T. P. says: My friend argues that a chain wound around a log and fastened to a pin in the log will roll up the skid poles on to a wagon more easily than it will by simply running the chain once around the log and fastening to the wagon. I contend that it makes no difference where the end of the chain is secured; the draft to the horses is the same, as the pulling point is always on the top of the log. He contends that winding the chain around the log helps to roll it, as part of the chain is pulling down on the side of log next to wagon. Answer: T. P. is right.

M. D. asks: 1. How long is a knot, used in estimating the run of a steamboat? 2. What is the area of a sphere or globe four feet in diameter? Please give a rule for the same. 3. How much more water will a forty horse power boiler evaporate with one pound on the safety valve than if there were ninety pounds, other things remaining equal? Answers: 1. The knot or nautical mile is about one sixth longer than the common statute mile. It is given by various authorities as 6,076·5 6,086, 6,120 and 6,139·75 feet. Bowditch gives 6120. The United States standard and most generally accepted value is 6086·07 feet. 2. The surface of a sphere is calculated by multiplying the square of its diameter by 3½ or more exactly, by 3·1416. The solid contents is measured by the product of the cube of its diameter by ⅙, or, to be precise, 0·5236. For a sphere 4 feet in diameter, these values are 50·265 square feet and 33·510 cubic feet. 3. In the inverse proportion of their total heats. If in both cases the boiler was fed with water at a temperature of 32° Fahr., the proportion would be as 1,148 to 1,183, about 3 per cent.

"Anxiety" says: I have a brother fourteen years of age who appears to be deficient in capacity and inclination for books. I am without sufficient patience to teach him, and I have found after schooling him two years that he cannot spell the simplest words, neither can he parse, or work out the easiest sum in arithmetic. Evidently the schools should share equally the blame: but I write for your advice regarding a trade for him. He can make a good pigeon house, ladder, and chicken house, appears to be fond of lending a hand to everybody about the house, and centers every interest in pigeons and chickens. What must I do with him, I mean, to have him out of my sight? Can I apprentice him? Answer: In the first place make up your mind to be really a brother to the poor boy; that is, be to him a loving and devoted friend. Bear with his infirmities, encourage the development in him of a good character by the exercise of the most patient kindness on your part. Take an interest in what interests him, and kindly endeavor to help him therein. Poultry breeding, especially of improved varieties, is not a bad occupation and requires the exercise of considerable intelligence. Supply him with pictures upon the subject, tools, materials and specimens of poultry, that is if you have the means. He will thus insensibly acquire a taste for that kind of information and ability to make use of what he knows; and thus a stepping stone to improvement in other directions, mental and practical, will be insensibly gained. Do not undertake to drive him out of your sight because he is a nuisance; on the contrary, strive to see how much you can improve and lift him up. But if there is any body in the world who can be a better friend to him than yourself, it might be your duty to encourage him to enjoy such influences.

M A. H. says: I have in view the improvement of a small water power; the fall is about 38 feet. The hight of dam will be 10 feet. I propose to use a small turbine, and convey the water from dam to wheel in a penstock. The whole length of penstock will be about 200 feet; about 120 feet of it will be on a level with base of dam and the last 80 feet will be built down a steep incline, the lower end being 28 feet lower than the upper. The wheel is said to use under this head 156 cubic feet of water per minute. The diameter of penstock when attached to wheel is 12 inches. What I want to know is Shall I get the benefit of the whole fall if I make the penstock the same size all the way? If not, would it do to construct the portion on a level with base of dam of 16 inches diameter and the remaining part 12 inches? Also which would be cheaper, water or steam power? Can the tables giving power and quantity of water for turbines be relied on? Auswers: 1. Make the penstock of a section at least as great as the wheel and of uniform size. The effect will be that due the whole fall less the moderate friction of the pipe. 2. Where it is uniform and reliable throughout the year or that portion of the year during which it may be required, water power is cheapest. The advantage of steam power lies in its reliability and uniformity and the privilege which it permits of locating the manufactory where convenience of transportation and proximity to market may make it desirable. 3. The tables of power of turbines are often unreliable; consult only those which are known to be based upon actual tests of the wheels themselves If a manufacturer will consent to allow a test of his wheel before purchase, he can evidently be trusted.

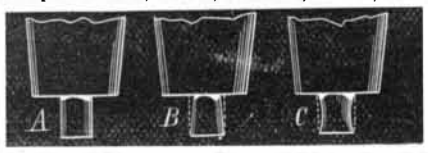
F. H. D. says: 1. How far is it practicable to carry steam from boiler to engine under about 60 lbs. pressure with pipe well protected? 2. How high vertically can water be raised with steam siphon through an inch pipe under same pressure? 3. Will coal tar do to paint tin roofs? 4. With 10 feet fall of water, what per cent of same could be raised 90 feet with hydraulic ram? Answers: 1. By very carefully protecting the pipe with non-conducting and non-radiating covering, and providing for the trapping off of water of condensation, steam can be conveyed almost any distance without great loss. Always make a steam pipe as short as possible, nevertheless. We have seen steam conveyed several hundred feet in well covered pipe, but the most economical steam engines which have come under our observation have had short steam pipes. 2. We know of no experiments on this point directly. The Giffard injector has been made to force water into a steam boiler while supplied with its own steam from a separate boiler carrying but half the pressure of the first. We should, from this fact, judge it possible for a well proportioned steam siphon to lift water to a hight of nearly 120 feet. with 60 lbs. steam. We should make the pipe large in proportion to the size of the instrument. The friction of water in pipes is often a serious retarding force. 3. Yes. 4. The hydraulic ram, if well designed, should force, with a fall of 10 feet, about five per cent of the water supplied to it to a hight of 90 feet.

A. W. asks: Did you ever know of an instance of the water leaving a steam boiler and going into the main steam pipe, so as to fill the pipe and stop the steam pump? If so, what was the cause and what the remedy? There has been a case of the sort brought to my notice, and I know of no cause unless it was because it was a new boiler, and that there was animal grease enough about it to make it foam badly. The boiler is connected with seven others, six of which are old boilers and never known to foam. It has always happened in the night time, when the rest were making little or no steam. The water used is river water. If this boiler be cleaned first, so that there is not much fire under it before cleaning the others, it has ceased to trouble. Answer: Cases have occurred in which steam has gradually filled a pipe as described, by condensation, where little or no current was passing through. Other cases are often met with in which so great a velocity has occurred as to take over sufficient water mechanically—by foaming—to choke a pipe. Our correspondent can judge for himself to which class of phenomena the case which he gives belongs.

E. R. D. says: I have charge of a 20x48 Corliss engine, making 56 revolutions per minute. On the side of the cylinder, there are two ½ inch globe valves for attaching an indicator. Can you tell me why I get strong electric shocks when I open either of these valves? Is it owing to the friction of the escaping steam, or to superheated steam let in from the superheater? Let me ask, as to my letter, published on page 164 of this volume: Were the fires caused by electricity or superheated steam? I will add a little more information: About 20 minutes before stopping, the last fire is put on, consisting of shavings and coke screenings mixed. Five minutes before stopping, full feed is put on and kept on till the water is six inches above the top gage cock. Twenty minutes after stopping and shutting off all valves, steam rises from 40 to 100 lbs., and will continue to rise if more cold water is not let into the boiler. Answer: The discharges are produced by electricity generated by the friction of particles of water, mingled with the escaping steam, against the sides of the orifice. Faraday proved that perfectly dry steam would not produce this effect. Superheated steam therefore, is not the cause, in this case. It is very probable that the fire referred to may have been due to electrical sparks, which are quite capable of igniting very inflammable substances.

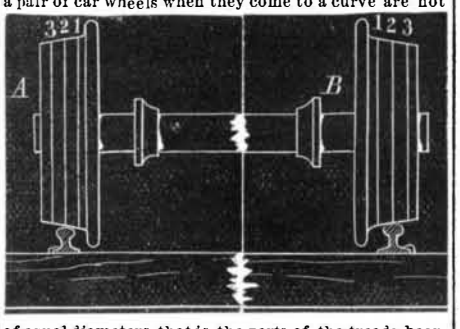
C. asks: If it is 14 feet from the rim of one driving wheel of a locomotive to the rim of the other, how wide should the tire of the driver be to remain on the track going around a 14 degree curve? 2. Is it, or is it not, atmospheric pressure which causes water to rise in a pump to fill the vacuum caused by the valve? Answers: 1. Lay it down on paper and determine it for yourself. You will be better satisfied than with a mere estimate. 2. It is.

W. S. H. asks: Which is the best form of punch for thin hammered iron? Should it be straight, with parallel sides, as at A, or conical, as at B, or holowed, as at C? Answer: The straight punch will be preferable, as the others will be more easily broken.



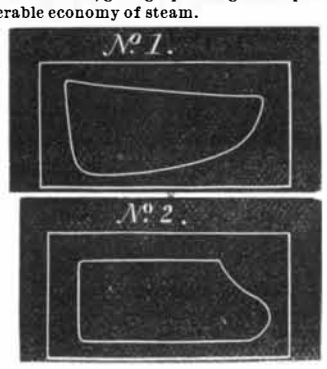
F. says: There are two lines of heavy shafting upon the same plane, but they are at an angle with each other of 33°. I wish to communicate 100 horse power from one to the other. The common mode, I am aware, is with gears, but in this case the noise is a serious objection. The driving shaft runs at a speed of 100 revolutions. Hooke's universal joint can be used successfully up to 15°. Can you inform me whether it is practicable to use three of Hooke's universal joints of 11° each, and in this way make the angle of 33°, communicating 100 horse power, and driving the second line of shafting? Will it work? Will the percentage of loss of power be greater than it would be if gears are used? Will the motion of the shaft driven be irregular? The size of shaft used is 3⅛ inches diameter. Answer: Three Hooke's joints would be likely to give trouble by the difficulty and expense of hanging and wear while driving them. The motion would be slightly irregular. There are patented modifications of Hooke's joints which are claimed to work well at any angle. If practicable, a belt led around guide pulleys would probably give most satisfaction, if it is impossible to use gearing. A double Hooke joint will give regular motion. In this form, an intermediate shaft is connected with each main line by a Hooke joint at each of its ends.

J. C. C. says that our answer to J. H., as to sliding of wheels on curves, was correct. Without coning, the flanges would last but a short time. The proposition of J. J. C. will not convince any railroad man that coning is an injury, from the simple fact that a pair of car wheels when they come to a curve are not



of equal diameters, that is, the parts of the treads bearing on the rail (see engraving) as at A, curve to the left and at B to the right. The wheel, being largest at or near the flange, travels a greater distance in the same number of revolutions than it does at figure 3, allowing it to curve without grinding the flanges, that is, if the curve is not too sharp; but the instant the wheel comes to a straight track, the bearings on the rail become of equal diameters, and the least tendency to vary from the center of the track is regulated by the cone. If J. J. C. will examine a pair of driving wheels with the coning worn off, he will find the flanges half ground off also, that is if the drivers are run very long after they become cylindrical or nearly so.

W. T. asks: Will you please give me the calculation for horse power practically in use under the following conditions: 10 inch cylinder, 2 feet stroke, cut off at end of stroke. Steam enters through about 10 feet of 2½ inch pipe. Pressure on boiler, 100 lbs., number of revolutions, 90. I do not know what to allow for friction and loss of pressure of steam in transmission; and the calculation without allowances gives so much that it would seem to require a considerable deduction to accord with our ideas of what we are using. Answer: A ten inch cylinder has 78½ inches area of piston; steam entering through 10 feet of 2½ inch pipe from a boiler carrying 100 pounds steam should reach the cylinder with a pressure of, probably, not less than 90 pounds, the engine making 90 revolutions per minute. The mean pressure will be reduced somewhat in the steam ports and, it may be, very greatly. We can tell nothing about it without seeing an indicator card. We can only guess that the average pressure on the piston in such an engine, under such circumstances, will not exceed 60 pounds per square inch. The horse power would, in such a case, be $78\frac{1}{2}\times60\times90\times4\div33000=51\frac{1}{3}$. This, our correspondent must remember, is merely an estimate. An engineer accustomed to the use of the indicator can settle the matter at once. The steam pipe is large enough. The valve should not be allowed to follow full streke. It would save fuel and give more power if cutting off at ¼. An engine following full stroke usually gives an indicator card like No. 1, while, if cutting off at ¾, it would make a diagram like No 2, giving equal or greater power with considerable economy of steam.

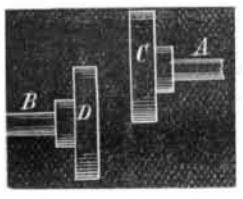


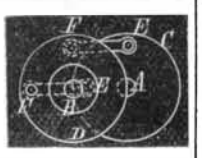
N. T. P. says: I propose to bore a hole 8 inches in diameter about 8 or 9 feet into permanent moisture, insert a lightning rod into this hole to the bottom, and then fill the hole nearly to the top with small scrap iron. Will this give sufficient dissipating surface? Answer: The ground connection which you propose is much better than the common practice of merely sticking the extremity of the rod into the ground for a short distance. The value of a ground connection depends on the quantity of conducting material which is introduced between the extremity of the rod and the earth. The greater the quantity of the conducting material, the better. Scrap iron is good for the purpose. Coke and charcoal are also excellent.

J. M. M. asks: Is there any liquid that can be prepared to black stoves with and not burn off, different from common blacking? Answer: There is nothing better than first quality plumbago for blacking stoves.

W. McC. asks: Can you tell me whether pine stumps can be blasted by any known process that will be cheaper than extracting them with a machine? What would be the cheapest and safest mode of blasting? Answer: Removal by the machine would be more effective than blasting, probably also cheaper. We have seen it stated that a good method is to bore the stumps and pour in petroleum. In a few days the oil will have penetrated the stump, which is then set on fire and will burn until consumed.

J. E. W. says: I have two shafts parallel to each other, distance from center to center three inches. I desire to transmit positive motion from one to the other, both to run at the rate of from 3,000 to 3,500 revolutions per minute and with as little noise as possible. Please tell me the most practical, durable and economical way to accomplish it. Answer: Will not this do? A and B are the two shafts, two inches from center to center. Fit on end of each a face plate, C D, and connect with links, E F, each three inches from center to center, making both links of same length by drilling the holes for pins simultaneously, clamping them together during the operation, and drilling in face plates, with equal precision, holes to take the pins. Then assemble as in the next figure. The face plates must be of such size that the distances E E and F F shall exceed the length of links over all, as otherwise they could not pass each other while revolving. Grind the pins to fit. If this will not do, try friction gearing, if the work is light and it can be worked in.





T. A. claims that January 1st, 1901, is the first day of the twentieth century. H. claims that January 1, 1900 is the first day of the twentieth century. Which is right? Answer: T. A.

Wm. H. Seaman, Lecturer on Botany, Howard University, Washington, D. C., says in reply to E. S. who asked how to preserve the morning glory pollen as a microscopic object: By mounting it in a cell filled with a mixture of glycerin, distilled water and alcohol, you can keep it in a natural condition. The proportions of the ingredients must be varied according to the nature of the object. The density should be that of the sap of the plant and this is arranged by altering the proportion of glycerin. If it is required to preserve color, but very little alcohol must be used, and a drop of carbolic acid to a dram of fluid is a useful addition. Verrill's solution is also very suitable.

COMMUNICATIONS RECEIVED.

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

On the Million Dollar Telescope. By S.V.C., and by S. L. D.

On the Creeping Rail Problem. By M. S. M.

On Small Pox and its Remedies. By A. B.

On Steam Launches. By J. T. B. S.

On the Atmosphere and the Milky Way. By H. A. C.

On the Motions of the Sun. By C. H. B.

Also enquiries from the following:

J. D. N.—C. W. H.—W. I. L.—J. F. E.—F.C. J.—W. C.—R. C. L.—H. B. M.—F. B. M.—D. D. E.—J. E. R.—J. A.—S. D. N.—G. R.—J. N. B.—C. W. J.—W. D. P.—S. & Co.—W. B.—H. W. A.—H. C.—F. H. L.—R. H. B.—R. A. D.—R. C.—A. C. B.—J. C.—J. C. H.—H. A. V.—W. H. T.—J. S. T.—N. M. L.—J. S.—A. B. & Co.—W. H. O.—W. F. D.—A. D. H.—R. H.

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

March 4, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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