Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

Notes & Queries

It has been our custom for thirty years past to devote a considerable space to the answering of questions by correspondents; so useful have these labors proved that the SCIENTIFIC AMERICAN office has become the factotum, or headquarters, to which everybody sends, who wants special information upon any particular subject. So large is the number of our correspondents, so wide the range of their inquiries, so desirous are we to meet their wants and supply correct information, that we are obliged to employ the constant assistance of a considerable staff of experienced writers, who have the requisite knowledge or access to the latest and best sources of information. For example, questions relating to steam engines, boilers, boats, locomotives, railways, etc., are considered and answered by a professional engineer of distinguished ability and extensive practical experience. Inquiries relating to electricity are answered by one of the most able and prominent practical electricians in this country. Astronomical queries by a practical astronomer. Chemical inquiries by one of our most eminent and experienced professors of chemistry; and so on through all the various departments. In this way we are enabled to answer the thousands of questions and furnish the large mass of information which these correspondence columns present. The large number of questions sent—they pour in upon us from all parts of the world—renders it impossible for us to publish all. The editor selects from the mass those that he thinks most likely to be of general interest to the readers of the SCIENTIFIC AMERICAN. These, with the replies, are printed; the remainder go into the waste basket. Many of the rejected questions are of a primitive or personal nature, which should be answered by mail; in fact, hundreds of correspondents desire a special reply by post, but very few of them are thoughtful enough to inclose so much as a postage stamp. We could in many cases send a brief reply by mail if the writer were to inclose a small fee, a dollar or more, according to the nature or importance of the case. When we cannot furnish the information, the money is promptly returned to the sender.

N. A. R. will find directions for browning gun barrels on p. 11, vol. 32. This also answers G. D. M., who can clean brass shells by the process described on p. 102, vol, 25.—M. L. is informed that a recipe for root beer is given ou p. 138, vol, 31.—A. D. B. is informed that there is no simple rule for the proportions of a screw propeller. He should read the subject up in the special treatises devoted to it.—O. B. S. does not give sufficient data as to his boiler.—L. T. F. and many others will find rules for calculating the horse power of engines on p. 33, vol. 33.—H. will find directions for whitening ivory on p. 10, vol. 32.—M. W. will find directions for making hard plaster of Paris on p. 43, vol. 34.—T. J. McN. should read our article on lightning rods on p. 144, vol. 31.—H. W. S. will find directions for making printers' rollers on p. 283, vol. 31.—M. A. A. will find something on cancelling postage stamps on pp. 83, 135, 266, vol. 36.—M. F. F. will find directions for removing freckles on p. 347, vol. 32.—E. R. C. will find directions for mounting chromos on p. 154, vol. 27.—E. J. L. will find a description of a galvanic battery suitable for medical purposes on p. 196. vol. 27.—W. H. C., J. J. Q., C. A. S., J. D. H., I. P., W. S., I. K. B., W. L., G. N. T., N. T., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) G. A. asks: 1. How thick must a tube of cast steel be to hold 1,000 lbs. pressure per square inch? A. These questions are too indefinite. The thickness of the tube will depend upon its size. 2. Through ¼ inch hole, how many gallons water would be forced out per minute with a pressure of 1,000 lbs. per square inch? A. The discharge through the orifice will depend upon its shape and location.

(2) A. J. C. asks: How can I make a pattern by which to cast a cam wheel having upon its outer edge three equal eccentrics? Motion is given by two levers, one above and the other below, the levers having upon each one a roller which presses upon the outer face of the wheel. thus giving three strokes of the levers for each revolution of the wheel. A. Make the outline of the cam such that all lines drawn through the center will be equal.

(3) B. I. L. asks: How many lenses, and of what sizes and foci, are required to make a camera obscura for copying pictures? A. It requires but one, and it is not material about its size and focus. One 2 inches in diameter and of 18 inches focus will answer very well.

(4) J. B. H. asks: 1. On. p. 186, vol. 36, in reply to J. N. A., you say that a horse power to 1·5 lbs. coal is among the best results. Will you state what class of boiler will accomplish this result? A. The figure represents exceptional results with marine engines having very efficient boilers, and giving a horse power with the consumption of 14 or 15 lbs. of steam an hour. 2. I suppose that the heat given up by the condensation of any given amount of steam would, if all used, evaporate an equal amount of water into steam. Is this true? And, if true in theory, about how much result in evaporation can be gotten from the condensation of a given quantity of steam? A. You will find this matter discussed in nearly any modern treatise on the steam engine.

(5) H. H. F. asks: Is the use of alum in bread and cakes, at the rate of a teaspoonful to a loaf of moderate size, injurious? A. Yes. The presence of alum in bread, in any proportion, is very objectionable.

(6) E. L. W. asks: 1. Can you inform me how metal stencil plates are prepared? A. Stencil plates are usually made of hard brass. The letters and characters, if small, are usually stamped out with suitable dies; but when large, the work has to be done by hand cutting. 2. Are they treated with hydrochloric acid? A. Not that we know of.

(7) J. D. E. asks: What are the curves and positions of the lenses of the Huyghenian eyepiece? A. There are two plano-convex lenses with their plane sides towards the eye. Their aperture is ⅓ their focal length. The field lens is of 2 or 3 times longer focus than the eye lens. Their distance apart is one half of the sum of their focal lengths: that is, if the focus of one is 1 inch, of the other 2 inches, the distance apart is 1½ inches. A diaphragm a little smaller than the aperture of the eye lens is placed between the lenses at the focus of the eye lens. For a medium power, the focus of one may be 1 inch, of the other ½ inch, etc.

(8) W. J. G. asks: How many lenses and of what sizes and foci are required for a photographic camera to take pictures 4 x 6 inches? A. It requires an achromatic combination of flint and crown glass. The diameter is not material, say 1 inch, with a focal length of about 8 inches. The smaller the lens, the sharper the picture.

(9) F. W. G. says: In a very severe thunderstorm last summer, a large brick house here was struck by lightning. An "American District" telegraph wire was connected with one of their boxes in the house. Parties at the house claim that the wire brought the lightning to the house. I say that the house would have been struck anyway, and that the wire was a protection. Who is right? A. It is most probable that the wire had nothing to do with the matter. A discharge which would damage the house would, in all probability, have fused the wire.

(10) P. M. S. asks: Can you give me some information about rosin oil? A. When rosin is distilled, it yields about 74 per cent of liquid distillates. The first portions are mobile, yellow, and strong smelling, and are known as essence of resin (colophonone). Later in the distillation the viscid fluorescent rosin oil (or pinolin) passes over. This body is used in paints, for the manufacture of printer's ink, in making soap, and as a cheap lubricant.

(11) W. E. B. says, in answer to G. S. W., who asked if there is any rule for dividing a circle into 3, 4, or more equal parts by parallel lines: He will not probably find any general rule for this purpose; but I find by calculation that the chord of an arc of 149° 16′ 30″ cuts off a segment whose area is about $\frac{1}{360}$ in excess of one third the area of the circle, and the chord of an arc of 132° 21′ cuts off a segment whose area is about $\frac{1}{1000}$ in excess of one fourth the area of the circle. These values are probably sufficiently accurate for all practical problems.

(12) A. E. F.—A good recipe for silver writing fluid is the following: Mix 1 oz. finest block tin in shavings with 2 ozs. mercury till they become perfectly amalgamated. Then shake up in a stoppered bottle with enough gum water to give proper consistence. The writing, when dry, will have the appearance of silver.

(13) H. S. asks: How is manganese obtained from the ore? A. Metallic manganese may be obtained from pyrolusite—the peroxide of manganese—by smelting at the highest heat of the blast furnace. It is, when free from carbon and silicon, a soft, easily tarnishable metal, resembling iron somewhat in appearance; and it has a specific gravity of about 7·2. It sells in small quantities for about $1 per lb. Manganese has six oxides, of which the dioxide is the most important. This occurs in Nature (in a nearly pure form) in the mineral pyrolusite, which, broken into lumps or powder, is commercially known as black oxide of manganese or simply manganese, the latter name being incorrect. The black oxide is worth from $10 to $20 a ton in New York. See p. 226, vol. 35.

(14) L. G. asks: 1. What is the greatest force, as expressed in horse power, which has as yet been obtained by means of electricity, and please tell me what is the name of the inventor? A. Professor Page, as long ago as 1850, constructed electro-magnetic engines of between 4 and 5 horse power. 2. As this power is very feeble, could I, by means of several engines working separately and giving the maximum power each is capable of, and working together on the same driving beam, obtain as great a power as desired, costing less and with less weight than from a steam engine of same force? A. No system of magnetic engines has yet been found as economical as the steam engine.

(15) J. E. S.—Your relay for submarine telegraphy might be used on lines of moderate length; but for very long lines the mirror instrument is the best.

(16) F. S. says: 1. I wish to construct a telephone. Can I be prevented from making and using the instrument by patent or other cause? A. You can make one for experiment, but could be prevented from using it after its successful working. 2. What number and length of wire should be used in the coils? A. Altogether about 190 feet of No. 24 copper wire will answer for short circuits. 3. How and of what material should the sounding plate be made? A. It can be made of thin iron. A very good description of the apparatus is to be found in Prescott's "Electricity and the Electric Telegraph." 4. Do you think a good mechanic could construct one that would work well from these directions? A. Yes

(17) J. F. says: For gumming envelopes I use mucilage composed of 2 ozs. dextrin, 1 oz. acetic acid, 1 oz. alcohol, 5 ozs. water. I am not satisfied with it. The adhesiveness is not sufficient. It is more adhesive without the alcohol. A. A strong aqueous solution of reasonably pure dextrin (British gum) forms a most adhesive and cheap mucilage. Alcohol, or rather diluted wine spirit, is usually employed as the solvent where the mucilage is to be used for gumming envelopes, postage stamps, etc., in order to facilitate the drying, and acetic acid is added to increase the mobility of the fluid. The strong aqueous solution is more adhesive than that prepared with alcohol, for the reason that it contains a greater proportion of the gum. To prepare this, add an excess of powdered dextrin to boiling water. stir for a moment or two, allow to cool and settle, and strain the liquid through a fine cloth. The addition of a little powdered sugar increases the glossiness of the dried gum, without interfering greatly with its adhesiveness. The sugar should be dissolved in the water before the dextrin is added.

(18) F. B. says: On p. 187, vol. 36, C. V. W. says that $\frac{\frac{1}{2}\text{chord}^2 + \text{height}^2}{2\ \text{height}s} = \text{radius of the circle.}$ Can this be true? I have tried it several times with a graduated beam compass, but cannot make it so. A. The rule is correct. Probably, you have made some mistake in applying it.

(19) J. H. F. says: I bought a small engine, nominally of 4½ horse power. The dimensions are as follows: Steam chest 4 x 5 inches, cylinder 8½ x 4½ inches, stroke 7 inches, upright boiler is about 6 feet high, with water space 4 feet 5 inches, and 2 feet in diameter. I have made several attempts to run a corn mill, and have tried 12, 16, and 18 inch burrs; it will pull them if they are fed sparingly, but if fed in the ordinary manner they stop the engine. If running fast, pulling the mill, the piston rod or the rod running from eccentric to slide valve bends and quivers from top to bottom. This rod has no knuckle joint, but is made thin in one place to give it the right motion. I notice that running at good speed with 60 lbs. of steam a man can stop it by simply bearing his weight against the pulley. Please tell me what power the dimensions indicate, and give me your opinion in regard to the unsatisfactory manner in which it works. A. From your account the engine does not seem to be very well constructed. We advise you to test it with a friction brake, and see how much power it can exert steadily, and how much steam is required.

(20) F. L. says: 1. How should I treat a leak in a flue of an upright boiler? When I let the water out, by the blow-off cock, I can hear the air escape out of the flue. When I have a fire under the boiler the flue does not leak at all; but as soon as the fire is out the leak begins again. A. Such a leak can doubtless be made tight by caulking, if a slight expansion is sufficient to stop it. 2. What is the best way to refit a pair of safety valve seats, the valves on which do not set very closely, and stick somewhat, after being opened by a high head of steam? A. You can grind them in with oil and brickdust or emery. 3. To have two safety valves on the boiler, is it proper to have both valves set at the same weight, or should one be a little heavier than the other, say one for 60 lbs. and the other for 70 lbs.? A. If each is large enough to relieve the boiler, they might be set as you suggest. 4. What is the cause of knocking in steam pipes? A. It is caused by water in the pipe, or condensation and sudden changes of temperature. 5. Would it not be a good plan to have hand holes in the outside shell of the boiler at the level of the crown sheet, so as to be able to clean the crown and flues with a hose? A. This arrangement is sometimes adopted.

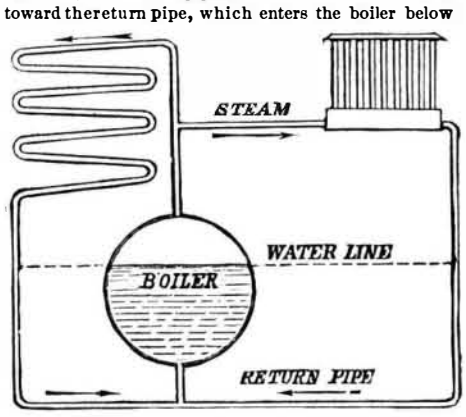
Will the rubber waterproof garments that ladies wear on damp days do to make a balloon? A. It might be made to answer very well if there was a demand for it. 2. How is this rubber material made? A. If you wish to experiment, it would be better to obtain samples from manufacturers than to attempt to make it.

(21) J. K. W. asks: What is the trouble with a double acting pump, which, in pumping from the cistern with the long suction pipe, if run very slowly (about 20 revolutions per minute) will work; but when the speed is increased to 100 revolutions, it seems to drop the water and the speed increases to 500 or 600 revolutions per minute, and it does not pump. A. The trouble is probably caused by the collection of air in the pipe. If so, it can be remedied by the use of a cock or valve.

How can I burn naphtha in a boiler furnace? A. We believe that there are special devices in the market for this purpose. Insert a notice in our Business and Personal column.

(22) J. E. asks: Can you inform me of any varnish for insulating No. 36 copper wire. I have used shellac dissolved in alcohol, but it would not answer. A. You cannot hope to thoroughly insulate helices of such fine wire by merely varnishing it. The wire must be covered with silk, cotton, or some other similar insulator. On cotton or silk covered wire, a strong solution of shellac gives very good results, and is very commonly employed. Fused paraffin waxis sometimes used, and is one of the best of insulators.

(23) C. G. L. says: You advise the use of a trap to return the water of condensation from the radiators to the steam-heating boilers. A trap of any kind is worse than useless, if the apparatus is for heating only, and all the radiators are above the water line of the boiler. It is only necessary that the pipes be of suitable size, and that all pipes and radiators shall incline toward the return pipe, which enters the boiler below



the water line. The water must stand at the same level in the boiler and return pipes, returning as fast as the steam condensed. I have known a boiler to be run for several months without the addition of any water: and in well constructed apparatus, the loss would be but a few gallons per month. The cracking and thumping often complained of is probably caused by water remaining in the pipes. This can frequently be remedied by raising any depressions in the pipe, where the water is trapped, or by taking the water from such depressions to the return pipe by a drip.

(24) J. N. says: 1. I wish to make a boiler which when finished will be exactly 30 inches high by 14 inches diameter. I intend making it of ⅛ inch wrought iron, and the boiler heads of ½ inch cast iron. Will the cast iron heads stand enough pressure to run a small engine, size 3 x 1½ inches, to do light work? A. We advise you to make the heads of wrought iron. 2. How much steam can I carry? A. You can carry about 30 lbs. per square inch.

What is the best way to clean the rust off iron and polish it afterward? A. If the work is very rusty, you can use oil and brickdust or emery, and finish with a file.

(25) J. P. G. says: 1. I would like to know the difference between phosphorus and amorphous phosphorus? A. Red or amorphous phosphorus is only a modified form—an allotropic condition—of the ordinary vitreous variety. Their chemical nature is identical, though they differ greatly in their physical properties. This difference is believed to be due to an alteration in the molecular grouping. This property is known as allotropism, a word which means simply "different states." The phenomenon of allotropism is not confined to phosphorus alone, but is more or less a property of all the elements. Carbon in one condition gives us the brilliant, transparent, and nearly incombustible, diamond; in another, the black, opaque, easily inflammable charcoal or coke; while in another we have the metal-like graphite. The red phosphorus is usually obtained by heating vitreous phosphorus for some time to, or nearly to, its point of vaporization in an atmosphere of carbonic acid or hydrogen. It is more passive or inert than white phosphorus; it is heavier, of a brick-red color, and is not phosphorescent. It does not oxidize at ordinary temperatures, and requires a much greater degree of heat for its fusion than the waxy or vitreous variety. into which it may be directly converted by heating to 500° Fah. 2. Which is used on the common matches? A. Both active and passive phosphorus are used in the preparation of matches; but the latter, although more costly, is coming into more general use in parlor or safety matches and the like, in which it is mixed with chlorate of potash to cause it to ignite readily by fric

tion. When once ignited, it burns as readily as the vitreous variety.

(26) W. P. C. asks: Can you tell me of any substance soluble in water, for which sulphuric acid (diluted) has a stronger affinity than for iron, lead, tin, and zinc? A. Your questions are rather indefinite. All of the alkalies—soda, potassa, ammonia, etc.—also some of the alkaline earths, as lime, baryta or strontia, are more or less soluble in water and have stronger affinities for sulphuric acid than iron. 2. Also any substances soluble in water for which sulphuric acid has less affinity than for copper? A. If we understand you, most of the metallic sulphates are soluble in water, and are not decomposed by strong oil of vitriol. If you mean metallic bodies, there are none that we know of that dissolve in water without decomposing it and combining with one of its elements to form bases. Platinum, silver, gold, lead, mercury, etc., are not attacked by sulphuric acid in the cold, the former not even by the hot acid. 3. Can you tell me where I can find a table showing the relative affinities of the principal metals, acids, and alkalies? A. You will find such tables in most good works on chemistry.

(27) M. E. says: You once published a recipe for milk paint which contains considerable lime. I have used it on my walls and find it very satisfactory, but knowing nothing of the effect that lime has on different coloring, I have been unable to obtain the colors I wished. Will you tell me how to produce a light buff and a brown? A. Use oxide of iron or yellow ocher mixed with a little umber for the brown. A mixture of Spanish brown with a little chrome yellow gives a good yellow. Use Vandyke brown for a strong tone.

(28) W. H. R. asks: How can I make and use a quick bleaching liquor, for bleaching cotton goods which have become yellow from long service? A. Make a strong solution of chloride of lime (hypochlorite of lime—bleaching powder) in water, allow to settle, and draw off the clear liquid. Rinse the goods in clean water containing about 5 per cent of sulphuric acid, and then pass them slowly through the bleaching solution. They should then be well rinsed in water containing a little carbonate of soda. If the cloth is much colored it may be necessary to allow it to remain for a short time in the bath. This is the usual method of bleaching in laundries.

(29) H. M. S. says: I shook some pieces of litmus in a bottle partly filled with water, until the latter became of a deep blue color. Corking it up tight, I placed it on a shelf with other chemicals, among which were several acids. About a fortnight afterwards I observed that it had turned to a yellowish brown color, quite transparent compared to what it was before. Upon uncorking it and exposing to the air, it turned gradually to a deep red or carmine on top, and this extended upon shaking until the whole liquid was so; and it became opaque again, though of a different color. Can you explain this? A. Litmus is very often adulterated with lime, plaster, Prussian blue, etc. The action you noted may have been due to these other adulterants, or to some acid impurity contained in the water used for making the solution.

(30) F. S. & S. ask: What is the best cement for filling white metal signs with? A. Try the following: Melt together in a clean iron pot 2 parts each of best asphaltum and gutta percha; stir well together, and then add 1 part of gum shellac in fine powder. It may be used hot, and mixed with smalt, vermilion, or other pigment, if desired.

(31) B. P. asks: Please give a recipe for making paste to stick bills which are exposed to the weather? A. Take flour 25 lbs., alum in powder ½ lb., boiling water sufficient quantity. Paste will not very long resist the action of wet weather, but may be made to do so by giving the bill, after sticking with it, a wash of soap water, sugar of lead solution, or a solution of crude lac in naphtha.

(32) F. S. C. asks: What will restore faded black walnut doors? They have been covered with shellac, but the color of the wood is gone. A. It will be necessary to first remove the shellac. Much of it may be removed with a little ammonia water and alcohol; but it is best to scrape off the last portions, and sandpaper the wood. If the wood is genuine walnut, a little oil will then bring out the color, and it may be finished with a good coat of copal varnish. If the doors are of imitation walnut, make a solution of 2½ ozs. Vandyke brown in a boiling solution of 1½ ozs. washing soda in 1 quart water, and add to it about ¼ oz. of powdered bichromate of potassa. Stir well together, and when cool strain through a cloth for use. This will give you an excellent imitation of dark walnut; and when dry, it takes a good coat of varnish.

(33) A. F. H. asks: How can I make a new white coating stick effectually on an old ceiling? A. It is necessary to take all the old white coat off complete, to thoroughly wet the brown coat left on, and then finish with a new white coat.

(34) W. A. H. says: I wear a small compass attached to my watch chain; and in casually looking at it I noticed that it deviated about 90° from north. I also noticed that, when I stood alongside of our safe, the compass pointed directly to the safe. I walked to the stove, and my compass again swerved; but instead of pointing directly to the stove, it pointed diametrically from it. The safe and stove are not near enough to each other to exert any combined influence. The only difference between the situations is that one lump of iron was hot and the other cold. Please give your explanation of this remarkable effect of caloric over the magnetic needle. A. The data given are not explicit enough to enable us to give a satisfactory explanation; but it will probably be found that the pole of the needle which points towards the safe varies as the former is near the top or bottom of the latter; possibly, also, the same will be the case as regards the stove. The safe or stove, or both, may have become slightly magnetic from the inductive action of the earth.

(35) W. S. says, as to the welding of the point of a spindle to the plate on which it rested, while running: We had a parallel case in our mill some years ago. The burrs were 4 feet diameter, spindle was 10 feet long, 4 inches diameter, of cast iron, with a taper steel point inserted in the spindle. The point was about 1½ inches in diameter, flat; it ran on a steel plate, above which was a collar, about 1 inch thick, fastened securely in the oil pot, which was square and always full of oil. The motion was observed to be getting slower, and something was unusual about the running of the burrs. The engine was stopped to examine, and it was found that the end of the steel point was perfectly welded to the plate and collar in which it worked. Before it could be got out, it had to be heated to a red heat in a blacksmith's fire and driven out by punching a hole through the steel plate. The tapering end, however, was loose, and allowed the spindle to revolve when the point stopped. The pot was full of oil in which the point was running. Had we not seen this, we could hardly have credited it. If the supply of oil were insufficient, and the heating had been caused by want of it, the wonder would not be so great; but when the oil was in the pot to a depth of 2 inches, it is difficult to account for the phenomenon.

(36) I. B. C. asks: 1. In making a core for an electromagnet is soft iron the best? A. Yes. 2. Which makes the best armature, soft iron or steel? A. soft iron.

(37) J. M. H. and several others write as follows: Your answer to query of W. D. S. in regard to carrying the bar of iron is incorrect. The true answer being 2 feet 3 inches instead of 3 feet, as published in No. 8, p. 299, vol. 36. I presume the error was due to an oversight. A. As our correspondent correctly surmises, the answer was due to an oversight, or perhaps something of the same character, as Mr. Richard Grant White calls "heterophemy," since the conditions to which our answer applies are those in which a weight is shifted on the bar for proper distribution, the bar being supported at the ends, and its own weight disregarded. The numerous corrections that have been sent to us show the interest with which this column is regarded; and as our only desire is to furnish correct and useful information, we are always grateful to our readers for calling attention to any corrections that may be necessary.

(38) F. G. W. asks: In making a small engine, cylinder 1½ inches in diameter and of 3 inches stroke, would gas stop cocks be sufficient as cut-offs, or must I have a slide valve? A. If the cocks were nicely fitted, they might answer very well.

(39) M. O. S. asks: Do you consider a rotary engine as powerful with the same amount of steam as a cylinder engine? If not, what is the difference? A. We understand you to ask whether the rotary engine will give out as much power with the consumption of a definite amount of steam as a reciprocating engine. In special cases it may; but on the average, we think not.

(40) S. B. W. asks: What does a first-class land engineer get a year? When do you think that the time will come when they will stop putting on so much cheap help to run engines, and have every engineer examined? A. In large establishments, such as public buildings and hotels, where the engineer has considerable machinery, pipe connections, etc., to look after, the compensation is proportionately large. We imagine that, including all classes of establishments, the pay of the engineer varies from $30 to $300 a month, perhaps, in exceptional cases, being higher. Laws regulating the appointment of engineers may be good in theory; in their practical application, however, they are not always successful.

(41) S. & K. say: 1. We are pumping oil from one tank into another. S. says his pump is sucking the oil from the tank. K. claims that the oil comes to the pump by the atmospheric pressure upon the oil in the tank. Is there any such thing as suction in the true meaning of the word? A. What is called suction is due to atmospheric pressure. See p. 352, vol. 31. 2. Can you pump as well out of a tank which stands on a level with the pump as you would out of a tank standing some distance higher? A. When the tank stands above the level of the pump, the pressure forcing the oil into the pump is increased by the weight of the column of oil.

(42) F. W. asks: 1. Will a boiler 4 feet long, 1 foot in diameter, with five 2 inch flues through it, put in an arch horizontally, make steam sufficient to run an engine, 2½ x 5 inches, at 300 revolutions per minute? A. The boiler will scarcely be large enough. 2. What power will such an engine give with steam at 75 lbs. to the square inch? A. See p. 33, vol. 33.

(43) H. J. D. says: I inclose a specimen of scale from my boiler. I have used potatoes, petroleum, tannate of soda, and sal soda. The sal soda seems to do as much good as anything. Is there any danger to the iron from sal soda in large quantities? A. With frequent blowing, you can use considerable amounts of soda safely. 2. Do you consider such scale, in places nearly ¼ inch thick, dangerous? A. Scale should not be allowed to collect to the thickness mentioned. 3. Could I keep the boiler clear by using soft water, say 4 or 5 months in the year? A. If you can use soft water occasionally, it will be likely to loosen the scale. From an inspection of the sample, we think you can prevent the greater part from entering the boiler by using a feed-water heater with sediment collector.

(44) J. N. P. says: I fitted up two barometer tubes. One stands about ¾ of an inch higher than the other. Would boiling the mercury before filling up the tube drive all the air out? A friend says it would not, but that I must boil it in the tube after filling. Can I do that successfully without bursting or warping the tube? A. It is desirable, to insure a good vacuum, to boil the mercury in the tube, and in a vacuum. If you have no experience in such matters, it will be much better for you to have the tubes filled by a philosophical instrument maker.

(45) T. J. M. asks: In floating down a river, will a flat-bottomed boat go at the same speed as the current if no power is used to push it or increase its motion? A. Yes.

(46) A. S. T. says: We have laid a pipe underground from a spring, and have brought it above the surface in one place for the purpose of tapping. Will the water continue to be discharged in an unbroken stream, that is, over the crook? A. Air may collect at the highest point, and should be removed by opening a valve or cock.

(47) P. W. asks: If a weight be suspended by a wire in water, one inch below the surface, weighs 1,000 lbs., would it weigh the same if lowered in the water half a mile deeper? Of course the weight of the suspending wire is to be deducted. A. The weight of a body immersed in water is reduced by the weight of the water which it displaces. As water is slightly compressible, the body will weigh a little less at a considerable depth than near the surface.

(48) E. W. P. says: We have an artesian well which does not overflow. The water is elevated by steam pump, the suction pipe of which passes down inside of the well tubing, leaving a small space between the two pipes. If the well tubing was attached to the pump and made airtight, leaving out the inner suction pipe, would the pump work? Would it not be on the same principle as trying to draw water from a barrel without an air vent? A. Exactly.

(49) S. D. Y. asks: If I make a model of a boat to a scale of 1 inch to the foot, will its buoyancy be 1,728 times less than that of the boat? A. Yes, if you mean by buoyancy the volume of water displaced, and if you use in the model materials of the same specific gravity as those that are in the boat.

(50) H. M. says: I am about making a water velocipede, but do not know of what size and weight the wheel should be. How deep should the wheel be in the water? The length of platform is 3½ feet, length of floats 8 feet, width of platform 2 feet 8 inches, height of seat 1 foot 4 inches, floats are to be 10 inches in diameter, platform 3 inches above the floats, with cork fenders on each side of platform to save it from upsetting, and make it safer. How long should the crank or treadle and the posts on stands for the wheel be? A. As we have had no practical experience with these devices, we are not sure that we can aid you much. Your proportions seem to be judiciously chosen. The crank, treadle, etc., may be arranged with the same dimensions as in ordinary velocipedes, suited to the proportions of the rider. If any of our readers have experimented with these water velocipedes, we would be glad to know the results.

(51) A. B. says: I am building a steamboat, the diameter of my paddle wheel is 8 feet, and is 6 feet 8 inches across. I use an 8 to 10 horse power engine. Boat draws from 8 to 12 inches water. How many buckets should I have, so as to have the least amount of slippage? A. Make it so as to have 3 or 4 buckets in the water, with ordinary draft.

(52) E. O. M. asks: 1. Which is the best way to learn the exact amount of priming when a boiler is tested? If the method is expensive, and requires the skill of an expert, what is a tolerably good way which is inexpensive and adapted to the capacity of an ordinary boiler tender? A. Some form of calorimeter should be employed; and we know of none that can be used successfully by an inexperienced person. 2. What is the peculiarity about a boiler which inclines it to entrain sediment without also entraining water? This peculiarity is claimed for some boilers. A. You should inquire of the patentees. 3. Robert Wilson in his work on steam boilers under the heading of "Incrustation," says that the light carbonates, when entrained, are liable to blow off the cylinder cover, break the piston, or stop the engine. Did you ever hear of such damage, and what are the particulars? A. If any of our readers can furnish information on this subject we would be glad to hear from them. No such occurrence has ever been brought to our notice. 4. Is it possible for any boiler to entrain all the scale-forming impurities of salt water? A. We think not. 5. What can be done to relieve the cylinder of the engine from its trials when so much solid matter is thrown into it? A. Use large relief valves.

(53) C. H. H. asks: How are electric bells constructed so that they may be made to ring for five or ten minutes? A. Attach one end of the line circuit to a spring against which the armature rests when it is not attracted; also, connect the armature to one end of the magnet coil. The other end of the coil is to be connected to the battery, and the circuit completed; this will cause an attraction of the armature; and after traveling together for a very short distance, the latter leaves the spring and breaks circuit. The armature, being now no longer attracted, returns to its normal position and completes the circuit again, when another attraction results and the vibration is continued as long as desired.

(54) B. N. G. says: 1. I want to build a boiler for an engine 2 x 2 inches, to run a boat 15 feet long with a screw 18 inches in diameter, of 3 feet pitch. I intend to build the boiler by placing the heads on the end of the shell, bolted on with several of the tubes with nuts on the ends. Do I need shoulders on the inside of tubes? How large should the shell be? A. No. 2. How large an oscillating engine should I want to run a boat 15 feet long, of 4 feet beam, and how large a boiler would it take? A. You can make the engine 2 x 3. Make the boiler 20 to 22 inches in diameter, and 3 feet high. 3. Should an oscillating engine be larger than a slide valve engine, of the same power? A. An oscillating engine, if properly constructed, will not take any more than the other, under the same conditions. 4. Shall I need a license to run my boat on the Merrimac? A. According to the United States law a license is required. Whether the law is strictly enforced in your locality, we do not know.

(55) H. M. C. asks: If the sides of a triangle, A B=a, A C=b, B C=c, are known quantities, how can I find the area A B C of the triangle, in terms of a, b, and c? Perpendicular, A D, is supposed to be unknown. A. The following is the formula, the demonstration of which may be found in any good treatise on plane trigonometry: $S=\frac{a+b+c}{2}$. Then

$$\text{Area} = \sqrt{S \times (S-a) \times (S-b) \times (S-c)}.$$

(56) G. J. R. says: I have been thinking of building a small steamer: I do not think the water will average over two feet deep. I have an engine of 2 inch bore with a 3 inch stroke. Please tell me its capacity? Will this engine do to drive a boat 26 feet long and about 5 feet wide, to carry 8 or 10 persons? A. The engine is, we think, too small for such a boat as you propose.

(57) E. C. W. asks: 1. Which is the better, cypress or cedar, for light boat building? A. Cedar is generally considered preferable. 2. How ought boats to be treated, after finishing, to protect from the water and weather? A. The joints can be made tight with putty or white lead, and the boat should be well painted.

(58) M. F. says: I am the owner of a tract of land in the Carson valley, that lies some 25 feet above the level of the Carson river. It is very productive, but I am at a loss to know how to get much of it under cultivation, as it must have irrigation, and ditching would cost me more than I am able to expend. Can I force water upon the land from the river by means of a force pump, say, through a 3 inch pipe? If so, what size or power of pump should I have? How much fall of water should I have back of the pump, and would it do to set the pump in an excavation in order to give it a fall? A. If you can use a windmill, your plan of artificial irrigation may be successful; and by addressing a manufacturer, you can obtain particulars as to machinery required.

(59) C. C. C. asks: How can I line sheet iron tanks with Portland cement? A. We do not think you can succeed in causing the cement to adhere permanently to the sheet iron unless the lining is given a great thickness. The cement could be moulded into thin bricks and built in with cement mortar. Portland cement can be obtained of any dealer in building materials.

(60) Mr. J. H. Tjörswaag, of Flekkefjord, Norway, says: As an example of how fast the appearance of a landscape can change even under higher latitudes, I can mention that last year in the early days of June the snow covered the ground at Masi, in the northernmost part of Norway under 70° north latitude, and in the middle of July the potatoes were all in full bloom. It is but fair to add that the sun does not go below the horizon from the 15th of May till the 27th of July at the above-mentioned place.

A couple of years ago I built a new barn with barnyard all of wood. Partly for the sake of appearance, but chiefly to make the barnyard more easy to clean, I gave the walls and ceiling two coats of oil paint. Now as long as mild or warm weather prevails, it is all well enough; but as soon as cold weather sets in, the evaporation from the animals (only four or five cows) settles under the ceiling, collects in drops, and (when heavy enough) falls on the floor, on to the animals, or runs down the walls, making everything wet and dirty. Can I ventilate the room (25x14x7½ feet) in an efficient manner, and at the same time retain sufficient warmth for the animals, and how? The temperature here during winter varies from 18° to 45° Fah. A. The space is rather small for that number of cows, and a little ventilation would benefit them. A small opening at the floor upon one side and at the ceiling upon the other would answer the purpose. The size of these openings might be graduated by sliding shutters.

(61) E. R. asks: 1. If I have an air-compressing pump which will hold ½ cubic foot of common air, how many times must I force the piston up and down until I have respectively pressures of 15, 30, 50, 75, 100, and 125 lbs. per inch over the atmospheric pressure in an air tank of the same dimensions as the pump? A. It will make considerable difference whether you cool the air as it is compressed, or not. You will find formulas by which you can make the necessary calculations, in question (26) on p. 235, vol. 35. 2. If the valve that connects the pump with the tank be 2 inches in diameter, will it take a greater force to move the piston down when the communication between the tank and pump is open, and does the compressed air in the tank press with a greater force on the valve than if the valve were only 1 inch in diameter? A. By using the larger valve, the friction of the air will be reduced.

(62) F. G. T. asks: 1. What size of boiler will it take for a small engine ¾ by 1¼ inches? A. You can make a boiler 3 inches in diameter, and 5 inches high. 2. Would it do to make it out of tin? If so, what pressure would it stand? A. It can be constructed of tin for a pressure not exceeding 10 lbs. per square inch. 3. Could I keep up steam with burners and coal oil? If so, how should they be placed, under the boiler or in a flue? A. The lamp should have a burner that would answer without a chimney, or by having a central flue in the boiler, that would take the place of a chimney. 4. What tools would it require to make a small engine out of ready made castings? A. The tools required to fit up the engine will be a vise, some files, taps and dies, hammers, chisels, and wrenches.

(63) R. K. asks: Will you please tell me what is the difference of heat in the sun's rays on a perpendicular round stick 4 inches thick by 2 feet high, and one of the same size placed to incline 6 inches to the south? A. We presume you refer to the different areas exposed at right angles to the direction of the rays, in the two cases. You can easily plot or calculate this for any assumed direction of the rays.

(64) F. W. S. says: I wish to build a vase which shall hold about forty gallons of water, to be placed where I can have pipes running about five feet below the vase. Will it be possible to construct it in such a manner that, by the use of pipes, the water of its own weight may be made to form a fountain from one to two feet high? A. You can arrange it on the principle of Hero's fountain, which is illustrated in many elementary treatises on natural philosophy.

(65) J. B. says: 1. We have to use salt water in a boiler. Is it injurious? A. Salt water forms scale in a boiler, which is injurious. 2. How is a condenser made? A. A condenser is a vessel in which the steam is condensed either by contact with or by being exposed to the cooling influence of water. 3. What is the hottest water which a common force pump will throw in a boiler? A. Pumps made for hot water will act when the temperature is quite high. With others, the temperature of the water should not ordinarily exceed 100°. 4. Is salt water more injurious to a boiler than sulphurous or lime water? A. There are some spring waters that are more injurious to boilers than salt water from the ocean.

(66) W. G. says: I have a steam pump of the following dimensions: 22 inch steam cylinder, 10 inch plunger, 4 feet stroke, 9 inch suction pipe, and 9 inch discharge pipe. The discharge pipe runs 250 feet north on a rise of 40°. It makes a quarter turn, and runs 94 feet east, horizontally, and then another quarter turn and runs 290 feet north on a rise of 40° to the point of delivery. The pump works as smoothly and with as little jar as possible; but there is a heavy jar in the discharge pipe which moves the whole column when the pump runs over 18 strokes per minute. When it runs less than 18 strokes, there is no jar. Will you please tell me the cause and the remedy? A. According to data sent, the vertical height of column of water is nearly 350 feet. The jar is probably due to the stopping and starting at the end of each stroke, and might be reduced by the use of a larger air vessel.

(67) J. V., of Canterbury, England, says: I have a traction engine, with one cylinder 8 inches in diameter and 12 inches stroke, which I work at 100 lbs. pressure. What difference will there be in the power if I put on an 8x16 inches cylinder, all other things being equal? What difference will there be in the power of a 9x12 inches and a 9¼x16 inches engines, all other things being equal, at 100 lbs. pressure? A. Calling the power of the 8x12 inches 1, that of the 8x16 will be 1·33, that of the 9x12 will be 1·27, that of the 9¼x16 will be 1·78.

(68) J. H. E. says: The following is taken from a book high in authority on mechanical subjects, speaking of an ordinary steam engine: "If, on the introduction of steam to the cylinder, it has a pressure of say 4 atmospheres, it follows that it will act upon the piston with all this force to cause it to descend; since, however, the lower part of the cylinder is at this time in communication with the external atmosphere, there is a resistance = 1 atmosphere opposed to its movement, therefore the actual effective pressure on top of piston = 3 atmospheres." I wish to inquire if the pressure (4 atmospheres) is that which is indicated by the steam gauge, and what becomes of the pressure of the air in the boiler after the air is worked out? I know that an engine will run with less than 15 lbs. pressure by the gauge. A. In the statement quoted by you the reference is apparently to absolute pressure, or pressure above a vacuum. The steam gauge, being pressed internally by the steam and externally by the air, indicates the difference of these pressures, or the pressure above the atmosphere.

(69) W. S. says: 1. Given the boiler or reservoir of a fire extinguisher, tested to 150 per square inch, 24 inches long, of 9 inches diameter, and about ¼ inch thick, laid horizontally and fired with charcoal, required the size of engine it will run, and the best working pressure? A. The reservoir could be made to answer as a boiler; but it would not be advisable to carry a pressure of more than 60 or 75 lbs. 2. I wish to cast the cylinder of brass. If I take a piece of iron, turn it off smooth, and polish it, could I use it for the core to cast the cylinder around, and could I drive the iron out? A. You will not be able to make a very good cylinder in the manner you propose. There is no difficulty in making a sand core quite as smooth as the one that you suggest.

(70) I. C. C. asks: How can I make a good filter, capable of filtering three or four pails of water a day? I have made my box 14x14 inches at top, and 14x 2 at bottom, with a height of 3 feet; and I filled it with alternate layers of charcoal, coarse gravel, and sand. For a week or 10 days it will work well, and then the amount filtered lessens. A. It would probably answer your purpose to use sand only, spread out over a large horizontal surface, and when choked by the accumulated sediment, to remove about one inch in depth of the sand and renew it. After a more extended interval the whole might be renewed.

(71) T. P. B. asks: What is fire? A. Fire is, commonly speaking, gaseous matter in a state of intense heat, due ordinarily to combustion, or a direct and energetic combination with atmospheric oxygen. Scientifically it might be described as matter under the influence of intense atomic or inter-molecular vibration. Consult some good work on chemistry or chemical philosophy.

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

C. W. R.—It contains carbonate of lime and alumina.—Miner, New Mexico.—It consists of red oxide of iron and clay.—G. F.—They are all crystals of quartz (pure silicic acid). They are quite common, and of little value.—M. A.—It does not contain silver, but antimony and lead. —M. A. A.—The sand you send consists principally of quartz crystals and iron, and manganese garnets.

M. H. H. says: 1. An acquaintance claims that, in a sugar cane mill, one of the crushing surfaces should be the surface of a small cylinder, for as it presents a smaller surface to the cane, it will do the same work easier. Is it so? 2. What are the advantages and disadvantages of horizontal and perpendicular rollers? —T. W. D. asks: Which steamboat, running in fresh water, is the fastest, and what is her speed?

COMMUNICATIONS RECEIVED.

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

On Saving Life in Case of Fire. By J. S.
On Nickel Plating. By D. G.
On High Interest. By J. H. S.
On Reclaiming the Desert of Sahara. By R. T. E.
On a Tidal Motor. By A. S.
On the Trisection and Multisection of Angles. By W. T.
On Pernicious Literature. By C. W. B.
On Labor-Saving Machinery. By T. R. V.

Also inquiries and answers from the following:

F. M. B.—C. G. L.—D. B.—G. W. K.—M. A.—W. D. —J. W. L.—J. E. H.—M. J. C.—S. H.

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.

Inquiries 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 inquiries analogous to the following are sent: "Who sells lampblack by wholesale, and what is its price? Who sells apparatus for the production of sulphate of potash? Whose is the best metallic piston packing? Who makes cotton and wool carding machinery? Whose is the best gas meter? Where can the best fireworks be obtained?" All such personal inquiries 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.

OFFICIAL.

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A complete copy of any patent in the annexed list including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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9,949.—HANDLES FOR TEA SETS, ETC.—E. Haviland, Plainfield, N. J.
9,950, 9,951.—CASSIMERES.—T. Holmes, Brooklyn, N. Y.
9,952, 9,953.—CASSIMERES.—H. A. Kimball, Pascoag, R. I.
9,954.—TOWEL BORDERS.—R. T. Webb, Randallstown, Ireland.
9,955.—NECKLACE.—H. W. Woods, Brooklyn, N. Y.

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