

(25) J. W. H. says: Fire balloons made of tissue paper occasionally take fire from the blaze of the alcohol. How can the lower part of the balloon be made fireproof? A. Try steeping the paper in a solution of tungstate of soda. See article on p. 55, vol. 32.

(26) E. B. McG. asks: 1. How can I bring tin to a liquid condition? A. We do not know of any method better than melting it. 2. How can I powder tin? A. Tin may be very finely granulated by first heating to bright redness and immediately pouring from some height into a vessel of cold water through a wet broom or sieve.

(27) M. V. O. says: In your reply to C. W., you say that the water in the drive well rises by the pressure due to a higher source of supply. If this is true, what need is there of any pump at all, and why does not the water flow over the top of the pipe? A. Your view is correct; but our correspondent's question referred to the cause of the water rising up to the level from which it was taken by the pump.

(28) O. C. asks: 1. What is the difference between the composition of gunpowder and blasting powder? A. There is no essential difference. 2. Which wood makes the best charcoal for powder, balm of Gilead, cedar, soft maple, or willow? A. Willow.

Is ivory black anything but burnt bones? A. No.

(29) W. M. G. asks: Will water or any other liquid boil away faster in the night than in the daytime? A. Not if the other conditions are the same.

What is meant by the multiplication of the cube? A. Give an example to illustrate your meaning.

I saw it stated that the cylinders of the Great Eastern were 14 feet in length; should it not be 4 feet? A. No. Fourteen feet is correct. 2. Was there ever an engine with 14 feet stroke? A. There have been quite a number.

Will a water wheel run with more force in the night than in the daytime? A. No.

(30) A. B. D. asks: If a tank has a pipe, $\frac{1}{2}$ inch, running in, and a siphon, $\frac{3}{8}$ inch, running out, the tank being empty, when the pipe running in was opened, when would the water begin to run out? A. As soon as the water level was up to the highest point in the siphon.

I am making a small steam engine, 3 inches stroke by $1\frac{1}{2}$ inches bore. Would a boiler 28 inches high and 12 inches in diameter do, and of what thickness and metal should it be? A. Make it about twice as large, of $\frac{1}{8}$ copper.

How can I remove Indian ink marks from my arm? A. We are not sure that there is any safe method. See p. 331, vol. 30.

How can I bronze a gun barrel? A. Rust the surface with chloride of antimony, or dilute muriatic acid. Then clean it, polish with wax, and apply shellac varnish.

(31) L. B. C. asks: 1. Would a 10 horse power engine raise enough water to run an overshot wheel that would give 30 horse power? A. No. 2. Would a 3 inch stream on a 10 foot overshot wheel force an inch stream up a hill 100 feet? A. No.

(32) H. S. asks: What is the shortest correct rule for getting the amount of 1 inch lumber in a log, given the diameter and the length? A. We doubt whether any general rule can be given. Of course it is easy to find how much can be cut from the log after it is squared, but frequently there are several slab boards taken off in squaring. Lumbermen, however, by a little observation, can readily construct tables, by which to estimate the contents of any log.

(33) J. C. B. asks: In driving a pipe for a well, how do you determine when you have arrived at water? A. By applying a pump, or sounding.

Will sulphur answer as well as lead to secure iron torock? A. Yes.

(34) D. H. W. asks: 1. To what class of mechanical power does the wagon wheel belong? A. It is a lever, as in the case of a locomotive. 2. Which runs the lightest, an iron axled or a thimble-skeined wagon? The iron axle is $1\frac{1}{2}$ inches in diameter, and the thimble-skeined axle 3 inches. A. Probably the question cannot be answered in a general manner, as it depends upon the friction between the wheel and the axle, and consequently upon the fit. 3. Which is the fulcrum, the axle or the ground? A. In the case of a wagon propelled from within, as a locomotive, the axle is the fulcrum. If it is moved by the application of a force from without, and the wheels revolve, the ground may be regarded as the fulcrum. It is evident, in this case, that the wagon could be moved without revolving the wheels.

(35) M. G. asks: Which will resist most pressure, a $1\frac{1}{2}$ gas pipe, or a $1\frac{1}{2}$ inch solid rod? A. The solid rod, if the material were of the same quality in each, because the section to resist rupture would be greater.

(36) G. P. asks: What causes a lathe to chatter? A. The springing of the tool or of the bar. It may be that the lathe is too light for the work.

(37) W. H. H. G. asks: Will a four-ply rubber belt be suitable for a fish elevator, the belt coming into contact with salt water and fish slime? A. We think not.

What is the process of deodorizing kerosene with chloride of lime? A. The oil is mixed with lime and heated, then treated with sulphuric acid, and washed with water.

(38) J. N. M. says: Some years ago, experiments were tried in running horse cars by means of compressed air, which was supplied in a strong reservoir at the beginning of the route. Why might not the power of a windmill be applied to condensing air into a large receiver, and the supply of condensed air used as a regular and constant motor for light or heavy machinery? A. The

idea seems good. The only way to settle definitely, whether it is so or not, is to try it.

(39) J. H. S. asks: 1. Would a cast iron tank of 1 cubic foot capacity or less, to be heated over a forge, do for melting zinc for galvanizing? A. Yes. 2. What should be used to keep the zinc from oxidizing and vaporizing? A. Use sal ammoniac with the zinc. 3. Would a hemispherical tank answer best? A. Yes.

(40) J. F. G. says: Our water reservoir is 2 miles distant, and 160 feet above our mill. What size of pipe must be laid from the reservoir to the mill, so that the natural pressure of water (at the mill) will throw a stream of water 100 feet high by the use of 50 feet of $2\frac{1}{2}$ inch hose and a $1\frac{1}{4}$ inch nozzle? A. It will depend upon the way the pipe is laid. If it is generally straight and free from abrupt changes of direction, it should be from 5 to 6 inches in diameter.

(41) F. L. K. asks: What wood makes the best patterns for light castings? A. Pine, covered with shellac, answers very well. Mahogany can be used for very nice work.

If small copper tubes be fixed in a mold, and melted brass be poured upon them, will the tubes melt or collapse? A. They would be very apt to melt.

Is there an injector that uses the exhaust steam? A. We do not know of any.

1. What are the holes through the side of the fire-box of a locomotive for? A. To admit air into the combustion chamber. 2. How can small leaks at seams and stays be stopped? A. By caulking. It is well to attend to small leaks promptly. 3. Would not the electric light be used as a headlight for locomotives? A. It would not be desirable, but it might be done. 4. How much coal will a 40 ton engine burn (on a level) to the mile, pulling a train of 20 cars weighing 10 tons each, the diameters of the drivers being 4 or 5 feet? A. From 40 to 50 lbs. 5. Why is zero on the Fahrenheit scale 32° below the freezing point of water? A. Because Fahrenheit considered the zero of his scale to be the greatest cold that could be produced.

(42) R. A. I. says: I read that steam at high pressure will not scald. Is this true? A. The statement is to be taken with considerable allowance; but the steam issuing from a tea kettle is far more likely to scald than the same quantity coming from a high pressure boiler.

(43) J. A. V. says: In your answer to W. C. R. (who asks whether, if he should take a cylinder of air with 100 lbs. pressure to the square inch, place it on a small boat, and let the air escape, the air on the outside traveling in the same direction and at the same speed as that coming out of the cylinder, it would move the boat or not) you say that the boat would move. What would make it do so? A. The unbalanced pressure opposite the place of discharge.

(44) W. M. C. asks: 1. The cylinder of my engine is of $2\frac{3}{4}$ inches bore and 4 inches stroke. By carrying 80 lbs. steam, making 150 revolutions per minute, how large a yacht can be propelled? A. Make the boat from 20 to 25 feet long. 2. How large a screw ought to be used? A. From 2 to $2\frac{1}{4}$ feet in diameter. 3. Ought the boiler to be vertical or horizontal? A. Vertical.

(45) H. W. asks: Can I ascertain the power of a locomotive from the diameter of cylinder, length of stroke, diameter of driving wheel, number of wheels connected, and weight of engine? A. No. The weight on the drivers must be given. If you suppose, however, that the adhesion is greater than the tractive force, the solution is very simple. We give the rule by which you can make the necessary calculations. The tractive force in pounds is found by multiplying together the square of the diameter of the piston in inches, the length of stroke in inches, and the pressure of steam in lbs. per square inch, and dividing the product by the diameter of the driving wheel in inches.

(46) H. L. N.—You cannot restore the peculiar finish to a knife unless you employ the original mechanism by which it was produced, namely, an emery grinding wheel and a walrus leather polishing wheel.—W.

(47) J. N. P. says: 1. I am making a small engine, of which the dimensions are as follows: Diameter of cylinder 3 inches, stroke 4 inches, with cut-off at crank angle of 135° , with lead. Exhaust closes at crank angle of 157° , and opens at extremity of the stroke. Ratio of crank to connecting rod is 1 to $5\frac{1}{2}$. I propose to use steam at 50 lbs. pressure; what would be the proper dimensions and style of a boiler for the engine, to make steam quick and use the minimum of coal? A. You should have a boiler with from 60 to 70 square feet of efficient heating surface. 2. What do you think of the dimensions of the engine? A. They are well proportioned. 3. I have discarded the slide valve, and am going to have two cylinders side by side, and use two pistons in the smaller to take the place of the slide valve; I thereby will save a greater part of the steam lost in the long ways incident to the slide valve, and avoid the enormous friction of the same. It has probably never occurred to many that, in order to move an ordinary slide valve 8 by 10 inches with steam at 80 lbs. pressure, it would require two draft horses doing their best, if attached directly to the valve stem, with no lubricant under the valve. A. We think this idea is in general very good. 4. I want to use an injector and indicator; can these instruments be used on so small an engine, and do I need verbal instruction as to their use? A. You can probably learn how to apply and use them by practice, and by studying the theory of their action. 5. How many revolutions will the engine make with 50 lbs. pressure, and no load except the friction of the engine? A. The engine might make 500 or 600 revolutions a minute.

(48) R. T. M. asks: 1. How much per cent of alcohol does lager beer contain? A. The strength of beer varies according to the quality

and quantity of the malt and hops used, and the mode of conducting each stage of the process, but especially the fermentation. If the first fermentation be stopped at an early stage, the beer will contain a considerable quantity of sugar and comparatively little alcohol; it will be mild, and if bottled will acquire the property of effervescing strongly when the bottle is opened. If, on the other hand, the fermentation be allowed to go on in the vats or casks till nearly all the sugar is converted into alcohol, and the carbonic acid escapes, the beer becomes more alcoholic. For these reasons, lager beer varies in its amount of alcohol from 2 to 10 per cent. 2. Can a grown person drink a pint of alcohol without being hurt? A. It would probably cause death.

(49) W. M. R. asks: Will strong sulphuric acid injure leather? A. Yes.

(50) H. J. S. says: Wells, in his "Philosophy," defines sound as produced by impressions made on the tympanum or drum of the ear by the vibrations of the air. If a cannon be fired far out of the hearing of any animal with the sense of hearing, would there be any sound therefrom? A. Certainly not, under the above definition of sound.

(51) O. W. B. asks: 1. Does soaking a flute in olive oil benefit it in any respect? A. We think it might possibly prevent the wood from becoming dry and cracking or warping. 2. Why are flutes with ivory heads and blow joints better than those with wood? A. The ivory prevents the instrument from getting out of tune by preserving the blow and key holes at a constant diameter. The common wooden instruments, in many cases, in a short time become utterly useless from the contraction and expansion of the wood.

(52) S. L. M. asks: What is the amount of expansion of an iron rod $1\frac{1}{4}$ inches in diameter and 35 feet long, when the thermometer rises from 10° to 75° Fah.? A. About $\frac{1}{4}$ of an inch.

(53) L. V. R. asks: How can I ascertain the number of degrees of heat required to reduce a certain metal to fusion? A. One method is the use of the pyrometer. As mercury boils at about 660° , we cannot use the mercurial thermometer for higher temperatures. The pyrometer consists of a hollow case of black lead or plumbago, into which is dropped a bar of platinum, secured to its place by a strap of platinum and a wedge of porcelain. The whole is then heated, as, for instance, by placing it in a pot of molten silver, whose temperature we wish to ascertain. The metal bar expands much more than the case of black lead, and, being confined from moving in any but an upward direction, drives forward the arm of a lever over a graduated arc, on which we read the degrees of Fahrenheit's scale. There are several forms of pyrometer, but their use for delicate work is not customary now. The arrangements now used for the determination of high melting points with the greatest accuracy are either based upon the expansion of gases and vapors, or on the electrical properties of bodies. For details, consult Ganot's "Physics."

(54) S. P. asks: Will petroleum gas answer as well as coal gas in forming a lime light? A. Yes.

(55) J. S. asks: 1. What coloring is put into spirits of wine for use in thermometers? A. The coloring made use of generally for this purpose is, we believe, annatto. 2. How can I make an alcohol thermometer? A. Obtain a glass tube having a very small even bore, and having a coil at its lower end. Fill the coil and a portion of the stem of the thermometer with the colored liquid, and boil until the air is completely expelled from the tube, which should then be hermetically sealed with the blowpipe. These thermometers are usually graduated by placing them in baths of different temperatures together with a standard mercurial thermometer, and marking on the alcohol thermometer the temperature indicated by the mercurial thermometer.

How can I mend rubber shoes? A. See p. 203, vol. 30.

(56) C. G. M. asks: 1. To whom should I apply for a license to run a steam engine? A. If it is for a license to manage a steamboat engine, you should apply to the United States Inspector. If it is for a stationary engine, there is probably a State or city inspector in your city. The customs vary in different States. 2. What are the usual questions asked by the examiner? A. The questions ordinarily refer to the applicant's previous experience, and his knowledge of the construction and management of engines and boilers.

(57) J. C. asks: What is the standard of comparison in the determination of the calorific value of fuel, and upon whose investigations is it based? In different books I find it stated that, by the combustion of one pound of carbon, sufficient heat is produced to increase the temperature of from 13,000 lbs. to nearly 20,000 lbs. of water 1° Fah. By some authors it is stated at 8,000, 8,080, etc., C. What is the present acknowledged standard? A. The unit usually employed is that first used by Rumford, who estimated the calorific power by the number of parts, by weight, of water which one part, by weight, of the body would, on perfect combustion, raise 1° in temperature. Thus one part, by weight, of charcoal, in combining with $2\frac{3}{8}$ parts of oxygen to form carbonic acid, will evolve heat sufficient to raise the temperature of 8,080 parts, by weight, of water 1° C. Estimates of this character are also made by what is known as Berthier's and Stromeyer's reduction methods. These processes consist in determining the quantity of either cupric or plumbic oxides reduced by a given quantity of the fuel.

(58) J. A. S. J. asks: How can I stain pine coffins black, to dry quickly? A. Steep the wood for two or three days in lukewarm water, in which a little alum has been dissolved, then put a handful of logwood, cut small, into a pint of water, and boil down to less than $\frac{1}{2}$ pint. If a little indigo is

added, the color will be more beautiful. Spread a layer of this liquid quite hot upon the wood with a soft brush, which will give it a violet color. When it is dry, spread on it another layer; dry it again and give it a third; then boil verdigris at discretion in its own vinegar, and spread a layer of it on the wood; when it is dry rub it with a brush and then with oiled chamois skin. This gives a fine black, and imitates perfectly the color of ebony.

(59) J. H. M. says: I have a small boat 48 inches from stern to bow, and 8 inches wide. How large an engine would it take to propel it? A. An engine with cylinder of one inch diameter will answer.

(60) E. M. asks: What will remove grease stains from marble? A. Try chloroform.

What will remove a beard from the face without using soap or razor? A. A depilatory will destroy the beard so that no future growth will take place. See p. 229, vol. 28.

(61) B. F. W. asks: 1. What is the reaction by which hydrogen is evolved when metallic zinc is boiled with K O H, and what chemical compounds are formed? A. By the action of a boiling solution of potash on zinc, hydrogen is liberated, while oxide of zinc is formed and dissolved in the alkaline solution. 2. What effect does the presence of an arsenious compound (As_2O_3) have on the reaction and the resulting compounds? A. The arsenious acid would speedily be absorbed by the potash to form arsenite of potash.

(62) C. M. F. asks: What is a good recipe for boot blacking? A. Ivory black and molasses, each 3 ozs., spermaceti oil 1 oz., white wine vinegar, 1 pint. Mix.

Can I obtain back volumes of the Science Record? A. Yes.

(63) S. A. E. asks: How are artesian wells bored? A. For a full description of the method of boring these wells we must refer you to some work on the subject. The instruments used for this purpose principally consist of long augers, chisels, gouges, etc., each one being about 7 feet long. As the hole deepens, fresh lengths are screwed on until the desired stream is reached. The most remarkable example of an artesian well is that recently formed at Grenelle, a suburb at the southwest of Paris, France, which cost eight years of difficult labor to perforate. The depth reached was about 1,800 feet. The water rose to the surface, and discharged itself at the rate of 600,000 gallons per hour. The artesian wells of Elbeuf and Tours, which were formed many years ago, overflow in never-varying streams; and the ancient artesian well at Lillers, in the Pas de Calais, has for seven centuries furnished a constant and equable supply.

How is salt obtained from brine? A. Evaporating pans are constructed of well riveted boiler plate, the shape being rectangular, the length about 30 feet, the width about 20 feet, and the depth 2 feet. These pans are supported by masonry, which also serves to separate the flues by which the pans are heated. Professor Cook's analysis of Onondaga brine gives the following percentage of dry impure salt in the brine: Syracuse 1854, Salina 14-85, Liverpool 15-86, an average of about 16-41 per cent.

(64) G. W. S. asks: 1. How can I make a cheap paint as nearly like white lead as possible? A. Use white oxide of zinc; this may be readily obtained by burning zinc with a full supply of air. 2. How can I bring it to a flesh color? A. Use carmine or vermilion.

(65) G. E. W. says: I cut to pieces a 2 cent piece and tried to melt it between two pieces of charcoal with a blowpipe and alcohol lamp, and failed. I tried borax with it and failed again. How can I melt it? A. If you use some filings of the coin and mix it with four times its weight of carbonate of soda, you should, if you are a good blowpiper, succeed with an alcohol lamp.

How can I make putty powder? A. It is readily obtained by treating metallic tin with nitric acid; violent action, attended with the extrication of nitrous fumes, occurs, and the tin is converted into a white, crystalline, insoluble mass, which is hydrated metastannic acid; after washing it with cold water, the acid, when dried and ignited, becomes anhydrous, and of a pale buff color; in this form it possesses the properties of the native oxide, and constitutes the putty powder employed for polishing plate, etc. It is also largely used for giving whiteness and opacity to enamels.

(66) G. W. W.—The reward offered by the State of New York for improved means of canal navigation expired and was settled over a year ago. No offer of reward now exists that we know of.

(67) R. D. A. says, in reply to J. G. S. who asked for a cheap paste for putting up paper exposed out of doors: Take 1 lb. white glue, soak in 1 pint water for 12 hours, white chalk 2 ozs., common resin 1 oz., white lead 2 ozs., all thoroughly pulverized and mixed. After the glue has stood the required time, dissolve it by gentle heat, then rub into it, in a mortar, the other ingredients, using only water enough to make a thick paste, in order to facilitate their union. Then add 1 pint more of water and let it boil for 10 minutes; after which add water to bring the paste to the required consistence for use. It will require to be kept warm while using.

C. H. S. asks: At what velocity must a cannon ball leave the earth so as never to return to it?—E. F. W. asks: How can I make carbons for electric lights?—J. H. asks: How can I blue lamp chimneys?—J. R. G. asks: How can I construct a cheap oxyhydrogen blowpipe?—O. F. asks: What formula is used to find the power of a wedge, having the width of the head, length of one side, and the blow in pounds given?—A. C. asks: What is the composition of percan marble?