Business and Personal.

The Charge for Insertion under this head is $1 a Line.

G. McK. does not state the materials of which his dried varnish consists.—A. S. will find a recipe for dressing skins in the Indian manner on p. 266, vol. 26.—C. H. B. is informed that iron gas pipe is not 5 per cent of the total iron manufacture.—B. B. S. will find full directions for solder of all kinds on p. 251, vol. 28.—C. L. N. will find the directions on p. 7, vol. 30, for constructing a telescope, trustworthy and correct.—J. D. H. will find instructions for skeletonizing leaves on p. 313, vol. 29. Suggestions for preventing echoes in buildings are given on p. 356, vol. 29.—J. N. F. will find some valuable information on the restoration of burnt iron on p. 51, vol. 30.—E. H. B. The attraction of gravitation is the attraction of all portions of matter for each other.—A. O. W. The prismatic colors are often visible in a halo, or in a fog of any kind. There is no generally accepted theory of the aurora borealis. Meteors are supposed to be small portions of matter floating through space; they are attracted to our center of gravity, and become incandescent by friction with our atmosphere.—A. F. B. will find that a marine glue, made of best glue and caoutchouc, will remain flexible if enough caoutchouc be used.—J. W. B., of Nashville, Tenn., does not send his name.—L. M. should apply to the master mechanic of some railroad for a situation as fireman.—W. C. T. will find directions for building cement walls on this page.—M. H. W. can fasten leather to iron by following the directions on p. 42, vol. 26. Cementing emery to cloth, leather, and wood, is described on p. 266, vol. 26.—W. A. R. can cast rubber by the process detailed on p. 283, vol. 29.—L. B.'s questions are incomprehensible.—F. L. S. can find the proportions of acids for silvering glass by experiment. We have never heard of any successful mode of silvering glass by electro-deposition.—A. B. D. will find directions for mounting and varnishing chromos on p. 154, vol. 27. For picture frame filling, see p. 90, vol. 29.—C. W. H. Jr. can attach cloth to cast iron by the process described on p. 42, vol. 26.—H. E. cannot do harm by having an investigation of his engine.—D. W. G. will find a bar or chisel handy for knocking clinkers from the sides of a stove.—J. A. will find directions for transferring engravings on p. 188, vol. 30. Chinese white or the mineral off an enameled card will do to whiten the surface of the block.—W. K. should read Wilson's "Treatise on the Steam Boiler."—G. F. D. can clean his old files by the process described on p. 263, vol. 28.—G. McI. can utilize his old rubber by following the directions on p. 349, vol. 26.—B. J. L. should read the instructions on p. 379, vol. 26, for polishing walnut wood.—W. F. will find directions for mending rubber boots on p. 208, vol. 30.

A. A. says: In the SCIENTIFIC AMERICAN of August 16, 1873 (editorial on lightning rods), it is stated that the gas and water pipes ought to be connected with the rod; because if not, there is danger that persons may receive shocks from such pipes by the induced electricity developed in them. Now, as the rod and the pipes all extend into the ground, are they not all substantially connected? If the water and gas pipes of a dwelling communicate with the ground, and through it with the rod, is any further connection necessary in order to prevent injury by induced electricity? A. The connection with the ground is good, but at the wrong end. The upper ends must be connected or the resistance of the pipes etc., themselves will cause the trouble mentioned; and also as regards the induction, this is an action in which the end of the rod nearest the cloud is charged and not the other end in the ground. These are a few points, but one must study the meaning of induction, resistance, tension or "potential," etc., to see the whole thing clearly.

B. B. E. asks: What shape or degree of convexity must a plano-convex lens have to ensure the least spherical aberration? A. The smallest curvature possible, in other words, a long focus lens.

C. R. asks: How much power is saved by the use of sperm oil for lubricating purposes as compared with lard, tallow, or mixed oils? A. There will be from 1 to 5 per cent of difference in the friction with different lubricants, according to Morin's experiments.

T. M. Jr. asks: 1. Do you know of any make of engines with the ordinary eccentric valve cutting off at both ends of the stroke alike? What would be the advantage of such an arrangement? A. It is sometimes done by making the lead different at each end of the stroke. 2. What could I do to prevent danger to surrounding buildings from sparks coming out of the stack of a cupola while casting? A. We cannot recommend any very reliable preventive.

A. P. G. asks: Has any steam frigate, of any sea-going vessel of any class, ever attained a speed of 25 miles an hour, under ordinary conditions? A. We have seen it stated that one of the English blockade runners, during the war, made a speed of 22 miles an hour; but this is not well authenticated.

S. says: Is smoking cigarettes very injurious, on account of the paper in which the tobacco is wrapped? A. The paper is injurious, but not more so than the vile weed it encloses.

F. G. W. asks: How heavy a weight with a fall of 20 feet will it require to run a sewing machine, on ordinary work, for an hour? A. A weight of 3,000 lbs.

H. R. G. says: I would like to mold some rubber blocks. How shall I dissolve my rubber? Would plaster of Paris do for molds? A. Dissolve in bisulphide of carbon. Plaster of Paris will answer for molds.

G. W. F. says, in reply to M, who asks what causes his pump valves to thump: "I set up an engine running at 150 revolutions with a pump which thumped. I put a bolt with a large head up through the air chamber and screwed it down over the valve, not letting the valve lift so high. Then I put a jam nut on top to keep it from turning, putting rubber between nut and air chamber, to make it tight. The head of the bolt, coming close to the valve, keeps it from lifting too high. It has worked all right ever since. [We are much obliged to our correspondent for this letter. Our readers would do good service if they would send us notes of this kind on matters of general interest.—EDS.

W. B. asks: What effect will frost or rain have on a wall made of water, lime, sand, and clay? How should these ingredients be mixed? How should water, lime, sand, and small limestone be mixed to make a wall? How would water, lime, sand, and soft coal cinders do for a wall? A. To build concrete walls it is not safe to use anything but the best cement, broken stone, gravel, and clean sharp sand. One barrel of the best Portland cement will be sufficient for 13 barrels of the other ingredients, filling the interstices between the particles of stone and gravel and adding nothing to their bulk. The cement should be well incorporated with the other ingredients, and supplied with sufficient water to set well.

F. H. B. asks: What is the advantage of constructing shot guns of laminated steel or twist iron barrels? Two old hunters here claim that a shot gun barrel made of pewter on any other material would throw shot just as well as guns of the best made steel, if they were subjected to the same charges of powder, and say that the material of which they are made makes no difference in the shooting. A. Provided the shape of the barrel is not changed by the discharge, we think the old hunters are right. It is not difficult to see, however, that a much lighter construction can be secured, with the same strength, by making the barrels of tough iron.

E. F. C. asks: 1. In constructing an induction coil, how many thicknesses or layers of wire should there be in the primary coil, and why should it be composed of coarser wire than the secondary? A. From one layer upward, although there is but a slight gain beyond a certain point. It is made of coarser wire in order to afford less resistance to the electric current. 2. How is the secondary coil to be wound? Should it be done by commencing at one end of the wire, and winding it upon the primary coil, as threads is wound upon a spool? A. It is best to wind it on flat layers like the coils of a rope, and insulate each layer from the next by a ring of oiled silk or other insulator. 3. How many cups of Daniell's battery, 8 inches high by 6 inches diameter, would be required to run the coil described on p. 316, vol. 29, so as to produce perceptible shocks? A. Six cups of Daniell's battery, with a properly constructed coil, should give sparks several inches in length.

J. H. D. says: 1. I am running an engine of about 75 horse power, an ordinary horizontal with common slide valve. I wish to reverse the motion or speed; how can I best do it, as I cannot very well get access to the valve? An engineer gives me the following rule: "Place the crank in position answering to the end of the stroke, and mark the valve stem with file or chisel close up to the gland of stuffing box; now place the crank on the opposite center, loosen the eccentric and turn it round upon the shaft until the mark on the valve stem comes out to the edge of the gland, and fasten the eccentric." Is this a correct rule, and will it give the same lead as before? It does not seem to me that it would. A. It would not give the same lead; and if you do not know the amount, you may have to equalize it by trial at the cylinder cocks. 2. On p. 331 of your vol. 29, in answer to F. H. D.'s query as to the proper dimensions of steam and exhaust pipes, you give a table taken from W. S. Auchincloss' work on valve and link motion. What I wish to know is how to use the table; I cannot exactly see into it. Will you please make it a little clearer for me and several others? A. The piston speed in feet per minute is twice the number of revolutions per minute multiplied by the length of the crank in feet. For example, an engine having a diameter of 16 inches and a stroke of 2 feet, making 100 revolutions per minute, has a piston speed of $2\times100\times2=400$ feet per minute. The area of the piston is 201 square inches, and from the table it appears that the area of steam pipe should be $201\times0{\cdot}053=10{\cdot}653$ square inches, which corresponds to a diameter of a little more than $3\frac{1}{4}$ inches.

O. C. W. says: I have a pipe 3 inches inside diameter and 20 feet long, standing erect with closed valve at the bottom. It is filled with water. What is the pressure on the valve? A. The weight of the water, if the valve has the same diameter as the pipe. 2. How can I increase the pressure without making the pipe longer or forcing the water in at the top of the pipe? A. By dissolving something in the water, to make it heavier.

L. W. asks: Will a rotary engine of 3 horse power propel a small side wheel boat 30 feet long by 7½ feet beam? It draws 12 inches of water. The boat has a medium flat bottom and is sharp forward. Her engine runs at 300 revolutions per minute, and is geared to wheel shaft in proportion of 4 to 1. What speed ought to be obtained, the diameter of wheel being 5 feet 6 inches, with 8x10 buckets? A. With such an engine, the speed would probably not exceed 2½ miles an hour.

H. G. C. says: Has the twist or rotary motion, given to a rifle ball by the pitch of the rifling, anything to do with its velocity or the distance to which it may be thrown by a given charge of powder? A. The twist diminishes the velocity.

C. Y. says: Please state what is the size of the quantity galvanic battery necessary to heat an iron wire the 1-25th of an inch in diameter to red or white heat? The liquids are to be nitric and sulphuric acids. A. About twenty cells.

N. D. S. asks: Is there a law that will hinder me from putting a steam saw mill on a boat and running it (by steam) to any place? I am not a licensed engineer. Can any inspector force me to have my boiler tested against my will, if I only carry my own property? A. We do not think that your case will fall under the requirements of the steamboat law.

M. W. R. asks: How can I restore the color of a black silk velvet cloak that had lime water on it, turning it to a light brown? A. Further injury may be prevented by rubbing the spot first with dilute acetic acid and then with water, but the coloring matter has been destroyed and can be restored only by dyeing again.

A. S. G. says: A stream of water moves at the rate of 10 miles an hour, with a fall of 1 foot per mile; what is the momentum of the water per square foot? A. The horse power of the water per square foot of cross section is equal to the velocity of the water in feet per second multiplied by 62·4 times the hight due to this velocity, and divided by 550. To illustrate: Velocity in feet per second = 14·6. Hight due to this velocity $(14{\cdot}6)^2 \div 64 = 3{\cdot}3$ feet. Horse power of water per square foot of cross section, $\frac{14{\cdot}6\times3{\cdot}3\times62{\cdot}4}{550}=5{\cdot}3$ nearly.

S. C. Z. asks: 1. At what part in a machine is it that the dead point most frequently occurs? A. It is the position of the crank when the piston is at either end of the stroke. 2. Can you tell me of any chemical that will dissolve mica? A. Most varieties are decomposed by sulphuric or hydrochloric acid. The silica can then be dissolved in hydrofluoric acid, or a solution of caustic alkali.

P. says: A neighbor bought a cast steel plow and put it into gravelly soil. After using it half a day, he found the mold board badly creased and furrowed. He then exchanged the steel plow for a cast iron one. It is well known that a steel sleigh shoe sticks worse on bare ground than a cast iron shoe. Is steel softer than iron? If not, how do you account for these facts? A. This may be explained on the supposition that the steel was of poor quality and badly tempered, so that it was not homogeneous in texture, and did not have the same degree of hardness throughout.

G. O. A. asks: Will a solid ball of iron weighing 25 lbs. fall a distance of 1,000 feet quicker than a ball of the same description weighing 1 lb.? A. No. 2. Will a cylinder of iron 1 inch in diameter and 12 inches long fall 1,000 feet quicker than a cylinder 1 inch in diameter and 1 inch long, if dropped end foremost? A. No.

S. says: We have a tubular boiler running night and day, using water pumped from the river, without any filtering. We find, after running three or four days, that the water foams in the boiler to such an extent that we are compelled to let the steam go down and draw off part of the water, and refill with fresh. Can you give me through the columns of your paper any method to prevent foaming? Is the use of tallow or any other oily substance injurious to a boiler? We have in use an upright boiler feeder, and until recently have used the exhaust from the pump to assist in heating water for the boiler, the pump piston being lubricated by tallow. The question has arisen whether the tallow used would materially affect the boiler or in any way have a tendency to cause foam by entering into a combination with matter contained in the water. A. The foaming seems to be caused by impurities in the water, which raise the boiling point. Blowing off a portion of the water at intervals may remedy the trouble, but it would be better to use a feed water heater that would extract the impurities. Oil and tallow will do no harm, unless they contain impurities.

J. E. C. asks: I. Will it increase the draft of a portable engine when not in motion to connect a small pipe with the boiler and let it extend into the smoke stack? A. Yes. 2. If so, what sized pipe should I use for a 12 horse power engine, and how far up in the smoke stack should it extend? A. About a quarter of an inch in diameter. Run it up three or four feet.

L. E. I. asks: 1. What are the proper dimensions for the ports of a cylinder 4½x6 inches, running 250 revolutions at 60 lbs. pressure? A. Make the port area one half that of the piston. 2. What would be the power of such an engine? A. Horse power equals pressure on piston in pounds multiplied by piston speed in feet per minute, divided by 33,000.

J. G. G. G. R. says: 1. I sit opposite a large stained glass window in church. I am shortsighted and cannot, with my eyes wide open, see the shape of the figures, but if I close them a little, every little line, etc., stands out very clearly. Why is this? A. Shortsightedness is owing to a too great convexity of the eye, the rays of light coming to a focus before reaching the retina. The muscular action of nearly closing your eyes may have the effect of flattening the humors of the eye sufficiently for distinct vision, and of also cutting off extraneous rays of light, like the stop or diaphragm used in the telescope. 2. I have not a heavy voice, but when I get up in the morning it is a deep bass. This continues for about an hour, and then it resumes its natural tone. How is this? A. It looks as if your voice were not inclined to rise until an hour after its owner. You had better consult a physician, as this may be owing to some slight bronchial or throat complaint. 3. Would a device for preventing an engine from getting on a center pay? A. Such a device might in some circumstances be an improvement. 5. Is there any method by which a person could copy music faster than with a pen, something in the way of types, etc.? A. An instrument has been invented by which, it is said, in the act of playing the piano, the composer's musical thoughts are at once printed by types on a piece of paper. The keys actuate machinery which is put in motion by electricity. 5. Is there any method by which a shortsighted person could restore his sight to its original quality? A. The only remedy we know of for shortsightedness is to wear spectacles of the proper curvature.

M. J. C. asks: How is steel wire tempered for making springs, and how can the temper be taken out of steel wire so that it will not break? What is the best way of tempering steel tools? A. Steel is tempered by being heated and then suddenly cooled in water or oil. The temper can be drawn out by heating the steel, and allowing it to cool slowly.

S. L. B. says: In your issue of February 14, M.M. asks: "If I hang a rope over a loose pulley and put my feet in a loop in one end and take the other in my hands to elevate myself, what proportion of my weight do I pull down with my hands? My friend says I have no advantage over a single rope, I say I gain nearly half. Which is right?" Suppose M. M.'s feet are in the loop and his hands on the other end of the rope, there is obviously the same weight on each end of the rope, for if one end were more heavily loaded than the other it would of course (after overcoming the friction of the pulley) draw the lighter end over the pulley. M. M.'s weight then must be just evenly balanced between the two ends. If he weighs 200 lbs., then each end of the rope supports just 100 lbs. To support himself then he must pull down with his hands just 100 lbs., and to raise himself he must pull enough more than 100 lbs. to overcome the friction and leave a slight excess of weight on his hands. Of course with a single rope he would pull the whole 200 lbs., and, equally of course, by the pulley and loop, etc., would gain, as stated, nearly one half his weight. A. It is a settled fact in philosophy that power is indestructible, and can neither be created nor destroyed by man. This being so, there can be no gain of power by the man, whatever arrangement he uses to elevate himself, the work done being the weight raised multiplied by the distance through which it was lifted. In the case of the loose pulley, if the man raises himself with half the force required where a single rope is used, he exerts the force through twice the distance that would be necessary in the case of the single rope. Moreover, there is some additional work required, on account of the friction of the pulley and the rigidity of the cordage. Notwithstanding this, it may be a convenience to use the loose pulley, for the same reason that other mechanical devices are frequently employed.

J. F. F. asks: What is the difference between a 3 foot wheel with 4 discharges, that will use 300 inches of water under 8 feet head, set in a flume, and one of 4 feet diameter with 8 buckets, with scroll on top of wheel, using same amount of water? Will the one in the flume run any faster than the other, if both wheels are of the same size? A. This is a matter that can best be determined by experiment.

G. B. asks: 1. How many barrels of cement will it take to build a house 60 feet long, 23 feet wide, and 25 feet high, the walls to be as thick as they ought to be in your judgment? A. The thickness of the walls should be adjusted to suit the length of the wall as well as the hight, independent of the weight of floors, etc., which they will have to support. If you have a cross wall at the center of your building, and the concrete be properly made, the walls may be 12 inches thick, for an ordinary load on the floors, etc.; but without the cross-wall, 16 inches would be little enough for their thickness. The concrete should be composed of one barrel of Portland cement to 13 barrels of broken stone, gravel, and clean sharp sand; the proportion of cement therefore, is equal to one thirteenth of the entire wall—for it is lost in the interstices of the stone and gravel. If 25 feet of hight includes the foundation (which should extend at least 4 feet deep into the ground if you have no cellar), then your wall, if 12 inches thick, will contain 4,050 cubic feet, but if 16 inches thick will contain 5,400 cubic feet; one thirteenth of these amounts is 311 7/13 and 415 1/2 respectively. A barrel of cement when slacked will make about 4 cubic feet; the 12 inch wall, therefore, will take 78 barrels, and the 16 inch wall 104 barrels. 2. Is common mortar as good as cement for building concrete houses? A. No; it is the most economical to use the best cement.

F. O. C. H. asks: How can a patch be put on a boiler with bolts, so as not to leak? We have tried lead, iron, and hemp with white lead, but neither would do. A. It should have a lip turned all around it, so that a good quantity of cement may be introduced. The cement should be made of red and white lead and iron borings, and should be very stiff.

P. D. F.—1. A siphon can only operate when its discharge orifice is lower than the level of its supply. 2. The lantern for showing paper pictures instead of glass transparencies, is constructed like any magic lantern, but the picture is placed where the light usually stands, and the light is placed at one side, so as to illuminate the picture. To work well a very strong light is required. The mineral specimen looks like a fossil plum. The width of the Gulf Stream is about 50 miles.

D. G. says: 1. Can the insulators ordinarily used on wires be coated, with lead, tin, or some other material that will protect the insulating material from decay? A. They can be coated with gutta percha. 2. What is "static induction"? A. The influence of an electrified body upon a body which is not in contact with it. 3. If copper is a better conductor than iron, is it necessary that a telegraph wire made of copper should be as large as one made of iron? A. No. 4. What size is the smallest copper wire which is sufficiently large for ordinary telegraphing, tension not considered? A. It will depend upon the current. It is only necessary that it should be large enough not to become unduly heated. 5. In your paper of January 31, p. 71, the writer on sumac speaks of an acre producing not less than three tuns; does he mean green sumac or dry? A. Dry. 6. How can I obtain the Commissioner's report spoken of there? A. Write to the Commissioner of Agriculture, Washington, D. C.

M. J. C. asks: I. How is brass wire tempered for making springs? A. By hammering or rolling. 2. Is there any way of hardening brass so that it cannot be filed? A. We do not know of any method.

M. J. C. asks: 1. How can cast iron be soldered? A. By first tinning it. 2. How is cast iron hardened so that it cannot be filed? A. By chilling it in the mold. 3. Can cast iron be welded? A. No.

C. W. K. asks: 1. What are the improvements needed in rotary engines? A. Some means of preventing wear. 2. Is the unequal balance in the revolving cylinder a serious objection? A. This is obviated in some forms. 3. As there can be no shock in this style of engine, would you consider a variable cut-off of any use? A. It will be useful in cases where the load is variable.

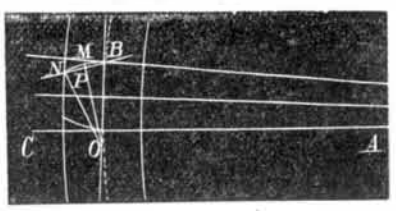
W. W. McK. asks: What is the best to do with cast iron borings? Can I melt them in a cupola? Will not the fan or blast blow them out? How would it do to put a small portion in each ladle of hot iron? Do you think they would melt sufficiently to make a good sound casting? A. Your best plan will be to melt in first in a crucible.

G. P. H. asks: Is there any invention used for the purpose of detecting mineral substances in the earth, as, for instance, silver? A. No.

W. F. W. says: When we speak of the power of the lever, three things are to be understood, the power applied, the resistance, and the fulcrum. Some people believe that a large water wheel is more powerful than a small one for the same reason that a long lever is better than a short one. In two overshot or breast wheels, one 10 and the other 20 feet in diameter, with buckets of equal size holding 200 lbs. water each, the segment to be on or near the outside of the wheel, with pinion attached on a level with wheel shaft, the power and resistance will be at the same point. Where is the fulcrum? Now suppose it takes 200 lbs. water (1 bucketful) to start the machinery. If one bucket, at the pinion on the small wheel, be filled with water, the machinery will start. Will any less weight of water start the machinery on the large wheel? A. You refer, as we understand you, to the supposed gain of power by the use of a long lever. This, of course, is a delusion. What the long lever accomplishes is to make a little force available; and in this way it is sometimes a convenience.

S. G. C. says: Your answer to W. F. W., February 28, as to the lever principle applied to the overshot water wheel may be correct if only applied to the turning of the wheel; but when the power of the wheel is applied to the driving of machinery, I assert that there is no lever principle applicable. One whee will start just as much machinery as the other, but the larger wheel will continue the power twice as long as the smaller wheel, for the reason that the water would remain twice as long on the larger wheel. I claim that the power of an overshot water wheel, when applied to driving machinery, is just the weight of the water it contains less the friction, without any advantage of lever purchase. Am I right? A. You have the correct idea on the subject. No well informed person imagines that there can be any gain of power by the use of a lever or other mechanical device. The object of the mechanical device is to make the power available.

F. L. L. asks: How can I draw the curves on teeth of gears? I send you a copy of a drawing from Armengaud's "Practical Draftsman's Book," but I do not understand it. His rule is: As draftsmen are generally satisfied with representing the epicycloidal curves by arcs of circles, which almost coincide with them and nearly fulfil the same conditions, such arcs must be tangential to the radial sides of the teeth at their points of intersection with the pitch circle. They are determined in the following manner: Through the point of contact B, draw a tangent, B O, to the pitch circle; then bisect



the chord, B N, which passes through the extremities of the curve by a perpendicular, which will cut the tangent, B O, in the point, O. This is the center of the arc, B M N, which very nearly coincides with the epicycloidal curve. The same arc is repeated for each side of all the teeth of the pinion, the radius, B O, being preserved throughout. How can I find the point, O, and how can I draw the chord, B N? If the point, O, is known, what is the use of drawing the chord, B N, and how far from the point of contact should the point O be? A. The points B and N are given. Connect them by a straight line. Draw P O perpendicular to B N at its middle part, and mark the point, O, in which it cuts the tangent. Draw the arc, B M N, with the radius O B or O N.

H. H. C. says: A friend of mine says that powder can be exploded in an ordinary gun, with an ordinary charge, without report, by oiling the barrel tube and cap. I think not. Which is right? A. It is best to settle so simple a matter by direct experiment.

T. L. asks: How can I set a locomotive eccentric which has slipped? A. It can be done by trial, placing the engine at each end of the stroke, and trying the cylinder cocks.

J. P. asks: How can I season a wooden screw made of green hardwood timber, so that it will not crack in seasoning? A. Your best plan will be to place it in some position so that it will become seasoned very slowly; but even with this precaution, it is doubtful if you can prevent cracking.

P. H. B. asks: 1. How can I make a calcium light for an experiment? A. A cheap modification may be made by forcing a current of air, by means of a blowpipe, into a flame of common illuminating gas, and directing the flame against a piece of chalk. You do not send sufficient *data* as to your other query.

G. A. asks: I. In spinning copper, how is the work fastened in the lathe? A. With a clamp. 2. Should metal or wood tools be used? A. Very hard material is necessary for the tool. 3. Which is the best wood for models? A. Mahogany.

A. N. R. asks: Is there any instrument for enlarging or contracting drawings? A. Yes. See engraving and directions for use and manufacture in *Science Record* for 1874.

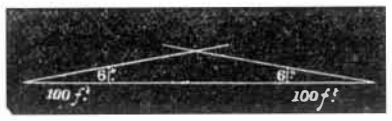
C. & P. ask: Can you give us a recipe for hardening cast steel mold boards of plows? We harden with prussiate of potash, sal ammoniac, and black oxide of manganese, but these, we find, only harden on the surface. A. You should harden the steel by the ordinary processes of tempering, which have been of late frequently described in our columns. A few experiments will show you the best heat.

A. H. D. asks: How many feet board measure are there in a scantling 2½ inches square at one end, and 3½ inches square at the other, and 11 feet in length? A. The ordinary rule of finding the contents, in board measure, of a piece of timber, is to multiply the breadth in inches by the depth in inches, and by the length in feet, and divide the product by 12. Where the timber tapers regularly, the center breadth and depth are used. In the given case, the piece of timber is the same as one having a breadth and depth of (26+38)÷2=32. Hence the contents in board measure will be (32×32×11)÷12=938·6+

G. W. A. asks: How do you calculate the number of square inches of a safety valve, and how large should the pea be? A. The following formula will enable you to determine any part of a safety valve, if you know the others: Pressure of steam in pounds per square inch × area of the valve in square inches × lever arm of valve = weight of ball × lever arm of ball + weight of lever × lever arm of lever + weight of valve and stem × lever arm of valve

P. T. B. says that an experience of 24 hours will convince C. R. M. that his potato vines would all be dead, if arsenic were used instead of Paris green.

R. A. B. says, in reply to E. B. who asked by what means was accurate alignment of the Hoosac tunnel attained: "I can answer this, as I did it myself. In the first place, a line was run over the mountain and tested several times to see that it was exactly straight. Then the working lines of the tunnel diverged northerly



six inches in every one hundred feet from each end This was to prevent the possibility of passing in the center without meeting."

H. M. P. says that G. S. D., who gives a method for finding the weight of a person's head without cutting it off, must try again, for two reasons: 1. This method assumes that the body, including the head, is of the same specific gravity as water. 2. It assumes that the head is of the same specific gravity as the rest of the body. The method can easily be tested by an experiment with an india-rubber-headed doll, first weighing with the head filled with air, and then with it filled with shot; but the simplest test of the principle would be to fill one end of a block of wood with lead, and to weigh it with the ends alternately immersed in water. The weight will be found the same, whether the light or the heavy half is above the surface.

J. H. W. says, in reply to many readers, who ask how to make flour paste that will not sour: Take 2 lbs. of flour and 4 pints of water, mix part of the water slowly with the flour, rub up all the lumps, continue to add the remainder of the water till all is added, then strain through a napkin or colender and cook slowly; stir frequently to prevent scorching; when it comes to a boil, take it off. It is sufficiently cold. Then stir in half an ounce of nitro-muriatic acid and put into an earthen vessel to keep. A small piece of alum, the size of a chestnut, broken up and dissolved in the water, has a tendency to whiten the paste. Paste required to be made white should be cooked, if acid is used, in a porcelain vessel. Cooking paste too much has a tendency to destroy its adhesive property.

S. K. W. says, in reply to F. H. M. who asked for the best way to wash flannels: Supposing this inquiry to mean without fulling or turning them yellow, I will give a *modus operandi*, which I have found satisfactory: Shave a little white soap into a pail, and pour on it water nearly boiling hot to dissolve it, adding, if you choose, a tablespoonful of spirits of ammonia. Pour the hot suds upon the flannels in a tub, and use a good pounder or a machine, as the water needs to be of too high a temperature for the hands. Wring the flannels, and put them into a second water, like the first except with less soap, and use again the pounder or machine. Rub the soiled spots in the suds as hot as you can bear; but never rub soap on the spots. Wring the flannels as dry as you can with a good wringer, and put them on a line in a brisk, drying air. The hotter they are when wrung, and the sooner they dry, the better. Their color may be improved by a little bluing; and if they are well ironed before getting quite dry, fulling is prevented.

B. W. says, in reply to M. S. W.'s three questions as to contraction of the horse's hoof: The contraction of the hoof is brought on by cutting the frog, and by ignorance in setting the shoe, by carrying the seating or bevel of the upper side of the shoe so far back that the heel rests on the slope of the seating, otherwise on two inclined planes; so that every step presses the heel together. The frog, having been cut, loses its elasticity and resistance. The heel should rest on a flat surface, and the shoe set flush with outer shell of hoof all round, and the frog should seldom, if ever, be cut. Nature has made ample provision for throwing off all superfluous frog. Contracted hoof operates on no part of the leg above the fetlock joint. The coffin joint is most affected. Your correspondent can experiment on the sensation produced in contracted hoof by putting the feet into a pair of boots that are two sizes too small and three sizes too narrow on the bottoms, and walking 10 miles per day for 30 days, then standing in them all of the next day on a hard floor. This will give him a better idea of what causes the lameness than can be described.

J. W. P. says: 1. I have a quantity of beeswax that has been used for dental purposes; it has become mixed with plaster of Paris, gutta percha, and the dirt from the laboratory. How can I separate the pure wax from the mixture? 2. Can old and brittle gutta percha be made over again, so as to work like new? J. J. J. asks: Is there a compound that will force the beard to grow faster than it will of itself? E. F. G. asks: Is there any way of photographing a positive picture on glass directly, so as to answer for a magic lantern slide? Is there any way of changing a negative into a positive?—A. E. C. asks: Which can be drawn more easily, a large or small axled wagon? Most farmers claim that a wooden axle in a pipe box can be drawn more easily, on bad or rough roads, than an iron axle, because it is larger.—G. J. asks: Can any one give the formula for the enamel used on engineers' instruments, which is called the bronze finish?—A. B. D. asks: In what manner should a common mouth blowpipe be applied to the flame and work to get the best effect in soldering (hard and soft) and in assaying and experimenting with ores and metals?—C. D. M. asks: Does the rapidity in which the temperature of steel is changed have a tendency to detemper it, providing the temperature is not raised above 225° Fah.? For illustration, take a razor at a temperature of 10° and plunge it into boiling water. Will this detemper it to an injurious extent? Does it injure a razor at all to put it into boiling water? What is the *rationale* of the detempering of steel? Is it effected by a rearrangement of molecules, or is it a decarbonization?—W. E. S. asks: Can any one start and stop a 20 horse power engine by telegraph? If so, how?—M. J. M. asks: How are clocks finished, and what kind of varnish is used?—C. L. asks: How can I construct a microscope (with two lenses) strong enough to see distinctly the animalculæ in water? 2. Why is a glass can protected from bursting, when being filled with hot fruit, if a knife or spoon is placed upright in the can?—W. E. S. asks: What is the best and most durable whitewash known, for outdoor work?—N. L. F. asks: If a vessel of water is revolved so that the contents will be elevated at the outside, and a series of endless chains, provided with floats, arranged over pulleys in such a manner that they will ascend at the outside and descend near the center of motion, where the water is considerably lower, will the unequal hight of the columns in which the chains are mersed impart motion to the chains, and if not, why is the buoyant effect o the liquid in this case different from what it is when a rest?

COMMUNICATIONS RECEIVED.

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

On a Ball dropped into the Earth, etc. By J. L. B.

On an Aerial Electric Ship. By C. W. W.

On the Hanging Rope and Pulley. By M. M., by C. B. T., and by N. P. M.

On Large and Small Water Wheels. By G. P.

On a Crooked Stick. By A. A. C.

On a Gasoline Accident. By W. L. W.

Also enquiries from the following:

P. A. T.—J. M.—M. P. C.—T. C. H.—G. C. H.—A. H.—J. M. M.—G. B. & P.—H. H.—N. R.—J. T.—H. G. J.—G. & A.

Correspondents in different parts of the country ask Who sells a plow that will scour as well in black prairie land (Texas) as in a sandy soil? Who makes sawing machines for felling trees? Who makes magnets to order? What is the best protector for wood work exposed to the weather? Who makes cork cutting machinery? Who makes machines for packing coffee, etc., in paper? Who makes furnaces for restoring spent alkalies? Who makes twist drills, of different kinds? Who has a patent plan for building lime kilns? Who makes iron slat blinds, suitable for brick-fronted buildings? Who makes portable paper boats? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

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.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

March 3, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Acid, making acetic, L. Brumlen	148,031
Addressing machine, L. Bailey	148,103
Agricultural implements, teeth for, J. King	148,218
Alarm, fire, A. F. & F. B. Johnson	148,215
Altitude instrument, H. Linton	148,222
Auger, earth, G. M. Filstead	148,199
Awl haft, T. Harrington	148,053
Awning, C. L. Barnes	148,105
Bag holder, J. Mayell	148,078
Bale tie, cotton, J. R. Kennedy	148,068
Bark from logs, removing, G. Ames	148,161
Barrel head, P. H. Griswold	148,209
Bath tub plug, etc., A. C. Brownell	148,172
Bedstead for woven wire mattress, J. G. Smith	148,254
Bench plane, Q. Rice	148,090
Billiard table chalk box, H. W. Collender	148,181
Billiard table design, N. Stoll (r)	5,779
Blind and sash fastener, W. O. Pond	148,188
Boilers, etc., covering for steam, J. N. Colby	148,190
Bolt, seal, J. Kinzer	148,219
Boot and shoe insole, Teague & Clark	148,044
Boot soles, squaring, J. R. Reed	148,243
Bottling and corking machine, J. & D. Fergus	148,198
Butter worker, A. J. Dibble	148,191
Caliper, E. Horton	148,065
Camera, portable, C. A. Agren	148,019
Can, milk transportation, G. W. Fluke	148,114
Candlestick, D. Bourland	148,106
Car axle journal bearing, J. McGee	148,231
Car brake, automatic, W. V. Robbins	148,092
Car brake mechanism, C. H. Hadley	148,210
Car coupling, R. Gilchrist	148,205
Car coupling, M. B. Marcum	148,227
Car coupling, W. Michael	148,233
Car, dumping, E. M. Hesselbom	148,059
Car ventilator, railroad, G. E. Crutchfield	148,183
Card teeth, setting, S. E. Guild	148,051
Cargo, preventing shifting of, R. Quintavalle	148,140
Carriage curtain fastening, Bannihr & Rhodes	148,104
Carriage safety strap, J. Farris	148,048
Carriage spring, J. W. Gosling	148,208
Caster for trunks, M. Schwerin (r)	5,776
Casting mold boards, chill for, J. Oliver	148,236
Casting mold boards, chill for, J. Oliver	148,237
Chair, folding, G. McAleer	148,230
Chimney sweeping apparatus, J. M. Curless	148,184
Churn, rotary, O. Cary	148,176
Cigar boxes, revenue guard for, W. Wohltmann	148,159
Clamp, book, D. Seawright	148,249
Clamp, rope, J. P. Smith	148,148
Cloth, etc., apparatus for stretching, I. E. Palmer	148,082
Cloth shearing, A. Brown	148,171
Clothes pin, Reid & Berry	148,088
Clutch, machinery, A. B. Bean	148,165
Cooler, milk, Porter, Foster, & Eaton	148,241
Corn crib, J. M. Wilt	148,271
Cotton gin, E. Bucklin, Jr	148,175
Culinary vessel, G. R. Moore	148,130
Cultivator, B. D. Tabor	148,261
Cultivator, B. D. Tabor	148,262
Cultivator, cotton, E. M. Hesselbom	148,060
Cultivator, hand, W. Marsh	148,226
Digger, post hole, N. W. Gay	148,204
Ditching machine, A. M. Nelson	148,080
Door, glass screens, W. Tunstill	148,153
Door check, H. Cope	148,037
Drilling machine, rock, E. S. Winchester	148,278
Ear ring, C. F. Pierce	148,086
Ejector, J. A. Cudlipp	148,111
Ejector, W. J. Sherriff	148,251
Elevator, hay, D. N. Webster	148,267
Elevator, hydraulic, Johnson & Thursby	148,123
Elevator, windlass water, N. B. Vosburgh	148,266