron. 2. What should be the diameter of the safety valve? A. Three fourths of an inch.

(26) W. D. and others: Our opinion is that power will always be got from coal for at least one fiftieth part of the cost of getting it from electric motors, using acid and zincs.

(27) T. C. C. says: I have a pump of which the pipe runs 12 feet horizontally and 8 feet perpendicularly. Would there be any difference in the pressure if the same pipe be all perpendicular? A. Yes, as we understand your question.

(28) E. asks: How much more steam does it require at 100 lbs. per inch to produce the same result with a plain oscillating cylinder, taking steam through the side to full stroke (as it must do), than it does with a stationary cylinder, using a slide valve and cutting off the steam at the most economical point? I think that a better result would be attained with oscillating cylinders than could be obtained with the slide valve, provided that the slide valve had no lap or lead, taking steam to full stroke, from the fact that the ports of the oscillating cylinders open almost instantaneously and at a point where the piston is traveling at its slowest; whereas, with the eccentric movement, no such rapid change can be attained. A. There are oscillating engines with ordinary slide valves in use.

(29) J. A. C. says: A saw was burnt, and, as the new one came to the mill, the men remarked: "We'll need a blower to make steam enough to drive that big fellow." I said: "I don't think you will need any more steam for the same work than for the little old one." The men were all against me. All things else being equal, does a large saw require more power than a small one? If so, why? A. All other things being equal, the large saw would require the most power, since the resistance is overcome at the end of a longer lever arm, the lever arm to which the driving force is applied remaining the same.

(30) J. E. (t. asks: What is a safe working pressure for a flat cast iron boiler, head  $\frac{3}{4}$  inch thick and 15 inches in diameter? A. About 50 lbs. per square inch.

(31) W. & B. ask: Is there a treatise published, explaining how to set a steam flue boiler, over a brick arch, so as to use the least possible amount of fuel? A. We do not know of any book that gives precisely the information you want. You will find some valuable hints in Wilson's "Treatise on Steam Boilers," and "Heat and Steam Engines," by Professor Throwbridge. See our advertising columns for booksellers' addresses.

(32) H. C. McE. asks: Enclosed find a piece of scale taken from a boiler. What will loosen it from the boiler? A. The best plan is to prevent the formation of scale by the use of a good feed water heater and frequent blowing. You can soften the scale somewhat, by hauling the fire at night, and leaving the water in the boiler until next morning.

(33) Mc. Bros. ask: Is there a work on the care and management of ordinary steam engines and boilers? A. We do not know of any such work. A great deal of information is scattered through treatises on steam machinery, and appears, from time to time, in scientific periodicals. The most valuable information is, however, unwritten, and can only be acquired by experience.

(34) C. M. B. asks: Can the tone of organ or flutina reeds be changed? If so, how? A. It can be done by changing the length of the vibrating part of the pipe or plate. Most wind instruments are arranged so that this adjustment can readily be made.

(35) M. E. J. asks: What is the rule for setting iron buggy axles, front and behind? A. There is considerable difference of practice, and beyond setting them so that the wheels will clear, we do not think there is any definite rule. Some of our readers will please correct us if we are in error.

(36) J. O. S. says: 1. I wish to build a flat bottomed steam pleasure boat, 16 feet long by 6 feet wide, with side wheels. How will a portable engine work in it, to run by a belt, and how many horse power should there be in proportion to that size boat? A. It will be better to discard the belt. Use an engine of from 2 to 3 horse power. 2. Is any license required to run such a boat on a river? A. Yes.

(37) E. S. S. says: I have some boxwood that I wish to make into croquet balls. It requires the whole size of the stick for a ball. Can it be seasoned without checking for next spring's use? A. Allow it to season slowly, in a moderately cool place at first, and finally in or near a chimney corner.

(38) W. E. H. asks: What is the process of manufacturing the small round glass beads which are sold by the pound? They seem to have no fractured edges. A. They are made from tubes cut into the proper lengths, the sharp edges being rounded by fusing, being heated in sand to prevent their fusing together.

(39) D. H. L. asks: Are the trade dollar coins issued by the United States government stamped or molded, to give the impressions? I wish to make similar medals. A. They are struck; but for your purpose it would doubtless be better to cast them.

(40) G. M. R. says: Suppose a locomotive engine is running at the rate of 30 miles per hour, in full fore gear, and is suddenly reversed to full back gear. Is there much danger of the cylinder heads being blown out? A. No. The danger would be of breaking some of the moving parts.

(41) J. O'C. says: In your answer in regard to belts on pulleys, you say: "Belts will move towards that part of the pulley where the radius is the greatest." I discovered this highside theory to be a fallacy in 1855. Let a main line of shafting be lined up by any of the usual methods; then the countershafts can be made right by moving them until the belts run even on the pulleys. In most cases, this can be done when the machinery is running. It is an expeditious and accurate method. A. You confound two distinct cases. Our remark had reference to two pulleys whose axes were parallel, one of the pulleys having a swell or convexity. Your illustration applies to the case in which the axes of the two pulleys are not parallel, and different principles are applicable. You will find this case ably treated in Professor Rankine's "Manual of Machinery and Millwork."

(42) R. T. asks: Would the compressing of a bale of cotton at a power of 1,000 tons injure the staple? Would the oily nature of the fiber of the cotton be impaired when compressed so compactly? Would the density of such packing render it more expensive to the manufacturer in giving it the flexibility required? A. We see no objection to any degree of compression, and the ordinary practice in commercial circles confirms this view.

(43) S. S. B. says: 1. It is stated in Auchincloss' "On the Slide Valve and Link Motion" that an engine of the Allen type, under Mr. Porter, attained the rapid piston speed of 1,400 feet per minute. Is this correct? A. Mr. Auchincloss is a very reliable engineer, and such a statement coming from him is worthy of full confidence. 2. How far is it from the Battery to Central Park, through Broadway and Fifth avenue? A. About  $\frac{1}{2}$  miles.

(44) C. H. S. says: I am building a steam yacht, length 18 feet, beam 5 feet, cylinder of engine 3x4 inches. What would be the best dimensions of screw to get the highest rate of speed, and how fast could such a boat be driven, provided that she be very sharp and with good lines? A. Screw, from 16 to 18 inches diameter, with 34 to 36 inches pitch. Six or seven miles an hour would be a very good performance.

(45) C. M. B. asks: Would it be safe to make the firebox of an upright boiler of cast iron, cast in one piece and made very heavy? A. No.

(46) W. G. asks: How many square inches has a 7 inch piston? A. About 38-45. To find the area of a circle, square the diameter and multiply it by 0.7854.

(47) W. W. G. asks: 1. What proportion should the suction pipe of a direct-acting steam pump have to the size of the water cylinder? A. Make it so that the velocity of the water shall not be over 800 feet a minute. 2. What is the velocity of water flowing into a vacuum under atmospheric pressure? A. It will depend upon the orifice, being about the same as water would have in flowing into the air under a head of 34 feet, plus the head required to overcome the friction in the pipes.

(48) J. M. says: Let there be four steam engines, similar in all respects with the exception of their cylinders. The mean pressure per square inch, the length of stroke, and the number of strokes in a given time are all equal, but the diameters of the cylinders are 8, 10, 12, and 14, respectively. Would the horse power of the four engines be in the proportion 8, 10, 12, and 14? A. Neglecting friction and other prejudicial resistances, the powers would vary as the squares of the diameters of the cylinders.

Are there any steamers provided with two steam engines, and do these engines work simultaneously? A. Such an arrangement is quite common.

(49) J. F. says: I wish to make my greenhouse tighter by putting the laps of the glass. Ordinary putty comes off after a year or two. Can you suggest a mixture, to be applied with a putty knife, that will adhere permanently and can be removed, when necessary, for repairs? A. Use soft putty, composed of 10 lbs. whiting, 1 lb. white lead,  $\frac{1}{2}$  gill olive oil, and sufficient linseed oil to give the mixture the proper consistence.

(50) D. D. P. asks: 1. Which kind of wood is best for railroad ties, oak, chestnut, or other kind? A. Oak is the best material. 2. Which is best to preserve them? A. The Bethel process of preservation, used in Europe, and to some slight extent in this country. 3. How long will one last if prepared with coal tar? A. A proper treatment is said to double the duration of service of a tie, making it last from 14 to 20 years.

(51) M. G. asks: 1. How is brass spun, and what tools are used? A. It is secured to a revolving mandrel on which the pattern is fixed, and pressed up against this with a blunt tool. 2. How many pounds pressure will a copper boiler, 3 feet long, 11 inches in diameter, and  $\frac{1}{2}$  inch thick, stand? A. About 60 lbs. per square inch.

(52) G. asks: How is lead given to the valve of a hoisting engine, running both ways with only one eccentric? The cam or eccentric rod works on an upper and lower hook of a rock shaft. How much should the valve overlap the port? A. The lead cannot be quite equalized by this arrangement, and you can probably adjust it best by a few trials.

(53) J. M. R. asks: 1. What is the composition of the cheapest brass? A. Apply to a cheap brass founder. We have seen so-called brass of such poor quality that but for its color we should have judged it to be lead. 2. Can bronze be cast in other than clay molds, renewed for each cast? A. Metallic molds are frequently used. 3. Is there any composition of metal which, while cheaper than brass, will be as hard and as tough? A. No. 4. What will prevent common gray iron from rusting? A. It can be covered with varnish or other preparation to keep off the air.

(54) W. J. P. asks: What is the best means for consuming smoke? We have two Cornish

boilers, 30 feet long by 4 feet diameter, with return flues 2 feet in diameter, and 5 feet furnace. We use soft coal which throws off a very thick smoke. How can we burn it? A. No general rule can be given. There are a number of patent furnaces for completing the combustion.

(55) C. W. asks: Why is it that, when the water in a boiler gets low, the steam becomes blue? A. It becomes so hot that it does not condense readily.

A friend of mine says that the water is not forced into a pump by the air, for if so, how does the water come up the drive wells? He says that there is no air at the bottom of the well. I think that there is air in the ground that forces the water up in the pump. Which is correct? A. The water rises in such a case from the pressure due to a higher source of supply.

(56) B. & H. say: We have put a mortise bevel wheel on our line shafting. The hangers are bolted to joists in the usual form, but it is very noisy. Is there any way to deaden the sound? A. Use cut gears, and some arrangement to make the shaft run steadily.

(57) B. G. says: Blacksmiths often have broken carriage springs to mend; and after getting them welded, it is difficult to get them tempered again. Please give me a good recipe for tempering them. A. Harden the spring in the usual manner, and draw the temper by heating to a temperature at which oil or tallow will just take fire.

(58) D. B. S. asks: What is the best composition to cast in brass molds, to be hard and strong and take a fine impression of small lines, figures, etc.? A. White metal is ordinarily used for such purposes.

(59) S. G. asks: What will be the flow of water per minute through a pipe under the following conditions: The pipe is 3 miles long, 20 inches in diameter, two thirds full, on a descending grade of 23 feet in the whole distance. The head pressure is no more than enough for the supply. Can you give a rule for such a calculation? A. By the aid of the following rules you can readily solve the example: Measure the length in feet of that part of the girth of the pipe which is in contact with the running water, and the sectional area in square feet of that part of the pipe which is occupied by the water, calling the first quantity  $b$ , and the second  $A$ . Also measure the length of the pipe,  $l$ , and the diameter  $d$ , taking both dimensions in feet. You can then calculate a coefficient of friction,  $f$ , by the rule,

$$f = 0.005 \times \left(1 + \frac{l}{12d}\right), \text{ and the total friction, } F, \text{ will be } F = f \times \frac{l \times b}{A}.$$

which the water is flowing, or the total grade,  $h$ , and the velocity in feet per second,  $v = 8.025 \times \sqrt{h}$ .

These formulas will give a close approximation of  $v$ .

having been constructed from careful experiments. There are, however, so many things that are apt to affect any particular ease in practice that an absolute result cannot be obtained except by a test.

(60) R. M. asks: 1. At what heat will fowl's eggs hatch in an oven? A. 102° to 104° Fah. 2. How are hatching ovens constructed? A. You will find a full description on p. 428, *Science Record* for 1873. 3. Are chickens so hatched as strong and healthy as those hatched by a hen? A. If proper care is bestowed upon the eggs while hatching, the chickens will be strong and healthy.

(61) H. A. S. asks: 1. What elements may be detected by the spectroscopic? A. Potassium, sodium, lithium, rubidium, cesium, barium, strontium, and calcium are the elements sought for in the usual course of spectrum analysis. 2. What is the usual charge for spectral analysis, when further examination is not required? A. From \$1 to \$10, according to the difficulty of the examination and the number of the substances to be examined for.

(62) G. P. asks: What is the best part of the States to go to, to shoot prairie chickens and other game? A. Iowa is considered the best State for prairie chicken shooting; but it is rather late in the season for good shooting at these birds. You would probably get the best sport during this month in the State of Georgia, making headquarters at Savannah. The game would be snipe, woodcock, quail, and duck. In some parts of this State, good wild turkey and deer shooting is to be had.

(63) H. J. E. asks: Has skilled labor advanced or receded in price in the United States since the introduction of factories, machine shops, etc.? A. It has advanced.

How does the gold dollar of the United States compare with the coin of other countries in fineness? A. The law of the United States, passed in relation to this subject, is as follows: "Be it further enacted, That the standard for both gold and silver coins of the United States shall hereafter be such that, of one thousand parts by weight, nine hundred shall be of pure metal, and one hundred of alloy; and the alloy of the silver coins shall be of copper, and the alloy of the gold coins shall be of copper and silver, provided the silver do not exceed one half of the whole alloy. The English pound has 916 grains pure gold in a thousand, the twenty franc piece of France has 898, the Austrian ducat has 986.

What wood is best for lightness, elasticity, and durability? A. Try lancewood. Your other questions are not suited to our columns.

(64) F. E. R. asks: At what speed would an engine having 2 inches bore and  $\frac{1}{2}$  inches stroke drive a boat 18 feet long, 5 feet wide, and drawing 4 inches of water? The engine will have 100 revolutions per minute and 50 lbs. steam. A. The engine would be entirely too small to give a satisfactory result, unless a much higher pressure of steam, and greater piston speed were employed.

(65) A. R. & G. K. ask: 1. What number of revolutions is perfectly safe for a 24 inch grist millstone of sectional French burr, imbedded in cast iron band with plaster of Paris? A. Each maker generally gives a table of safe speeds for his mills. 2. How much more power will be required to drive a 24 inch millstone if driven by a 20 feet countershaft than if driven direct from the driver wheel, all things being properly arranged? A. Probably about 5 per cent.

Our water contains iron. Is it safe to use in a boiler that cannot be scoured out or cleaned except by blowing off through the ordinary style of mud valve? A. From your experience, we judge that it is quite safe.

(66) G. W. K. says: I have a foot lathe with only one speed. The driver is 20 inches in diameter by 3 inches face; the driver, on the lathe spindle, is 3 inches in diameter. I want to fix it so as to run a small emery wheel and circular saw, and I purpose to belt from the face plate on to the arbor. How large should the pulley on the face plate be? A. You may have to use a countershaft to get up the speed. A 6 inch emery wheel should make about 2,400 revolutions a minute; an 8 inch, 1,800; a 12 inch, 1,200.

(67) V. M. J. says, in reply to E. M. C., who speaks of difficulty of running his engine on account of heating of bearings: The construction of the engine and the comparative steam pressure has much to do in the case. If the crank is overhung, and high steam pressure is used, 80 or 100 lbs., there will probably be considerable spring to the shaft when the engine is working full, with the size of shaft as given,  $3\frac{3}{4}$  inches. Again, the shaft may not be lined properly, in which case it will be impossible to run without heating or knocking; and although the crank may be in line with the cylinder, it may not be in line with the slides, or the wrist may not put in square with the face of crank. Any one or all of these errors may be the cause of the trouble.

(68) E. B. W. says, in reply to F. J. H., who asked how to calculate the distance between two points on the surface of a globe, angle and radius being given: Multiply the radius by  $628318$ , which gives the circumference of the globe; then  $360^\circ$ : the given angle:: circumference: distance between proposed points measured on the surface. The distance measured on a straight line may be found by a simple operation in triangulation.

(69) B. K. W. says, in reply to R. C., who asks if there is any way to test the sourness of vinegar: I find that the pickle manufacturers use the soda test, as follows: Put in a proof glass 1 oz. of vinegar, weigh out a certain number of grains of English bicarbonate of soda, and slowly drop it into the vinegar until it ceases to foam. If it will stand 35 grains, it is fit for their use: but much less strength would do for table use.

(70) A. L. W. says, in answer to R. O. B., who asks for a rule for finding the radius when an arc and its chord are given: The logarithmic sine of  $\frac{1}{2}$  the arc is to  $\frac{1}{2}$  the chord as the logarithmic cosine of  $\frac{1}{2}$  the arc is to the cosine of  $\frac{1}{2}$  the arc. That is:  $\log \sin \frac{\text{arc}}{2} : \frac{\text{chord}}{2} :: \log \cos \frac{\text{arc}}{2} : \cos \frac{\text{arc}}{2}$ .

$$\text{Then: } \frac{\left(\frac{\text{chord}}{2}\right)^2 + \cos^2 \frac{\text{arc}}{2}}{2} = \text{radius.}$$

(71) A. W. S. says, in reply to several correspondents, who asked how to keep cider sweet: Fill a barrel with new cider, plug it up with a cork, and through the cork put a lead pipe. Bend the pipe over and put the other end in a pail of water. This will allow the gas from the cider to pass off through the pipe, and the water will keep the air from getting into the barrel.

W. S. M. asks: What chemicals will keep tallow in solution with crude petroleum at a low temperature?—J. E. W. asks: How can I tin small lead castings?

#### COMMUNICATIONS RECEIVED.

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

On Mind Reading. By W. E. H.  
On Coinage Free of Charge. By A. S. S.  
On the Spider's Ingenuity. By I. T. T.  
On Patents and Patent Laws. By G. W. P.  
On Powdered Fuel. By J. J. S.

Also enquiries and answers from the following:

J. H.—W. B. R.—C. T. S.—V.—A. N. W.—J. F. T.—C. L.—D. de F.—A. R. J.

#### HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all, but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of enquiries analogous to the following are sent: "Who makes the odontograph, for laying out teeth of gear wheels? Who sells diamond drills? Who sells lithographs of marine engines? Who makes the best evaporator, heated by steam? Who sells nail making machinery? Who makes drive well apparatus?" All such personal enquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.