

J. K. says: I have been running circular saws for sawing logs for over 12 years, and have not had any two saws with teeth at a uniform distance apart. It seems that it has been demonstrated that a circular saw ought to run 9,000 feet of cutting edge per minute; now if that be so, I think there ought to be some established rule for the distance of the points of the teeth apart. Please inform me if there is any such rule, and state whether there are movable tooth saws that can be used with side set. We never have used that kind, but would if we can use side set. We think the swage set very objectionable. A. The variations in the diameter of saws, the numerous varieties of timbers to be sawed, together with various capacities of mills (sawing, as they usually do, from 300 to 5,000 feet per hour), and the fact that solid toothed saws with side set require even numbers of teeth, preclude the possibility of establishing any definite rule. There is no manufacturer of inserted toothed saws who recommends a side set for them; and the fact that inserted toothed saws are fast superseding the old style of solid saws, and are approved by many of our best and most experienced sawyers and lumbermen, who spread the teeth exclusively for the set, seems to conflict with your idea of objectibility.—J. E. E., of Pa.

J. W. C. asks: What are the following articles: Pulv. Frondese Chizeta, Pulv. Milvian Rad., Pulv. Perino Alifolia, Ext. Bertula Natura? A. A competent authority says that these names have been written by one not unacquainted with pharmaceutical and chemical preparations, but that they are all bogus names of things which do not actually exist.

S. A. G. asks: 1. How long does it take to send a signal through the Atlantic cable? A. About four seconds. 2. What is the average number of words sent through per minute? A. Three. 4. What is the speed of electricity through copper wire? A. 288,000 miles per second.

J. T. B. S. asks: How can I make a simple muffle furnace for the purpose of enameling photographs? A. Nothing could be simpler than certain forms of muffles, which are already manufactured and sold at low prices.

W. H. S. asks: 1. If a wheel were placed in a perfect vacuum, so arranged that there would be no friction, and set in motion, would it continue to revolve forever? A. Yes. 2. How is the glycerin commonly sold by druggists manufactured? A. The mother liquor of the soap boiler is first concentrated by evaporation, the saline matter which is thereby gradually separated being removed from time to time. When the fluid is sufficiently concentrated, ascertained by the boiling point having risen to 300° Fah., it is transferred to a still, and the glycerin distilled off by means of superheated steam carried into the still. The distillate is next concentrated and brought to the consistency of syrup in a vacuum pan.

S. P. says, in answer to V. V. V., who asks for a formula for mixing show card paints: The following will answer the purpose: For black, asphaltum varnish 3 parts, dammar varnish 1 part, tube black to suit; temper with spirits of turpentine. For fancy colors with gloss, use any desired shade (tube colors) mixed in dammar varnish; temper as above. These colors should be used freely and as rapidly as possible.

O. K. asks: How can I mend a broken band saw? A. By brazing the ends together. 2. How can I mend a broken tooth in a circular saw? The saw is 1-12 of an inch thick and of 14 inches diameter. A. File down the tooth to the teeth on the same circle. 3. With two horses on a lever power, I run circular saws from 10 to 16 inches diameter, making 900 revolutions per minute. Can I do more work with the same power if I double the speed with countershafting? A. That could only be decided by experiment. There is doubtless a speed at which you will get the best results with a given power; but every piece of gearing you put in consumes some of the power.

J. A. P. asks: Is there any comparatively cheap process by which I can force up a continual stream of water from a well which is 25 feet deep? A. You can possibly employ a windmill.

A. P. R. asks: Has a man, to get steam boat engineer's papers, to be a practical machinist? If not, where would be the best place for a beginner to go to get on? A. It is desirable that he should be, but we believe it is not absolutely essential, provided he can show that he has sufficient practical knowledge to make ordinary repairs to engines and boilers. It might be well for you to try and get a position as fireman or other on some steamship line.

L. F. L. asks: Are the hard spots in steel, rendering the same difficult to work, properly called knots? A. This term is not sanctioned by general usage.

T. G. Jr. asks: 1. For a 30 inch diameter steam boiler, about how much should a cast iron head be thicker than a wrought one 1/4 inch thick? A. It could not be made as safe. 2. Can small flues be put into a cast iron head in the usual manner and make a good job? A. Not as well as in the case of a wrought iron plate. 3. How thick should a cast iron head 30 inches diameter, without flues or stay bolts, be to stand 100 lbs. per square inch? A. The arrangement would not be advisable.

C. B. K. asks: 1. Are the civil engineering schools of Europe better than those of America? A. They are generally more thorough. 2. Which are the best in the United States? A. We do not feel able to make a strict comparison between the different engineering schools in the country.

S. S. asks: Can you direct me to an analysis of the boiler scale from sea-going vessels that have no condensers? A. An analysis of the scale found in French sea-going steamers gives the following results: Sulphate of lime 85.2 per cent, carbonate of magnesia 2.6 per cent, free magnesia 5.95 per cent, water 6.5 per cent.

C. W. S. says: I have always been instructed to place my valve with the pressure on top of the seat. Now an engineer of 45 years experience tells me this is wrong; the better pressure ought to be underneath the valve seat. I want to know which is right? A. Your method is most generally adopted. Still, there are advocates of the other system, claiming as an advantage the possibility of packing the stem with pressure in the valve.

W. P. B. asks: 1. What causes the lumpy or boggy formations in marshes and wet places? A. It is caused by the accumulation of dirt and vegetable matter at certain points, which are determined by local causes. 2. What colors shall I mix to make brown madder? A. It is best to make an extract of the burnt root of the madder plant. 3. Can you tell me of a book on fossils, and one on the preservation of birds or other animals? A. Consult Dana's "Geology," and Coues's "Field Ornithology."

H. J. H. asks: 1. What is the exact difference between a high and a low pressure engine? A. As the terms are ordinarily used, a low pressure engine has a condenser and air pump, and a high pressure engine has not. 2. In your last week's paper you say the horse power equals pressure on the piston in lbs. multiplied by the velocity of the piston in feet per minute divided by 33,000. If a cylinder is 4 1/2 inches diameter x 6 inches stroke, making 250 revolutions per minute, with steam at 60 lbs. pressure, I make: 4 1/2 x 4 1/2 = 21 1/4 x 0.7854 = 15.9048; 15.9048 x 60 = 954.261; 954.261 x 250 = 238565.25 ÷ 33,000 = 7.23 horse power. If the engine only made 80 revolutions per minute, what would be the correct result? A. The first example is right as far as you have carried it; for the second, we shall have  $\frac{954.261 \times 80}{33,000} = 2.34$  horse power. 3. What is meant by injection? I am told that 2 1/2 times as much water is necessary for injection in a locomotive boiler as is required for steam. A. Injection water is that used in a condensing engine, to condense the steam. A locomotive does not have a condenser.

T. H. D. S. asks: 1. Has table rapping ever been scientifically explained? A. Frequently. 2. What was the conclusion arrived at? A. That the experimenters were self-deceived as to the supernatural character of the phenomena. 3. Did not Professor Faraday lecture upon the subject? A. Consult his "Experimental Researches."

A. D. asks: What articles are used with lime to make blackboards for school purposes? A. Manufacturers of blackboards for school purposes inform us that they do not use substances with lime. They prepare a surface of hard plaster, and then paint it with a thin coating of pumice, some black substance, and a varnish which, when dry, will not crack. [What difficulties have you found in making gelatin for molds? Do you mean in making the gelatin, or in using it for this purpose?—Eds.]

A. O. says: 1. What cement is best for the steam chest and cylinder heads of a small steam engine? A. Take white lead 3 parts, and red lead 1 part. 2. Will one of Bunsen's three quart cells do to plate a watch case? A. Yes. 3. How can I make oxygen gas cheaply? A. By strongly heating black oxide of manganese. 4. What is the best packing for the stuffing box of an engine, also the piston? A. Rubber packing is mostly used now.

H. A. F. asks: 1. What are the ingredients of orole or some other soft metal that will not tarnish and is susceptible of high polish? What kind of mold should I use to have the work come out very smooth? A. Pure copper 100 parts by weight, zinc 17, magnesia 6, sal ammoniac 3, quicklime 180, tartar of commerce 9. The copper is first melted, then the magnesia, sal ammoniac, lime, and tartar in powder, little by little; the crucible is briskly stirred for about half an hour, so as to mix thoroughly, and then the zinc is added in small grains by throwing it on the surface and stirring until it is entirely fused; the crucible is then covered and fusion maintained for about 35 minutes; the crucible is then uncovered, skimmed carefully, and the alloy cast in a mold of damp sand or metal. The orole melts at a temperature low enough to allow its application to all kinds of ornamentation; it has a fine grain, is malleable, and capable of taking the most brilliant polish; when, after a time, it becomes tarnished from oxidation, its brilliancy may be restored by a little acetic acidulated water. If the zinc is replaced by tin, the metal will be still more brilliant. 3. Can I get the SCIENTIFIC AMERICAN for 1873 from you already bound? A. Volume XXVIII is on sale. The numbers of volume XXIX are mostly out of print.

S. F. S. asks: How can I take perspiration and grease stains out of Panama hats without injuring the straw? A. They can probably be removed by benzine or French chalk.

J. A. F. asks: Is there a liquid preparation that will resist nitric acid as well as if not better than beeswax? A. Yes: melted paraffin.

A. H. T. asks: If a small vessel should be placed in a larger one, and the air pumped out of the large vessel, what would be the effect upon the air in the smaller one? Would there be any pressure outward? A. If the vessels communicated, the air in the inner vessel would expand, and diffuse itself until the air in both the inner and outer vessel had the same degree or tension.

J. G. C. asks: 1. How many cells of the ordinary Smee battery, each cell consisting of 2 zinc and 1 copper plate, 5 1/2 by 8 inches, will be required to produce the phenomenon of the voltaic arc? A. From 20 to 30 cells, according to the size of the arc required. 2. What number and size of copper wire is best for the inner and outer coils of the Ruhmkorff induction coil? A. For a coil giving a 5 inch spark, from No. 32 to 42 wire for induced current, and No. 6 to 8 wire for the primary.

R. A. M. asks: In making a magneto-electrical machine, capable of producing a power sufficient to kill a human being, what must be the power of the permanent magnet? In other words, what weight must it be capable of lifting? A. The power does not depend upon the attractive force of the permanent magnet alone, and the question is founded on an erroneous idea of the principle and mode of construction of such machines. 2. Are the magneto-electrical machines the best for medical purposes, and are they generally driven by springs? A. They are going out of use, and electro-magnetic machines are now generally employed for medical purposes. They are not generally driven by springs.

G. F. S. asks: Why does the point of the needle of a surveyor's compass, at times, rise and adhere to the glass? A. It is due to magnetic disturbances, and at times to the influence of local attracting forces.

C. C. H. asks: How can I make a glass box to hold a solution of nitrate of silver? I think I could make one of common window glass, if I knew of something with which to fasten it. A. Glass packed with rubber will do.

R. S. asks: What would be the cost of a small swift-sailing steam launch, length of hull 15 or 20 feet? A. About one thousand dollars. 2. What rate of speed per hour would she have? A. Six miles an hour. 3. What would be the power of the engine? A. From four to five horse power. 4. How heavy a load could she carry? A. About 1,000 lbs.

W. E. F. asks: How can I make a cheap Leyden jar? A. We believe there is nothing cheaper than a thin glass candy jar, lined inside and outside with tin foil such as is used to wrap chewing tobacco in. Stick the foil on with mucklage, varnish, or flour paste. A still cheaper plan is simply to fill a glass jar nearly full of water, and place it within another vessel of water, so that the water, both outside and inside, shall be on the same level.

J. B. H. asks: 1. Which time of the year is the best for cutting and transplanting large forest trees, and what shall I do to make them grow again? A. See p. 180, vol. 28. 2. How can I make putty of a bright yellow that will stand when laid in wood? A. Mix the putty with chrome yellow.

W. F. A. asks: Will an electromagnet, wound with one insulated copper wire 100 feet long, produce as much magnetism as two wires 50 feet long? A. It is better to have two spools, 50 feet in each. 2. How many feet of wire are there in a Tom Thumb electromagnet? A. Forty.

B. A. R. says: 1. Is it injurious to inhale the dust of common school crayons? A. It is not injurious in small quantities. 2. What causes whirlwinds? A. It is caused by the rush from various quarters of the surrounding air into a rarefied atmosphere, produced by the rising of vast bodies of air, over a heated area. 3. I have noticed several times this spring the smoke from a dwelling gathering around a new barn situated about one hundred yards from the dwelling, about 15 feet below the level of the house. What is the cause of it? A. It finds about the barn a stratum of air of density similar to that in which the smoke itself is floating, and the lower level of the barn and the obstruction which it offers prevent the smoke being carried away by currents in the atmosphere.

X. asks: Why is it that the storm glasses sold in shops are hermetically sealed? Do they not all require to be so constructed as to give access to air? A. The storm glasses made by instrument makers are sealed so as to prevent access of air and evaporation of the solution.

T. A. C. says: The lightning rod on my house passes entirely over it in an unbroken line, and enters the ground to the depth of 10 feet on each side; branches of the rod are connected and extend several feet above the chimney, thus:



1. Is this a good way to arrange a lightning rod? A. Your arrangement of rod is good so far as the building is concerned; but the extent of the rods in the ground is insufficient. 2. Would it add to the security to connect the rod and the water conductors? The latter are tin and extend entirely around the house, but do not reach the ground by 3 or 4 feet. A. It adds to the safety to connect the water conductors and roof with the rod. 3. What would be the effect of a pile of scrap iron around the rod where it enters the earth? A. The effect of scrap iron or iron ore placed around the base of the rod would be to increase the security. The best way would be to dig a trench three feet deep, leading away from the house. Bend the lower end of the rod to run in the trench, and lay your scrap iron along the bottom of the trench. Let the extremity of the rod communicate with the iron. The larger the quantity of iron and the longer the trench the better. Lightning rods are of little value unless that portion which enters the ground is extensive or is placed in connection with a large mass of conducting material, such as iron, iron ore, coke or charcoal.

J. M. says: 1. I have a scroll chuck to a foot lathe which will not run true on the spindle. How shall I remedy it? A. It is a good plan to bolt the chuck to a plate, which can be turned true whenever required. 2. What wages do machinists get during apprenticeship? A. About fifty cents a day. 3. Can a machinist become a mechanical engineer by studying during the time allowed him out of work hours? A. It can be done, but few have the necessary perseverance. 4. On p. 316, vol. 29, you give an engraving and description of an induction coil. How can I make one? A. See p. 264, vol. 25. You should consult some good work on the subject, such as Noad's "Text-book of Electricity." The sketch is not sufficiently complete to enable one to build the coil without other information. 5. Is the current of a battery changed in quantity or in intensity by making the acid solution weaker? A. All the qualities are affected relatively. 6. Can I melt brass in a cast iron crucible in a charcoal fire, with a hand bellows to supply the air? A. Yes. See p. 74, vol. 28.

S. F. R. asks: 1. How can I braze cast iron and wrought iron? A. Tin the surfaces, secure them together, and apply the solder, heating the articles. 2. How can I case-harden wrought iron? A. Place the articles in an airtight case, together with animal or vegetable charcoal, and expose the box to a low red heat for a few hours. 3. How can I soften steel? A. Steel plate is softened for engraver's use by putting it in a cast iron box with a well closed lid, with half an inch depth of pure iron filings over every part of it. The sides of the box must be at least three quarters of an inch in thickness. Expose the box and its contents for 4 hours to a white heat.

T. C. H. asks: 1. Is litmus paper reliable in testing for a minute quantity of nitric acid in a solution of nitrate of silver in water? A. Litmus paper, properly prepared, is reliable. 2. How are the names of subscribers printed on the margins of newspapers? A. With stamping machines, made for the purpose. 3. How can I coat a plaster cast of type, etc., with black lead, for electrotyping? A. By rubbing the black lead upon it with a brush. 4. I have attempted to make small stereotype plates by pouring type metal into shallow cast-iron boxes, but could not get a sharp cast, what is the reason? A. You should sink your molds into a deep vessel full of molten metal, so as to get a pressure on the cast. 5. What is the best treatment of steel instruments, guns, etc., to prevent rusting? I have heard that opodeldoc rubbed over them was better than oil. Is it better than good oil? A. Gunsmiths say that it is not. A. Did the Pneumatic Transit Railroad prove a success, and how much of it is completed? A. You will find full particulars, dimensions, and engravings of this railway in back numbers of the SCIENTIFIC AMERICAN. It operates with success, and is to be enlarged.

A. W. says, in reply to J. A. McC. Jr., who asked why the paper is not blown off the card: The air which is compressed by being driven through the tube suddenly expands on issuing between the disks, and rushing out in all directions carries with it part of the air separating the disks. This causes a partial vacuum, and the pressure of the air upon the surface of the upper card is greater than that below it, consequently the card is forced toward the tube instead of being blown away.

J. W. C. says that O. W. H. Jr. may fasten cloth to iron by soaking it in a dilute solution of galls, squeezing out the superfluous moisture, and applying the cloth, still damp, to the surface of the iron, which has been previously heated and coated with strong glue. The cloth should be kept firmly pressed upon the iron until the glue has dried.

H. B. says, in reply to J. A. McC., who inquires for the explanation of the experiment described on p. 299: If a vessel or pipe contains a liquid or a gas of a certain pressure, in a state of rest, the pressure on every square inch of the walls of the vessel is the same. This, however, is no longer the case when the liquid or gas is in a state of motion. Where the stream of liquid or gas has to contract by reason of the diminution of the section of the pipe, and consequently has to increase its motion, the pressure increases. In the hydraulic ram, the section of the stream is suddenly reduced to zero, and hence the increased pressure. At places where the section of the pipe widens and the velocity of the liquid has to diminish, the actual pressure will decrease. In the experiment in question, the air is bound to escape from the center in a radial direction between the pasteboard and the paper disk; and as the section of this current of air is rapidly increasing, its pressure is diminished to a degree somewhat below that of the atmosphere, and the surplus of the atmospheric pressure on the back side of the paper disk balances the impact of the current in the center.

C. G. L. says, in answer to correspondents who ask for the method of photographing from tracings on vellum: The negative is made on paper, on which the lines show white on a brown ground. This negative is taken from the tracing without a camera, the transparency of the tracing allowing it to be used as a negative is used in printing a positive. Tints show with greater or less intensity according to the colors used.

H. M. says, in answer to P. J. F., who asks: What is the proper charge of powder for a 12 caliber shot gun? A. 1 3/4 scruples, but you might use double that quantity without any hurt.

M. S. T. says, in answer to W. H. D., who asked whether powder of a coarse grain shoots more strongly than one of a fine grain: When powder of a fine grain is used, only a part of it, nearest the point of ignition, is exploded; the rest is thrown out before it has time to explode. This may be seen by noticing the non-exploded powder inside of a gun which has been fired with fine grained powder. With a coarse powder the explosion is nearly complete, and consequently the force is increased. If blasting powder were used in a gun, the force would be less, because there would be so much space between the grains as to give the gases an opportunity to expand easily. Coarse sporting powder is the best for shot guns.

J. W. R. says, in reply to E. C. B., who wishes to know what jewellers use to clean diamonds: I clean all diamonds and precious stones by washing them with soap and water with a soft brush, adding a little ammonia in the water, and then dry in fine box-wood sawdust. If E. C. B. will put a little pot of pearl-ash in the water, it will answer the same purpose.

H. M. says, in answer to M. F. B.'s query (1) as to which will shoot the greater distance, a breech or a muzzle loading gun: A. If the charge is the same there will not be the least difference. 2. Is 30 inches long enough for a 10 gauge barrel? A. Yes, for any gun barrel; but it would not hurt if it were a little longer. 3. What are the different strengths of the materials used for gun barrels? A. A barrel of any kind of twisted or laminated steel is stronger than a common iron barrel.

O. P. K. says, in reply to B., who asks what is the proper slope in left-handed penmanship: "I have written with either hand for over twenty years; and I hold the pen and slope according to the ordinary rules of penmanship. I am naturally left-handed, but at school I learned to use both hands in writing, and have found it to be of utility. I also use both hands in mechanical work, which is a saving of time." [Our correspondent's letter is written partly with one hand and partly with the other, and it is not possible to see any difference in the penmanship.—Eds.]

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

C. R. M.—Your specimen appears to be a mass of feathers and parts of feathers rolled up into a spherical form.

J. H. S.—It is an old Dutch gold coin, and has no particular value as a curiosity.

J. M. B.—It is a minute fragment of quartz.

E. P. F.—It is a twenty-four sided crystal of lime alumina garnet, of the form known to mineralogists as the tetragonal trisoctahedron.

D. S. F.—The specimen you sent is metallic zinc, and the ore is zinc ore, probably calamine or blende.

COMMUNICATIONS RECEIVED.

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

On Measuring the Width of a Stream. By S. N. M.

On Matter and Intellect. By J. E. E.

On the Mensuration of the Circle. By H. E. A.

On a Draft of a New Patent Law. By T. C. H.

Also enquiries and answers from the following:

P. H. B.—V.—J. M.—S. V. P.—W. S. S. 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.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.