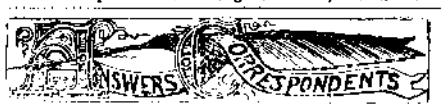


In our answer to H. S. H., p. 15, current volume: "If no heat is lost during compression" should be substituted for "if the temperature is constant during compression.

A. L. M. asks: What is the cost of a machine for making ice? Is a steam engine necessary, and what amount of power does it require? How many pounds will it produce per hour? How much would it cost per hundred pounds, exclusive of first cost? A. Your questions are rather indefinite. A small ice machine, to make from one to two tuns a day, will cost about three thousand dollars. The running expenses would be from five to six dollars a day.

W. F. W. asks: Which gives the most power, a two horse engine or a two horse power of the most approved style? The horses weigh 2,000 lbs. each. How much would one horse raise at the rate of one foot a minute by a good power of the endless floor form? A. Ordinarily, an engine of one horse power will do more work in the same time than a horse, and the engine can be kept at work much longer than the horse.

J. D. R. asks: Would it be practicable to build a wooden railroad (using no iron on rails) on which to run a locomotive of say 7 to 7½ tuns, hauling from 3 to 4 cars at a load, each car and load weighing not over 5 tuns, and to ascend grades of 100 feet to the mile? The rails are to have a bearing surface of 4 inches. What kind of timber would be best for such rails, white oak, rock oak, or maple? A. It would be better to have the rails nearly twice as broad, and to fit the wheels of the locomotive with rubber tires. We would recommend white oak, of the three varieties of timber mentioned.

R. M. R. says: 1. I am building an engine of 2 inches bore and 4 inches stroke, and have finished the cylinder and bed plate. How large ought the balance wheel be, and what should be its weight? It is to take a belt. A. About 10 inches diameter and 2 inches face. 2. How can I make the governor regulate the slide valve? A. There are quite a number of devices in use for regulating the point of cut-off by means of the governor. It would be difficult, however, to make such attachments to so small an engine to any advantage. 5. Would a boiler 4 feet long by 10 inches in diameter with 12 flues ¾ inch in internal diameter, arrangedas a return tubular, be large enough to run the engine at 200 revolutions under 60 lbs. of steam? According to my calculation, the engine would be about ¾ horse power if the pressure were 60 lbs. on the piston during full stroke. A. It will be large enough, if properly set.

J. T. S. asks: 1. What is the best cement for filling millstones? If plaster of Paris and alum will do, how should it be prepared? A. Take baked plaster of Paris, steep in a saturated solution of alum, recalcine, and reduce to powder. Mix with water for use. 2. I have a throttle valve which has a small piece of the edge of the seat broken off; it lets through so much steam that I cannot stop the engine without taking off the cam rod. Is there any way of remedying this, other than getting a new valve? A. Possibly the seat can be repaired, or a new seat can be fitted in.

S. A. T. asks: 1. What is the *modus operandi* of plating by the galvanic battery? What causes the metal to adhere? Is the metal visible in the solution? A. The metal is not visible in the solution. The attraction of the fine particles of the deposited metal for the properly prepared conducting surface of the negative plate causes its adherence. 2. What is the action of the hydraulic ram? A. The water with a certain headraises a valve and flows into a chamber; but in making its escape the passage of the water is relieved and allows another weighted valve which was closed before to open. This permits the water to flow again, when its pressure once more closes one valve and opens another. Again a portion of water escapes, again the pressure is relieved, and so on intermittingly. 3. What is chloride of calcium used for? A. It is employed in many chemical processes. Its avidity for moisture is remarkable. Copies of any of the patents issued can be obtained from this office.

B. R. asks: What is the most accurate rule for finding the friction on the slide valve? A. It is about one quarter of the unbalanced pressure on the valve, increased by one quarter of the weight of the valve.

M. F. J. asks: 1. In your last issue of the SCIENTIFIC AMERICAN, the engineer stated that if a piston rod and cylinder head of an engine were lined with lead, it would save an amount of steam. What can I put on the tin so that hot lead when poured on will run evenly over the surface? A. Build a rim around the head. 2. Would copper be better than tin? A. You can use whichever is most convenient.

M. H. H. says: 1. I and a few friends have had an argument as to which was horizontal motion. Some of us contended that a mill burr revolved horizontally, and others that the cylinder of a threshing machine was an example of horizontal motion. We concluded to get your views. A. It is usual to speak of a vertical wheel as one in which the shaft is vertical, and to call it a horizontal wheel when the shaft is horizontal. 2. Why is the equatorial diameter of the earth greater than the polar diameter? A. It is supposed to be due to the action of central forces, when the earth was in a fluid state.

J. H. asks: 1. How are black lead crucibles made? Is the lead mixed with any other substance? A. It is mixed with from one third to half its weight of clay. 2. Could I use plaster of Paris molds for casting small brass boxes? A. Yes. 3. What proportion of copper should I use to make a good box? A. You do not give sufficient particulars. You will find compositions for journal bearings in back numbers.

W. E P. asks: 1. What would be the capacity in gallons per minute of a force pump 5 inches diameter by 10 inches stroke, running at 60 revolutions per minute, with 4 inches suction? Will you give us the formula for the same? A. Multiply area of piston, in inches, by length of stroke and by number of strokes per minute, and divide the product by 231. 2. For cleaning 100 lbs. of cotton waste, how much bisulphide of carbon should be used? A. See p. 44, vol. 29. As to the blower, address the manufacturers.

A. P. B. says: We run our machinery by water, and have a large surplus of power. Is there any practicable and not expensive method of converting the surplus power into heat for warming the shops? What would be the effect of using, say 10 horse, power in condensing the atmosphere into strong radiators, to 100 lbs. to the inch? A. Some modification of your plan would probably answer very well. So far as we know, this is a novel idea, and it impresses us very favorably.

A. A. W. says: An engineer tells us that our gage glasses kept breaking, and he could not get any to stand; upon enquiry we found that he often took his glasses out and cleaned them with a piece of waste tied on to a piece of stout wire. Upon our trying the experiment with a piece of telegraph wire, by thrusting it in and out several times through the bore, the glass broke into fragments in a few minutes. Can you explain it? If the discovery may be of service to engineers and others, in the way of caution, I hope that you will give them the benefit of it. A. Most housekeepers know the fact that it will not do to use iron rods in cleaning lamp chimneys. The trouble is probably caused by the unequal heating or cooling of the glass by contact with the iron, throwing strains upon some portions of the glass.

F. W. R. asks: Does the lateral pressure against the sides of a reservoir of water increase with the enlargement of the reservoir? A. In some cases, yes, and in others, no. Thus, if the depth remains constant, an increase of size does not affect the pressure.

C. E. T. says: The common rule among mechanics for finding the speed of a driven shaft, when the diameter of pulley on the shaft and the diameter and speed of the pulley on the driving shaft is given, is to multiply the diameter of driving pulley by the number of its revolutions per minute, and divide by the diameter of driven pulley. Some of those who should know say that unless one thickness of the belt is added to the diameter of each pulley, the answer will not be the true one. By the latter rule, in driving from a large to a smaller pulley, the result of the calculation is a less number of revolutions than by the first rule, and *vice versa* from a small to a larger pulley. A. The correct method is to add the thickness of the belt. This may be explained as follows: The belt leaves the driving pulley in the direction of a tangent; and neglecting the slipping, the ratio between the velocities of the driving and driven pulleys is the same as would take place with a pair of gear wheels having the same pitch. The part of the belt in contact with the pulley, neglecting the slip, acts as if it were rigidly connected to the pulley, so that the line of connection between the driving and driven pulleys must be in the axis of the wrapping connector, or at the middle of its cross section.

A. R. asks: 1. Are Britannia and white metal the same? A. Yes. 2. What kind of wood is best to use for chucks for spinning? A. A close grained, hard wood.

C. H. C. asks: 1. What can I put on paper to make it impervious to moisture? A Dissolve 8 ozs. of alum and 3¾ ozs. of white soap in 4 pints of water; in another vessel dissolve 2 ozs. of gum arabic and 4 pints of glue in 4 pints of water. Mix the two solutions and make the mixture hot. Immerse the paper in the mixture and then hang it up to dry or pass it between cylinders. 2. What do 8vo., 16mo., 18mo., and 4to. mean? A. 4to. means quarto (4 to a sheet), 8vo. means octavo (8 to a sheet), 12mo. means duodecimo (12 to a sheet) and so on. 3. Will the moon eclipse any stars or planets next month? If so, which one? A. Consult the *Nautical Almanac*.

H. S. asks: What ready method is there of precipitating antimony from solutions with other metals? A. There is no general method of separating antimony from all the metals, when they are present in the same solution. If arsenic and tin are absent, the easiest way is to precipitate with hydrosulphuric acid as sulphide of antimony. In answer to your other questions, see our advertising columns for booksellers' addresses.

G. N. M. asks: What is "red acaroid of resin," mentioned in a late number of your journal, as part of a recipe for imitating mahogany? A. It is the resin of *xanthorrhea hastilis*, a liliaceous tree growing in New Holland; also called resin of Botany Bay. It has a yellow color, an agreeable odor, and is soluble in alcohol, ether, and caustic potash. Its potash solution, treated with hydrochloric acid, deposits benzoic and cinnamic acids. Nitric acid converts it into picric acid, and so readily that this resin appears to be the best raw material for obtaining picric acid. By distillation, the resin yields a light neutral oil, which appears to be a mixture of benzol and cinnamol, and a heavy acid oil, consisting of hydrate of phenyl, mixed with small quantities of benzoic and cinnamic acids.

W. F. asks: 1. Will a single cell of a sulphate of copper battery do to work a private telegraph, about 300 feet long? A. Not satisfactorily. 2. How many cells of the above kind would it take to run it? A. If copper wire is used, three cells. 3. How many cells of zinc and lead, as described in the *Science Record* of 1874, would it take to make it work? A. About three. 4. Would copper wire, No. 28, do for the wire to connect the houses? If not, what size copper wire would it take? A. Use No. 12 galvanized iron wire. 5 In making a horseshoe electromagnet, is coarse or fine wire the best? A. Use 22, silk covered. 6. How should it be wound on, the same way on both poles or in opposite directions? A. Wind in the same direction. Connect both inside and both outside wires. 7. In making an induction coil, is it necessary to have the wire insulated? A. Yes. 8. How would it do to have one coil of the primary inside, and then have 4 or 5 coils of the secondary wire, then another coil of the primary wire, then 4 or 5 of the secondary, and so on through the induction coil? A. There would be nothing gained by so doing. 9. In the SCIENTIFIC AMERICAN for April 4, you describe a magneto-electrical machine. About how many feet, and what size of wire does it take to make such a machine, to give shocks? A. Four or five hundred. From No. 32 to 40 will answer.

D. M. T. says: On p. 183 of *Science Record* for 1874, experiments with iodate of calcium are related. Can you inform me how to make this substance? A. Iodide of calcium is prepared by mixing a solution of the iodate of potassium with a solution of chloride of calcium. A large amount of the iodate of calcium thus formed remains dissolved in the water; the remainder crystallizes out slowly. The iodate of calcium is formed by melting iodide of potassium in a crucible, leaving it to cool till it becomes semifluid, and then gradually adding 1½ parts chlorate of potassium the mass becomes fluid, swells up, and solidifies to a spongy mass of iodate and chloride of potassium. It is dissolved in hot water, the iodate left to crystalize, the crystals redissolved in hot water, and the iodate precipitated by alcohol.

J. N. J. and J. B. ask: Is there a solder that will solder aluminum? A. The largest dealers in and manufacturers of aluminum say that there is no solder that will answer. Try the pure metal.

J. F. A. says: In a factory there is a large belt running over two pulleys. A person standing under the belt with his hat off will have his hair lifted on end; if he raises his hand above his head, a light of a violet blue color will escape from the end of his fingers. What causes the electricity? Can it be collected? If so, how? A. The phenomena are those produced by frictional electricity and are due to the friction of the belts. The electricity could be collected by a series of brass needles placed at suitable points, and directed towards the belts and put into metallic connection with a metallic body presenting the required amount of surface.

H. S. B. asks: 1. How can I purify solutions of sulphate of alumina from iron? They have an acid reaction, and give blue and green precipitates with the prussiates of potash. A. To the dilute solution add a slight excess of solution of ferrocyanide of potassium. Allow the precipitate to settle and separate by decantation and filtration. 2. How can I separate napthaline from paraffin? I have a crude heavy coal oil which contains both. A. We find no process for this operation.

B. W. R. asks: 1. Has there been any substance discovered lighter than hydrogen? A. No. 2. Please give me the specific gravity of the following: Oxygen, hydrogen, nitrogen, chlorine, fluorine, and carbonic acid. A. The specific gravity of hydrogen being taken as unity, that of oxygen is 16, nitrogen is 14. chlorine is 35 5. carbonic acid is 44. Air being taken as unity, oxygen is 1 10563, hydrogen is 0·06926, nitrogen 0 97137, chlorine 2·47, carbonic acid 1·524. 3. Please give me directions for making a waterproof glue. A. Add ½ lb. of common glue or isinglass glue to 2 quarts of skimmed milk; and then evaporate to the thickness of glue. See our advertising columns for booksellers' addresses.

H. K. M. asks: 1. Which is the most successful form of magnetic motor? How are the magnets arranged to give the motion? A. It is said that the best form is that in which electromagnets are arranged in the periphery of a large double wheel, while the armatures are fixed and arranged in such a manner that the accumulative force is obtained. 2. What amount of force does it possess? A. One constructed on a large scale has driven a car, on an ordinary rail track, at the rate of 10 to 15 miles per hour.

J. M. asks: 1. How can I make a solution of gold that can be used to plate small articles with by a Daniell's battery? A. Dissolve one ounce of cyanide of potassium in one quart of nearly boiling distilled water. About half fill a porous cell with the solution, and stand it in the vessel containing the bulk of the solution. Attach a piece of sheet copper to the wire issuing from the zinc of the battery and place it in the porous cell. Put a piece of sheet gold, attached to the copper of the battery by a wire, in the outer solution, and allow the whole to remain in action until the solution has acquired about one pennyweight and a half of gold, which may be ascertained by weighing the gold before and after immersion. The porous cell may now be removed and its contents thrown away. The solution is now ready for use, and should be worked at a temperature of about 130° Fah. 2. How is a composition made, of sawdust, used for making small busts with? A. We do not know the composition you mention. Try plaster of Paris for the purpose.

W. F. G. says: 1. I have a battery and all the appliances for silver plating, and succeed in getting a good thick coating of silver on various articles, but I am not able to polish the articles so as to obtain a nice smooth brilliant surface. What tools are used to burnish silver? A. Burnishing tools, which are made for the purpose and are of different patterns, are used. They are rubbed smooth on a damp cloth, and the polish imparted by rubbing to and fro on the silverplated surface with pressure. 2. Can you tell me what kind of chalk is used to mark on glass, and how it is made? A. By mixing powdered chalk and soap and drying the mixture.

H. L. C. asks: 1. In making an electric engine, is it best to use a U shaped piece of iron or two separate pieces? Which is best, wire 1-32 of an inch in diameter, or a fine thread-like wire, both being properly insulated? A. It is customary now to make the magnet in three pieces, the sides being made of bar magnets screwed into a crosspiece, the whole being nearly in the form of a square. Use No. 22 wire. 2. Does the power of the magnet increase in proportion to the number of layers of wire with which it is wound? A. To a certain point, but the size of the coil should not exceed an inch and a half in diameter.

A. B. asks: 1. What is the cause of mustiness in flour? A. A chemical change which takes place in moist flour. 2. What are the chemical properties of musty flour? A. The gluten of the flour undergoes a change of properties, in consequence of which it slowly loses its soft, elastic, insoluble condition, and becomes converted into a substance closely resembling diastase.

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 timber to be sawn, 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 objectability.—J. E. E., of Pa.

J. W. C. asks: What are the following articles: Pulv. Frondesæ Chizeta, Pulv. Milvani Rad., Pulv. Perino Alnifolia, 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 for ever? 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 200° 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 consistence of sirup 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 best 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 rest of the teeth to 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 oiler 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 ¼ 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 2·45 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 boiler 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 Coue'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 4½ inches diameter x 6 inches stroke, making 250 revolutions per minute, with steam at 60 lbs. pressure, I make: $4\frac{1}{2}\times4\frac{1}{2}=21\frac{1}{4}\times0{\cdot}7854=15{\cdot}9043\frac{1}{8}$; $15{\cdot}9043\frac{1}{8}\times60=954{\cdot}261$; $954{\cdot}261\times250=238565{\cdot}25\div33{,}000=7$ 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 $\frac{954{\cdot}261\times80}{33{,}000}=2{\cdot}3+$ horse power. 3. What is meant by injection? I am told that 2½ 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 oroide 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 3·6, quicklime 1·80, 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 oroide 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 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 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 outwards? 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 of tension.

J. G. C. asks: 1. How many cells of the ordinary Smee battery, each cell consisting of 2 zinc and 1 copper plates, 5½ 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 Rhumkorff 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 mucilage, 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 inrush 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 casts of type, 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. 3·3 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 coarser 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 shotguns.

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 or 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 gage 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.