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.

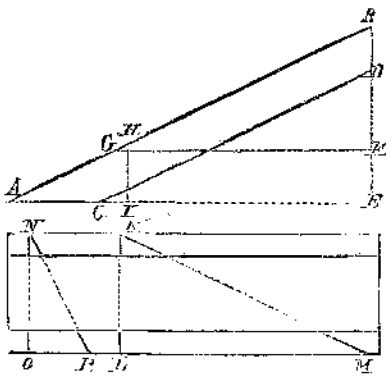
W. C. A. asks: How is the silvering prepared and applied in making glass reflectors?

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?

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.

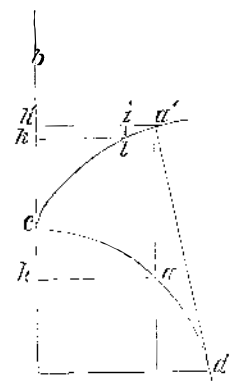
G. W. C. should consult Auchincloss on "Link and Valve Motions." See our advertising pages for booksellers' addresses.

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.

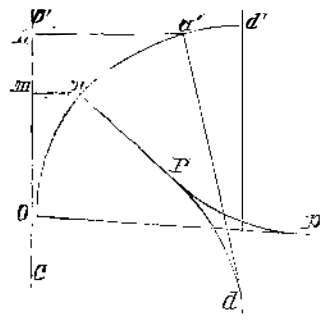
G. W. F. asks: 1. Is spherical gearing illustrated in the Science Record for 1873? 2. Why is the pipe that connects to a steam gage bent into an S form? Answers: 1. Yes. 2. So as to retain water in the pipe.

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.

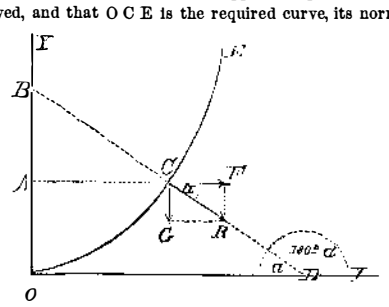
J. E. H. sends the following solution of C. H. A.'s question, on page 187, of our current volume:



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: $u = log.(\frac{1}{2}v \pm \frac{1}{2}\sqrt{v^2-8}) - \frac{1}{8}v^2 \pm \frac{1}{8}v\sqrt{v^2-8} - \frac{1}{2}$. 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.