would depend so much upon the attendant circumstances that we could not give a general answer, except to say that, if our fire department were to act as efficiently as it usually does, the cable would probably not be injured.

A course for a boat race is three miles long, measured on the shore of a river. At slack water a rower can row the distance in 20 minutes. How long would it take him to row over the same course with the current of 4½ miles an hour, and how long also against the same? A. See p. 202, vol. 31.

(29) G. E. M. says: 1. How many horse power would it take to run a dummy on a 20 inch gage railway, not over 30 feet grade to the mile, hauling weight 8,000 lbs. at a rate of not over 10 miles per hour? A. It would probably require 2 or 3 effective horse power. 2. What style of engine would be best? A. A pair of vertical engines would answer very well.

(30) J. C. W. asks: 1. What kind of stove is best adapted to the use of coke, and could the same be economically used in the place of anthracite coal at about half the price per tun? A. A stove with open grate would be the best. We scarcely think there would be any great economy in this arrangement; but if it proved efficient, you would have a very cheerful and healthy fire. 2. Would it do to mix coke and coal for use in an ordinary coal stove, a self-feeder? A. It seems to us that the action would be somewhat the same as if wood were mixed with the coal. We have never tried the experiment, however, which is the only way to settle the matter.

(31) O. W. R. says. I have an engine of 1 inch bore x 3 inches stroke. It makes 500 revolutions per minute, and cuts of at ¾ stroke. Fly-wheel is 1 foot in diameter and 1 inch wide, weighing 10 lbs. What power could I get by running it at a pressure of 50 lbs. per square inch? A. You might realize about ⅙ of a horse power. 2. What kind of a boiler should I use? A. A cylinder boiler would answer very well.

(32) R. H. S. says: I dissolved a three cent nickel coin in nitric acid: after filtering, I poured in a solution of soda of commerce, then added spirits of ammonia, and precipitation commenced. I washed with pure water, and had a green mass. What is it? A. You first formed a solution of nitrate of nickel and nitrate of copper. On adding the soda, you neutralized the nitric acid in excess of what was needed to convert the metals into nitrates. On adding ammonia (in case you added it in proper quantities) you threw down a greenish blue precipitate of a copper salt, together with a little hydrated oxide of nickel. If you had used potash, you could have effected the precipitation more perfectly. This residue cannot be used for plating.

(33) C. H. asks: What is the cheapest way of obtaining 1,000 cubic feet of oxygen? Perfect purity is not required. A. Oxygen may be obtained on a small scale very readily by simply heating in a close retort a mixture of 4 parts chlorate of potash and 1 part black oxide of manganese. If large quantities are desired, the continuous process of T. du Motay may be employed. The principle of this process resides in the fact that the manganates and permanganates of potash, soda, and baryta, the ferrates and chromates of the same bases, and in general all metallic oxides and acids which will form, with potassa, soda, or baryta, binary compounds capable of superoxidising, possess the property of yielding their oxygen, at a more or less elevated temperature, when they are submitted to the action of a current of steam. These bodies, thus deoxidized, also possess the property of reoxidizing themselves when they are exposed to a temperature more or less great. The atmosphere is therefore the constant source from which the oxygen is derived. The mode of operation is the following: One of the binary compounds just enumerated is placed in a distilling vessel, whether at the maximum or minimum state of oxidation. If the compound is in the latter condition, it is oxidized by means of a current of air mechanically drawn over it; if at the former stage, it is deoxidized by means of a current of steam. The oxygen and steam, on issuing from the mouth of the retort, pass together into a condenser, where the steam is separated by condensation, while the oxygen passes over into a gas holder, and is there collected. When all the utilizable oxygen has been disengaged by the steaming process, the action of superoxidation by means of the air current is recommenced. By this alternate process the oxygen is generated as long as may be required.

(34) J. A. H. says: We have heard lately considerable difference of opinion about the distance boilers should be set from the grates. Some parties claim that 6 feet is better than less; others say 3 or 4 feet. I am satisfied that there is economy in having plenty of space. Can you tell what would be the most economical distance to set a 60 inch shell, tubular boiler with 4 inch flues, 16 feet long? A. If by "from" you mean "above," we should say that for burning coal, with natural draft, it would probably be well to set the boiler not more than 30 inches above the grate, which would make 5 feet from center of boiler to surface of grate.

(35) R. K. asks: What is the best mode of setting steam boiler furnaces? Some claim that it is best to have a space of from 3 to 6 feet between the grates and boiler, and the same space for fire bed along the length of the boiler. A few of this class claim that it is not best to have a bridge wall, as they want the above space for the whole length of the fire bed. Others claim that from 12 to 18 inches space between boiler and grate is enough, with a bridge wall at back of grates. A. We do not believe that any authoritative rule can be given that will apply to all cases. From our observations, we should judge that both parties have good reasons for their opinions, since we have seen boilers set in both ways that did well. A bridge wall is generally convenient in working the fire. The most common practice in setting boilers is to place them from 1¼ to 2½ feet above the grates.

(36) C. H. asks: I have several times noticed the chimneys of my kerosene lamps break without apparent cause. Sometimes they were being carried, at others they were on the table in a warm room. Can you tell me the reason for such constant breakage? A. We must class these occurrences with the unexplanable one of the vase that went into a thousand pieces just before the maid of all work was going to dust it.

(37) J. H. S. asks: What advantage is derived by running a main belt at 3,368 feet a minute, when the driven belt only requires 527 feet in the same time? What law governs it? A. The greater the speed of a belt, the less tension it requires to transmit the same power.

What is the expansion of steam pipe, when heated, per foot? A. Its length is about $\frac{1}{846}$ greater at 212° Fah. than at 32°.

(38) J. & H. ask: Does the use of coke in ordinary stoves, with cast iron or brick-lined fire pots, injure the stoves? A. Not unless you allow the iron to become unduly heated.

(39) H. C. W. asks: 1. Is the air in the air chamber of a hydraulic ram or force pump absorbed and carried off by the water? A. It is absorbed by the water to some extent. 2. If cast iron is used for such chambers, can it be rendered impervious to air by japanning or glazing, or any other means? A. An ordinary cast iron air chamber will answer well enough for most cases.

(40) 1. F. asks: Is there any way by which printing ink may be removed from paper without materially injuring the same? The paper in question is heavy writing paper, and could bear a good deal of rubbing without tearing. A. We know of no better method than that of acting upon it with some solvent, such as turpentine or benzine.

(41) D. J. asks: What colors can I mix to make pearl gray paint? A. Any white pigment with a little blue black.

How can I separate gold from silver? A. The silver and gold may be parted by treating the alloy with very pure aquafortis. In order that this process should succeed, it is necessary that the silver should be as two or three to one of gold; also that the acid should be pure.

Is there any work on mixing of pig iron to produce the different grades of bar iron? A. Read Bauermann's "Treatise on the Metallurgy of Iron," or "The Practical Metal Worker," by O. Byrne.

(42) J. J. T. asks: Does a revolving body, such as the fly wheel of an engine or two weights revolving on arms, weigh as much when at rest as when in motion? A. Yes.

(43) J. W. asks: Can you tell me anything about the Keely motor of Philadelphia? I have seen scientific men, who have seen the power generated and run off, who say it is a fact and can be utilized. Have you seen it? Do you believe in it? Do you know anybody connected with it? Tell me all you know or think of it. A. The Keely humbug was shown up in our paper last year.

(44) W. P. asks: What is the best means of polishing leather? A. After the usual process of currying, the hide or skin, being rendered flexible and uniform, is conveyed to the shed or drying house, where the greasy substances are applied, which is called dubbing (daubing) or stuffing. The oil used for this purpose is prepared by boiling sheep or doe skins in cod oil. Before waxing, the leather is commonly colored by rubbing it with a brush dipped into a composition of oil and lamp-black on the flesh side, till it is thoroughly black; it is then black sized with a brush or sponge, dried, tallowed with the proper cloth, and "slicked" upon the flesh side with a broad, smooth lump of glass, sized again with a sponge, and dried.

(45) P. R. S. asks: 1. What is the correct chemical formula of the double sulphate of nickel and ammonia? A. Ni $(NH^4)^2(SO^4)^2$. $6H^2O$, in the new system, or NiO,SO_3+NH^4O,SO_3+6HO in the old system. 2. Can I use cast zinc cylinders for Bunsen batteries, and how should I prepare them? A. Yes. First dip them in dilute sulphuric acid, and then rub them with mercury by means of a piece of flannel. You should experience no other trouble, if your connections are properly made. 3. Which are the right proportions of water and sulphuric acid for a Bunsen battery? A. One of acid to ten of water. 4. How can I obtain the nickel in a metallic state out of a mixture of it with nitric and sulphuric acids, most of it being sulphuric acid? A. On a small scale, the method of electrolysis will probably answer your purpose best.

(46) B. C. asks: How is cider made to effervesce? A. By bottling while the fermentation is still going on. In this case the carbonic acid gas generated in the process of fermentation is imprisoned in the liquid in the bottle, and escapes violently when, on drawing the cork, the pressure is removed. 2. What gives it the biting taste? A. It is due to the vegetable acids present—malic and acetic acids.

(47) P. I. says: I want a cheap vessel of 100 gallons capacity to boil a mixture, in containing 4 per cent of sulphuric acid, over an open fire. Is there anything cheaper than a copper tank? Will lead or nickel-plated iron do? A. For this purpose lead is out of the question, as it is a poor conductor of heat, and would speedily be burnt through. As to nickel, we have tried the experiment in the following manner and with results as stated below: First, a suitable vessel was coated on the interior with an even coating of nickel by galvanic action, filled with a solution containing 4 per cent of sulphuric acid, and gradually brought to the boiling point; in about half an hour (the solution being kept at about the same density by the addition of water from time to time) the nickel was found to be entirely dissolved. For your purpose we can recommend large porcelain-lined iron pots, which may readily be obtained, and at a much smaller cost than either of the above.

(48) A. F. O. says: 1. Is bichromatized glue insoluble in water? A. It is insoluble in water only after being exposed in thin films to the action of light. 2. Is it also as insoluble, in alcohol, as it was before the bichromate was added? A. Yes. 3. What proportions of glue and bichromate are used to produce the best result, and how should they be treated? A. Make a strong solution of isinglass in pure distilled water; for this purpose the water should be hot. Add to this as much bichromate of potash as it will dissolve; allow to stand. When cold, decant from the crystallized salt.

(49) J. McL. asks: How can I make ink for writing on zinc labels? A. Dissolve muriate of ammonia and crude sal ammoniac in strong vinegar.

(50) C. A. L. asks: How can I burnish silver plating? A. Use a tool of hardened cast steel or bloodstone.

(51) H. W. S. says: To find the radius when the length of chord and hight of arc are given: Let x = distance from center of circle to chord; then, by well known properties of right angled triangles, the value of x can be found, and x + hight of arch = radius. But I give a simpler rule. To the square of half the chord, add the square of the hight and divide the sum by twice the hight. This will give the radius, or $\frac{(\frac{1}{2}\text{ chord})^2+h^2}{2h}=r$.

(52) R. L. DuB. says, in answer to several correspondents who ask as to burning sawdust: I erected a saw mill in New Jersey. The boiler was a return tubular, 14 feet 6 inches long and 54 inches in diameter, with 64 three inch tubes, and brick firebox 48x56x27 inches high; bridge wall was 7 inches at center, rounded to the sides of boiler. I had to use coal for a few weeks and lined the firebox down to ⅝ the above size. After making sufficient sawdust, I endeavored to run with that and slabs, and I found it hard to keep up steam enough to run an hour steadily. I experimented until I reached the following result: I made the firebox the original size, lowered the bridge wall 13 inches (keeping the same circle as before), lowered the paving in rear of firebox to a level with the grate bars, and obtained a barrel of furnace slag from 3 to 7 or 8 inches in size and 1 or 1½ inches thick, which I placed on the grate bars, about half covering them. I fired with wood; and when the slag got heated, I threw in the sawdust, which burned very well but smoked fearfully (clouds would arise from the smoke stack). I then introduced a 2 inch pipe, with about fifty ¼ inch holes, directly behind the bridge wall, leaving both ends of pipe open; after which, I never had a particle of trouble either in keeping up steam or in burning up the smoke. Not even in firing up did I ever see any smoke come out of the stack, which was 30 feet high and 32 inches square, enlarged near top and to the top to 36 inches inside measurement. I forgot to state that I covered the top of boiler with sheet iron, then laid brick on it, covering the interstices with sand. The sheet iron was to prevent the sand from wedging off the wall when the boiler expanded.

(53) V. M. J. says, in reply to J. C. W., who has small success in burning slack or fine soft coal: "From personal knowledge, I can say that neither unusually strong drafts, nor close bars, are necessary. We have a boiler 15 feet long by 4 feet 3 inches diameter with 51 four inch flues, connected with a stack 101 feet high, with a round 3 feet flue hole in it. Originally the boiler had common cast iron grate bars under it. Length of bars was about 4 feet, and the grate was 4 feet 8 inches wide. With this arrangement, ordinary lump coal was used; but owing to the quality of coal and the amount of steam required for power, it was very difficult to fire for 5 hours and keep clinkers off the bars; and at noon and night, it required hard and hot work to get the bars in good order. Three or four years ago, a change was made in the grate bars, substituting those now in, which are the same width as formerly, but 8 feet long, being more than half the length of boiler. The bars are made in short pieces, half the length in width, and supported by cross bars. The openings in bars are about ⅝ x 2½ inches, and the ribs of bars about ⅝ inches wide. Immediately inside of furnace doors, at end of boiler, is a shelf of fire brick, on line with grate bars, on which the fuel may be thrown. Also, at side of boiler and back end of grate bars are doors and similar arrangements, as at front of boiler. The doors are provided with dampers for regulating draft, both for furnace and ash pit. Damper in breech just at entrance to chimney, and boiler about 23 inches above the grate, complete the general arrangement. With this arrangement, common slack is used successfully, requiring less in quantity than coal formerly used, being much easier to fire, and with the great advantage of having the bars free from clinkers, from the draft not being so intense. Good judgment and experience in firing with this arrangement will insure the almost complete combustion of the smoke. The same kind of bars were put under a boiler which had a stack 65 feet high, with satisfactory results. The bars have been furnished in other cases, and wherever used will soon repay the expense of the change from the old style, on account of better combustion, and being able to use a cheap kind of coal.

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

J. E. C.—It consists of silica, which, under the microscope, appears as extremely small transparent grains. It may be used for polishing, or as a detergent (alone or along with rouge or saponaceous substances), or as a base for siliceous paints, or in soluble glass, or in glassware, glazes, etc.—T. S. C.—The specimen sent was found to consist of silica, silicate of alumina, carbonate of lime, carbonate of magnesia, oxide of iron, and sulphate of lime. It is a very poor conductor of heat, and would largely prevent the heat from passing to the water, and thus the iron would be overheated.—G. A. F.—A most careful analysis of this specimen was made, and revealed not a trace of nickel. Why did you form the opinion that it was an ore of iron and nickel?

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(17) D. J. C. asks: Supposing a man is pulling a boat in smooth water in a dead calm, at the rate of a mile in 10 minutes, and to accomplish this he is compelled to pull thirty strokes per minute with a pulling force of 50 lbs. to each stroke. The oars are ten feet in length, weigh 10 lbs. each, the weight of the oar being equally distributed along its full length, so that you can balance it horizontally by holding it on your finger in the center of its length. The oars extend outside the rowlocks 7½ feet: the oarsman has to make the recover in ⅓ the time it takes to pull the stroke. What percentage of the pulling power is required to make the recover?—J. E. B. asks: How can pearl be dyed of various colors, using aniline?—H. P. asks: How can I imitate twist on a gun barrel?—E. B. L. asks: How can I make blacking for boot sole edges?—F. S. V. asks: How can I make soap for blowing bubbles that will last?—D. D. F. asks: Can anyone give me some information as to the raising of hops, the distance apart, manner of cultivation, when to pick them, etc.?

COMMUNICATIONS RECEIVED.

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

On Rapid Transit in New York City. By G. R. N.
On the Motions of the Heavenly Bodies. By W. I. L.
On the Sun's Orbit. By J. H.
On the Epimethean Gods. By G. H.
On Oscillating Saloons on Steamers. By A. de B.
On Theories of Spiritualism. By S. C. F.
On the Highest Lakes. By C. R.
On Small Steam Engines. By G. F. S.
On Hollow Bolts. By J. B.
On Ornamenting Locomotives. By H. W. G.
On Diphtheria. By S. D. F.
On High Lakes. By H. R. S.
On Weights and Measures. By S. P. L.

Also enquiries and answers from the following:

N. B.—T. B. B.—W. W.—J. B. S.—W. J. B.—C. R. S. B.—W. C.—J. D. C.—M.—M. McC.—J. R. B.—H. P.

HINTS TO CORRESPONDENTS.

Correspondents whose inquries 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 machines for preparing peat for fuel? Who makes machines for shaping ax and broom handles? Who makes machinery for working flax fiber? Who sells plane guides? Who sells decalcomaine pictures? Who makes domestic gas machines? Whose is the best covering for steam pipes? What is the best preventive of boiler incrustation?" 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.

[OFFICIAL.]

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January 12, 1875,

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