Notes & Queries

J. W. C. asks: If a cone is 2 feet in diameter at the base, and 30 feet high, and a line is fastened at the top and then wound around the cone at every two feet perpendicular hight, until it reaches the bottom, what is the length of the line?

M. W. asks: If two stakes of equal hight stand 80 feet apart in a horizontal plane, what will be the dip or sag of a chain or cord connecting their tops, the cord being 100 feet long? What is the nature of the curve? Is it elliptic or parabolic?

R. R. asks: How can I restore the color of leather and cloth backs of books? They have suffered from the sun and from dust.

W. C. A. asks: How is the silvering prepared and applied in making glass reflectors?

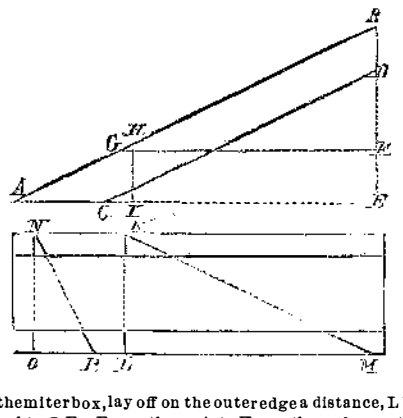
O. says: Astronomers tell us that the planet Neptune is 40,000 or 50,000 miles in diameter, and cannot be seen with the naked eye. Would it be reasonable to suppose that all the stars that we do see (outside the orbit of Neptune) are over that magnitude?

T. F. de S. says: A friend says that if one takes a gun, and shoots straight up (no wind blowing), that the ball will not come down at the point whence it was discharged from the gun, but that the motion of the earth will move the gun from the ball. He says that one would have to hold the gun at an angle to correspond with the motion of the earth to let the ball come down at the spot whence it started. Is this so?

ANSWERS TO CORRESPONDENTS

P. S. A. asks: How do lapidaries cut, grind and polish amethyst and other quartz and hard stones? Answer: The rough stones are first cut to a plane surface by means of a slitting mill. This consists of a thin circular piece of iron like a circular saw, without teeth, however, the periphery of which is covered with diamond dust. It is made to revolve rapidly, and the stone applied to its edge. The stone is then taken to the roughing mill where the surface is prepared for polishing. The roughing mill consists of a revolving leaden disk covered with emery. This gives a smooth surface to the stone, which is lastly polished at the polishing mill. The polishing mill is a revolving leaden disk kept covered with rottenstone and water.

E. R. G. asks: Can you give me directions for getting the bevels for a miter box to saw the lower end of a rake or rafter molding? Answer: As we understand your question, you wish to find the bevels, A C and B D, of the ends of a rafter, A B C D, set at any pitch. Draw a triangle, A B E, making A B represent the inclination of a rafter. Construct a miter box in the usual manner. Draw a square line, K L, across the top of the box. On the side, B E, of the triangle, lay off a distance, B F, equal to K L, the extreme width of the box. Draw G F, perpendicular to B E, and note the point, G, in which it cuts the side, A B, of the triangle. From the point, L,



in the miter box, lay off on the outer edge a distance, L M, equal to G F. From the point, K, on the other outer edge, draw a line connecting K and M. This gives the bevel for A C, the lower end of the rafter. To find the bevel for, B D, draw another square line, N O, across the miter box, and lay off, on the side A E of the triangle, a distance, A I, equal to K L or N O, the width of the miter box. From I draw I H perpendicular to A E; and from O, lay off a distance, O P, equal to I H. Then N P represents the bevel at which the upper end of the rafter is to be cut. These constructions are based on the principle that the angles of the miter box are the complements of the angles B A E and A B E.

S. Y. O. asks: 1. Is it a fact that the animal body, especially that of man, is heavier when asleep than when awake? In other words, is there a power to counteract gravitation in the living human body? 2. Is it an established fact that tables are moved by the mere act of the will by so-called mediums? Answers: 1. We think not. 2. No.

E. H. F. says: If I take a piece of plate looking glass and cut a fine line through the amalgam coating on the back, and then set this glass firmly on and perpendicular to the surface of a plane table, so that the line on the glass will be truly perpendicular to the table, and (turning the face of the glass northward, at the time of the transit of Alioth, and standing in front of the glass) adjust the table and glass so that the line on the glass shall bisect both the north star and Alioth, will a line drawn truly perpendicular to the plane of the glass, across the plane table, be a true meridian line, making allowance of 17 minutes after the transit to bisect the north star by the line? Or, in other words, would the star, the eye, and the line on the glass be all in the same vertical plane at such time? Could the star, as seen in the glass, be bisected by the line on the glass without bringing the eye into a plane perpendicular to that of the glass? If not, then by reversing the glass, with the table thus fixed with reference to the north star, could a shadow of the sun be bisected by the line on the glass, as seen by the eye, at any other time than when the sun is on the meridian of the plane? The reflection of the eye, as well as the star, in the glass, must be bisected by the line on the glass, at the time of the transit. Answer: To ensure, with the arrangement you propose, the line drawn on the plane table being in the same vertical plane with the line of sight, it would be necessary to have two pieces of glass, and sight through both to the north star. We think there are better plans than this in use at present.

F. T. T. says: The feed pipe of a heater from tank enters the top. The pipe leading to force pump is 18 inches from bottom of heater. The glass water gage or tube is attached so that center of pipe is level with center of glass, that is, 6 inches above and 6 inches below the center of pipe. Pipe is 1¾ inches diameter. On starting engine after a few hours' stoppage, the water always leaves the glass tube, the lower end of which is 4 inches below the lower edge of feed pipe. In the course of 15 minutes all comes right again. Can you explain the reason? Answer: It may occur from the formation of a vacuum in the heater, when the engine is not running.

E. C. H.'s calculations as to the rotundity of the earth per mile are correct: but he misunderstands the word rotundity in this connection. The question is: If a straight line tangential to the curve leaves the earth's surface at a particular point, how far will the earth's surface be from a point in the line one mile distant from the starting place? Answer: Eight inches.

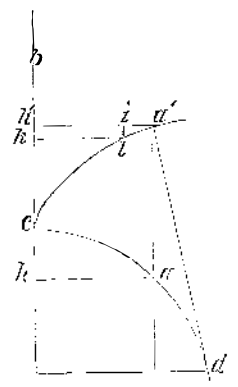
G. W. C. should consult Auchincloss on "Link and Valve Motions." See our advertising pages for booksellers' addresses.

P. asks: How can I preserve leaves? Answer: Press them between pieces of blotting paper, with a heavy weight, until all the juices are dried up.

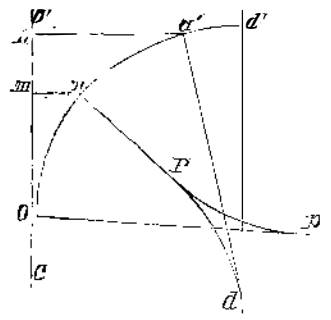
G. W. F. asks: 1. Is spherical gearing illustrated in the Science Record for 1873? 2. Why is the pipe that connects to a steam gage bent into an S form? Answers: 1. Yes. 2. So as to retain water in the pipe.

H. F. B. asks: What is the value of the skivings of sole leather as a fertilizer? The flesh part of the skin is steamed until it becomes a pulp, and then is dried and ground. Is the liquor valuable also? 2. Can bones be made soft so that they will crumble easily by steam pressure? If so, are they worth less or more, when ground, as a fertilizer? Answers: 1. We must ask some of our farmer readers to answer this question. 2. Ground bones are generally considered the best.

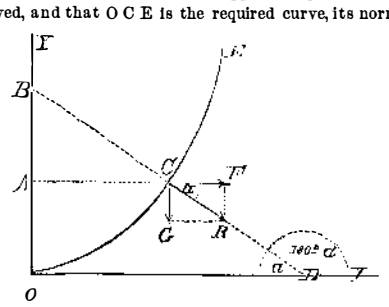
J. E. H. sends the following solution of C. H. A.'s question, on page 187, of our current volume:



Let $h'a'$, $= y$, represent any distance of the ball from the axis $b\,c$. Then, from the laws of central forces, we shall have $h'a'$ $(=y)$ is proportional to the centrifugal force at a'. Let the curve $a'c$ represent the resultant of the centrifugal and gravitating forces at all distances from the axis between zero and $h'a'$, and let $c\,h'$ be represented by x, and draw $k\,l$ indefinitely near and parallel to $h'\,a'$; and draw $l\,i$ perpendicular to $h'\,a'$. Then will $l\,i$ represent $d\,x$ and $a'\,i'$ will represent $d\,y$. Now because x may vary uniformly, $d\,x$ is constant; and because the differentials of x and y represent the components of the two forces at any point, $\therefore dx : dy :: 1 : y$. $\therefore dx = \frac{dy}{y}$, ... (1). Integrating (1) we get: $x = log.y$ . . . (2). As (2) is a well known equation and represents the Napierian system of logarithms, and as the tangents to the required curve must be perpendicular to this curve, therefore the required curve is the evolute to the Napierian logarithmic curve. The equation to this curve I have not investigated; its tangent, however, which is perpendicular to and limited by the resultant curve, is $\frac{(1+y^2)^{\frac{1}{2}}}{y}$. The question, as I understand it, may be definitely stated as follows: Suppose a ball to revolve in a horizontal plane, at variable distances, about a vertical axis, $b\,c$, making one revolution per second, and suppose the resultant of the force of gravity and the centrifugal force due the several distances from the axis to form a continuous curve from its greatest distance at d' to the axis at c: Can another curve be drawn whose tangents shall be perpendicular to the resultant curve and which shall also be continuous between the greatest and least distance of the ball from the axis? The answer to this latter question must be a negative; for, as I have shown in the solution, the resultant curve will be the Napierian logarithmic curve, and hence the required curve will be its evolute.



I have determined the equation to the evolute, and find it to be: $u = log.(\frac{1}{2}v \pm \frac{1}{2}\sqrt{v^2-8}) - \frac{1}{2}v^2 \pm \frac{1}{8}v\sqrt{v^2-8} - \frac{1}{4}$. The evolute may be constructed from this equation, and consists of the two branches of P and Pp as above. Answer: It is required to draw a curve, whose tangent shall be perpendicular to the resultant of the centrifugal force and force of gravity at any point, or whose normal shall coincide in direction with this resultant. Suppose the problem to be solved, and that O C E is the required curve, its normal



B C, at any point, C, having the same direction as the resultant, C R, of the centrifugal force, C F, and the force of gravity, C G. Let w = weight of ball, m = mass of ball, g = acceleration due to gravity, v = angular velocity, r = radius of rotation at any point, F = centrifugal force, G = force of gravity. $F = \frac{m \times v^2}{r} = 4m \times \pi^2 \times r$, since $v = 2\pi \times r$; $G = W = m \times g$; tangent of angle $F\,C\,R = \frac{CG}{CF} = \frac{m \times g}{4m \times \pi^2 \times r} = \frac{g}{4\pi^2 \times r}$. The equation of the line B D is $y = -\frac{gx}{4\pi^2 \times r} + b$. To find O B, make $x = 0$, O B $= b$. To find A O, make $x = r$, A O $= -\frac{g}{4\pi^2} + b$. Hence subnormal of curve $=$ O B $-$ A O $= \frac{g}{4\pi^2}$ = a constant, and the curve is a parabola.

B. F. asks: Why is it that street cars are not run by compressed air? Could there not be enough air compressed in sheet iron vessels (say in the seats and a hollow or double floor) to run a small engine which would propel the car from station to station? To increase the efficiency, the compressed air might be heated in the cylinder of the engine with a suitable lamp. 2. Could not gas be generated out of water by electricity, with a sufficient force of expansion to run a small engine? 3. As the Nicholson pavement is apt to rot soon, would it not be better to lay a floor of boards, as in the Nicholson, then a thin layer of sand, and perhaps coal tar or cement, and on that basis (while the cement and sand or tar is yet soft) put common paving stone? Answers: 1. We have published accounts of the running of such cars. It is probably an expensive method. 2. Not economically. 3. The Nicholson pavement, as generally laid, does not have a good foundation. Were this attended to, and proper care used in the selection of the blocks, wooden pavements would be very durable.

W. T. H. asks: How can I put quicksilver on glass, to make a looking glass? Answer: Place a sheet of tin foil, the size of the glass, upon a perfectly smooth solid marble top table, and carefully rub down all the wrinkles in the metal with a brush, taking care not to break the foil. Then pour over it a small portion of mercury, and rub it over the tin foil gently with a clean piece of very soft woolen stuff. Then pour on as much mercury as it will hold, placing a strip of cloth around the edges to prevent waste, and slide a perfectly clean and dry sheet of glass over the surface of the liquid metal, beginning at one end and ending at the other. Some experience is necessary in sliding the glass, to make a perfect mirror. Afterwards the glass is placed under heavy weights, to remove superfluous mercury.

O. M. says, in reply to the question of E. C. M., p. 250, as to where a body sliding down the side of a hemisphere whose base is horizontal, will leave the side: I think it will not leave it at all; for after it starts, there will be, as it were, two forces acting on it, the original moving force accelerated by the force of gravity, acting in a line tangential to the sphere, and the force of gravity acting in a line perpendicular to the base. The tendency would then be to move in the diagonal of these two forces, which lies within the base of the hemisphere; hence it would never leave the side. Answer: When the body is at its starting point, the propelling force is applied tangentially, or in a horizontal direction. Hence the resultant motion will be that due to motion in a horizontal direction and vertically downward; and this resultant may fall without the base of the hemisphere.

F. H. M. asks: Is there any metal, or composition of metals, or any other known substance, that will break the attractive power of a magnet if placed between it and its armature? Answer: We think not.

C. W. C. asks: How can I plate polished steel with nickel? Answer: See page 266, current volume. Probably it will be cheaper and more satisfactory for you to send the articles to an establishment where they make a specialty of such business.

F. W. W. asks: 1. Is there any known chemical which, if contained in an airtight chamber, would make sufficient heat to boil water? 2. Is there any known combination of chemicals which will have the desired effect? 3 Is there any known chemical which, if confined in an airtight vessel, will burn and make considerable vapor? Answers: 1, 2. Yes. Lime and water. 3. Yes. Gunpowder.

E. W. asks: How can I make Russian sheet iron? Answer: Russian iron, so called, is not made in Russia exclusively, if indeed any that we use comes from that country. Very pure iron is used in the manufacture of these sheets. The glossy appearance is produced by heating the sheets, moistening them with a solution of wood ashes, and passing them through polished steel rollers.

C. V. D. says: A vessel, 6 feet in diameter at the bottom and 5½ feet at the top, is 6 feet deep. How can I estimate the amount of outward pressure upon the hoops of said vessel? What is the least amount of common hoop iron that will resist the pressure, the vessel being filled with water, and where should the hoops be placed? Answer: If the vessel is filled with water the pressure on the base is equal to the weight of a prism of water whose base is equal to the base of the vessel, and whose hight is equal to the hight of the vessel. The pressure on the sides of the vessel is equal to the weight of a prism of water whose base is equal to the area of surface pressed, and whose hight is equal to the distance of the center of gravity of the vessel below the surface of the water. Knowing the tensile strength of the hoops to be used, their size can readily be proportioned.

L. S. asks: How can I get rust, caused by salt water, off fine steel instruments? I cannot use emery, a file, or anything of the sort. Answer: If there are parts that you cannot reach with any rubbing instrument, you probably cannot remove the rust. We have an idea however, that you can succeed in arranging a cloth or brush so that you can polish every part; and in this case, you can clean the instruments with oil and fine brick dust, afterwards applying some polishing powder.

D. L. S. asks: How can I remove deep scratches from a pianoforte case? Answer: This is work for an expert, and we hardly advise you to attempt it. The scratches, when very deep, are sometimes filled with a cement which is colored to match the wood, and then the whole is re-varnished. In ordinary cases, very fine sand paper is used. The wood then requires to be polished and varnished.

A. T. asks: What book gives, in the most condensed form, the relative strength of metals and woods? I also want books on the workings of the different trades, as text books for a class in mechanics. Answer: We advise you to correspond with Professor R. H. Thurston, Professor of Mechanical Engineering in the Stevens Institute of Technology, Hoboken, N. J. We are sure that he will be glad to give you the desired information, while his experience and ability will make his reply of peculiar value.

P. P. H. asks: 1. What power is required to drive a sewing machine? 2. To what pressure can air be conveniently compressed in a suitable receiver by the air pump? Answers: 1. From 550 to 1,000 foot pounds per minute, varying with different machines. 2. The inventor of the Giffard injector states that he has compressed air, by the use of a piston of his own design, to more than 1,000 atmospheres, or till it attained a pressure of about 15,000 pounds per square inch.

W. L. C. says: We have occasion to use a large number of hard rubber balls for testing castings by water pressure, and we find that the balls get dry and hard, consequently soon crack and break. How can they be kept soft and pliable? Answer: Probably you cannot restore their former qualities. Your best plan will be to purchase a superior class of rubber.

S. H. D. says: 1. A safety plug to a steam boiler melted out when the boiler was being blown off; the fires were drawn and the steam gage indicated about 35 lbs. of steam: what was the cause? 2. Of what alloy or metal should a safety plug be composed? 3. How many years has the SCIENTIFIC AMERICAN been published? Answers: 1. It is quite probable that the iron was corroded around the plug, so that it was shaken out by the shock due to the contraction of the boiler. For a recipe for fusible metal, see p. 281, vol. 26. 3. The first number of the SCIENTIFIC AMERICAN was issued in August, 1845.

J. F. W. says: I wish to watch the inside of a small thin copper cylinder. Can I cut a slit in it, and then cement a piece of glass over the aperture so that it will stand 200 lbs to the square inch? I am afraid of unequal contraction and expansion. Could I cement it to any better advantage in a cast iron cylinder? Answer: The Committee of the Franklin Institute, who made experiments to determine the cause of boiler explosions, used a boiler having an opening covered with glass. We believe the glass was broken several times, under high pressures. Your best plan would probably be to make the joint with rubber.

E. J. C. asks: Will kerosene oil do in place of petroleum for steam boilers? Answer: We think not.

W. R. F. asks: 1. What is the best and cheapest way of making an exhaust air blower, to take the dust from a small emery grinder? 2. What is the cause of the clinking noise heard in cold steam pipes when steam is let on? 3. When does the Fair of the American Institute close? Answers: 1. It can be done by enclosing a shaft with vanes, in a box, having suitable openings. It will probably be more satisfactory for you to purchase a blower from an established manufacturer. 2. It is caused by the impulse of the condensed steam acting in a vacuum, and by the movement of the pipe as it expands. 3. On November 15, unless extended for one week by vote of the Board of Managers.

J. F. C. asks: 1. Could not drills be used with a rotary movement in boring rock, as is done in boring metals? 2. Could not some form of acid or solvent be used to facilitate the boring of rock? 3. What are the comparative advantages of the different forms of explosives for practical use in blasting? 4. In clearing fields of stone, would it save labor to use the more powerful explosives instead of ordinary blasting powder? Answers: 1. They would get dull too quickly. 2. Agents that would soften the rock might perform the same office for the drills, and in any case the process would probably be too expensive for general use. 3. Giant gunpowder is probably the most economical. 4. Yes.

J. R., Jr. asks: 1. What is the longest distance you have known steam to be conveyed from the boiler to the engine, as for steam pumps in shafts and mines? 2. How far do you think it could be conveyed to have an available working force, from a boiler of 125 lbs. pressure, if well boxed and packed? We wish to place a pump about 2,500 feet from the boiler. Answer: We think you can carry out this plan successfully if you use a large pipe, protect it carefully, arrange expansion joints at suitable intervals, and put in efficient traps to carry off the water. We advise you to have plans prepared by a competent engineer before putting up the pipe.

F. H. C. asks: What is the nominal horse power of the largest steamer on Long Island Sound, also what is the indicated horse power? Answer: Nominal horse power, by English Admiralty rule, 580. Indicated horse power, about 3,000.

C. J. H. asks: 1. At what surface speed should I run common emery wheels (wood covered with leather) to get the best result in grinding and polishing malleable cast iron? 2. Is there any better way to attach emery to leather, than with good glue? 3. Where is the best (sharpest) emery obtained from? 4. Can corundum be obtained in market, in grades like emery? Is it superior to emery in abrasive qualities, enough so to pay for the difference in cost? Answers: 1. About ¾ of a mile a minute. 2. We think so. 3 and 4. Where emery secured to leather is used, it stays on so short a time that the cheap grades of emery answer as well as the better qualities. Corundum can be obtained, but its use is not recommended in this case, for the reason given above.

M. W. says: By accident I got some zinc mixed with type metal. How can I separate them or can they be made to work together? There is only a small amount of zinc in it, just enough to give it the appearance of cold metal in the cast. Answer: The zinc can probably be separated by vaporizing it. This is, however, a rather difficult operation, and you will scarcely succeed unless you have had some experience in the method.

Y. E. asks: 1. In calculating the horse power of a boiler, do you count any of the breeching, or do you count nothing but the actual fire surface of the boiler? 2. What is the best dress to put on a circular saw when cutting pine timber? 3. How is naphtha oil manufactured? 4. What is benzine made from? 5. What horse power has an engine of the following dimensions: Cylinder 9 x 16 inches, working at 68 revolutions per minute, with a pressure of 70 lbs. to the square inch? 5. Did the great transatlantic balloon burst from the high pressure of gas, or did Professor Donaldson cut a hole in it? Answers: 1. Take only the effective heating surface. 2. It is hard to give a general rule, as much depends on the size and quality of the timber. 3. It is a natural product similar to petroleum. 4. It is ordinarily prepared from coal tar oil. 5. The data furnished are incomplete. Probably the mean pressure of steam is not 70 lbs., and there are some deductions to be made for back pressure and cushion. But using these figures, we have horse power = $68{\cdot}6 \times 70 \times 68 \times 2 \times 16 \div 33{,}000 \times 12 = 22{\cdot}7$ nearly. 6. We expect no one but Mr. Donaldson could give a correct reply to this question.

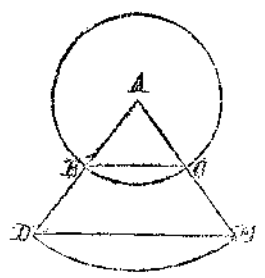
C. D. M. asks: 1. What horse power would a propeller engine, 8 inches in diameter x 8 inches stroke, have? 2. Would you advise using a square water tube boiler to supply steam for the above engine? It is to be used in a small yacht, 40 feet keel x 10 feet beam. 3. How large ought a boiler to be for this engine? Answers: 1. It depends on piston speed and steam pressure. 2. We think you had better use a cylindrical boiler, of the same general character as those now used on ocean steamers. 3. Allow from 18 to 20 square feet of heating surface per horse power.

J. S. asks: In constructing a compound microscope, what are the focal distances and diameters of the glasses to be used, to produce a magnifying power of 80? What are the distances that the glasses should be placed from each other? Answer: Use for the object glass a plano-convex lens, ⅛ inch focus, with its plane side towards the object and its aperture one fifteenth of an inch. At the distance of about 6 inches from this glass, place the eye glass, which, in its simplest form, is a double convex lens. The magnifying power can be increased somewhat by increasing the distance by means of a draw tube between the eye glass and the object glass, but this is at the sacrifice of distinctness.

G. K. M. asks: How can I make paint adhere to zinc? Answer: Dissolve 1 oz. nitrate of copper and 1 oz. sal ammoniac, in 64 ozs. water. Then add 1 oz. hydrochloric acid. Apply this mixture to the zinc; and when it is dry, paint it, using mineral paint. M. M. M. should use this recipe for painting galvanized iron.

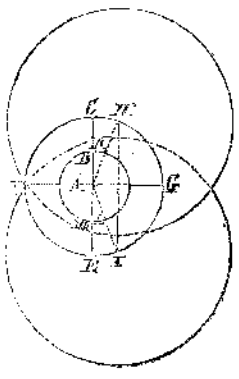
D. H. S. Jr. asks: 1. In fastening pulleys or straight gear to vertical shafting, ought the keys to be driven up or down? In securing bevel gear, ought the keys to be driven with or contrary to the thrust? By thrust I mean the tendency of the wheel to push out of mesh. 2, What scale of measurement is used in expressing the gage of a saw? Answers: 1. Drive the key so that the thrust of the wheel tends to tighten it. 2. There is a great lack of uniformity on the gage question, in the practice of different manufacturers. In ordering a saw, it is best to write to the maker and request him him to send a cut of the gage he uses.

J. O. R. asks: Will you please give a formula for finding the length of a lever for working a roll valve, diameter of steam chest, travel of valve and throw of eccentric being known? Answer: Let the circle described with A B as a radius represent the steam chest. Knowing the travel of the valve, the chord B C can be found. Then the chord, D E, which represents the throw of the eccentric, being given, A E, the length of



lever can be found by a simple proportion. Example: Diameter of steam chest = 6 inches. Travel of valve = 5 inches. Throw of eccentric = 11 inches. Angle B A C = $5 \times 360 \div 18{\cdot}8496 = 95°30'$ nearly. Chord B C = $6 \times 0{\cdot}672 = 4{\cdot}032$ inches. Lever A E = $3 \times 11 \div 4{\cdot}032 = 8{\cdot}18$ inches.

H. R., S. H., and H. C. say: Locomotive eccentrics sometimes slip round upon the shaft. Bourne, in his "Catechism of the Steam Engine," gives the following rule: "Draw upon a board two straight lines at right angles to one another, and from their point of intersection as a center describe two circles, one representing the circle of the eccentric, the other the crank shaft; draw a straight line parallel to one of the diameters, and distant from it the amount of the lap and lead; the points in which this parallel intersects the circle of the eccentric are the positions of the forward and backing eccentrics. Through these points draw straight lines from the center of the circle and mark the intersection of these lines with the circle of the crank shaft, measure with a pair of compasses the chord of the arc intercepted between either of these points, and the diameter which is at right angles with the crank, and the diameters being first marked on the shaft itself, then by transferring with the compasses the distances found in the diagram and marking the point, the eccentric may at any time be adjusted without difficulty." Can you make this a little clearer for us? Answer: In the accompanying diagram, let F G and E C be the two straight lines at right angles to each other, the circle described with A B as a radius be the end view of the shaft, the circle described with A C as a radius be the circle described by the center of the eccentrics, and H I the line parallel to E C, and distant from it the amount of the lap and lead. Then if F G represents the direction of the crank when on the center, H and I will be the positions of the centers of the eccentrics, according to the rule. If, then, the points K and L, in which the lines A H and A I intersect the circle representing the shaft, be transferred to the shaft, by laying off on its end the two diameters, and the chords B K and L M, the eccentrics can readily be set.



E. S. asks: Is hard rubber expansive in its nature when subjected to steam under pressure? Will an india rubber conical plug placed in a hole in the shell of a boiler, so that the steam pressure would make it faster in the plate, expand as fast as the hole increases in size by the expansion of the boiler? Answer: We think the proposed arrangement will answer the purpose very well.

R. asks: How can I take 4 or 5 copies of a letter written in copying ink? Answer: There are several varieties of copying ink in the market, which, their makers state, will take 5 or more copies; but you can probably make the ink you use at present effective by adding a little more sugar.

L. Z. R. says: I have a head of water of 7½ feet. During 3 months of winter, we cannot run, and I have tried means to use the water over again. Below me is a lake reservoir always full of water above is the lake which supplies my stream. My idea is to run a penstock, 4 feet deep and 3 feet wide, level with the lower lake, through and under my dam: and thence a penstock at right angles to this, 200 feet long, parallel to my dam. This admits the water of the lower lake in said penstock right into the water of the upper lake, whence it must be raised by power into the upper lake for use the second time. On this 200 feet (or longer if needed) penstock 12 or more large cheap windmills with 12 feet arms can be easily erected by simply driving 4 piles to form a frame; wood arms and sails would do, cheapness and strength being the only requisites. What kind of pump will discharge the most water, under 6½ feet head? I want simply a pump to raise the water from the penstock, discharging directly in the water above the penstock, the power being furnished by said windmills. Answer: Your plan is practicable, provided you can depend upon the wind. Probably simple piston pumps, double acting, will answer as well as anything.

H. says: I notice your answer to H. in reference to heating a room by gas. If a gas stove is put up properly, having not less than ⅜ inch connecting pipe, you can use it without any objectionable smell. There is, however, a great difference in gas stoves. In some, the combustion is more perfect than in others. The only secret is to have oxygen enough to mingle with the carbon to produce perfect combustion, free from odor.

R. A. M. says, in reply to C. M. N., who asked how to read the superscriptions on coins: Lay your coins upon a piece of hot iron; the dates will be so visible as to be plainly read. The iron must be red hot, and the coins must be read while hot.

H. says, in answer to S. W. G., who asked as to elevating water: A hydraulic ram is the most economical for your purpose. In order to elevate water 115 feet, you must have a fall of 12 feet from the spring or fountain head. You should excavate, at the exit of the springs, to 3 feet depth, and group together as many outlets of the springs as possible. Box the sides of the excavation with 2 inch plank and cover the same. Make a hole six inches square at the lower end of the box, in the trench or excavation. Cover this hole with a coarse wire gauze, conduct the water from this through a wooden box 4 inches square into a square box in which the ram should set, at the foot of the hill. Close the end of the wood supply pipe, and in this insert a piece of iron pipe 2 inches in diameter to connect with the ram. The supply or wood pipe should be from 25 to 50 feet long. This will take a No. 5 ram, which will receive from 6 to 14 gallons water per minute. The iron discharge pipe that runs up the hill to the reservoir should not be less than 1 inch. The end of this 1 inch pipe at the top of the hill should be inserted in a close, heavy, iron bound 10 gallon cask, at the lowest point. At the opposite point of the cask, insert another piece of pipe 1 inch in diameter, and continue to the fountain or reservoir. The cask is to equalize pressure. The ram will discharge one seventh of the water it receives into the reservoir. For every foot descent in the supply or drive pipe, you have a raising power of 10 feet in the discharge pipe. The object in having the discharge pipe large is to avoid friction; for when the pipes are smaller, there is more friction, the ram labors heavily and is more liable to get out of order. The box in which the ram sets should be made double, with a space of 10 inches, filled with sawdust, to prevent freezing. The discharge pipe and cask should be buried in the ground below freezing point. Avoid sharp angles.

T. L. M. says, in reply to several enquiries as to leaf printing: The bichromate of potash photographic process spoken of by your correspondent J. N. Q. gives but a faint picture, even after lengthened exposure to the sun. The image may be reddened by a dilute solution of nitrate of silver. Blue leaf prints are obtained by floating paper on a strong solution of ferricyanide of potassium, commercially called the red prussiate of potash. They are fixed by simple washing. By Obernetter's process, using salts of copper, pictures may be obtained in different tints of deep red and violet, with intermediate shades; but five different solutions are required, and the process, though not difficult, is rather tedious. Leaf prints of the greatest beauty and delicacy may easily be made by amateurs by the ordinary processes of photography on paper, scarcely any utensils being needed besides those found in any household. Make a solution of sixty grains of nitrate of silver and sixty grains nitrate of ammonia to the ounce of water. Float pieces of albumen paper, obtainable at any photographic supply store, on this solution for half a minute or a minute; pin up to dry in the dark. When dry, lay the paper on a thin board, the leaf on the albumen surface, and upon this a pane of glass. Fasten all together with spring clothes pins, and expose to the sun till the darkened albumen paper begins to show a metallic marbling; then remove from the glass, wash, immerse in a solution of chloride of gold. For a ten cent sheet of albumen paper, 18 by 22 inches, a grain and a half of chloride of gold is needful. Dissolve in a pint of warm water, add a teaspoonful of salt and a little chalk to remove the acidity; leave the washed leaf prints in this till they have assumed a pleasing shade (ten or fifteen minutes will be sufficient); then immerse ten minutes in a solution of hyposulphite of soda, two ounces in ten of water, remove and wash thoroughly; if possible, leave over night in running water. These prints are very pretty. In experimenting with them, I obtained beautiful results by soaking them in aniline dyes; the color does not show on the black ground, but the leaves shine out like exquisite paintings on ebony. The entire expense for chemicals (excepting the aniline colors) is $2.50, for this process; this will be enough for twenty square feet of pictures.

COMMUNICATIONS RECEIVED.

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

On Electricity *vs.* Yellow Fever. By O.

On a New Theory of the Universe. By D. L. S.

On Cement Water Pipes. By M. S.

On Richmond, Va. By H. E. C.

On Compressed Air Cars. By J. P.

On Propylamin. By C. D. D.

Also enquiries from the following:

J. T. T.—J. M. S. Jr.—H. Z. T.—M. F.—C. W.—J. P. L.—F. D. B.—F. C. D.—J. M.—P. L.—S. N.—A. L. B.

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 FOR THE WEEK ENDING

October 28, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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