Notes & Queries

J. B. asks: Is there anything poisonous from a cast iron furnace when wood is used for fuel?

J. W. J. says: How can I make a cheap calcium light to experiment with? What kind of gas shall I use?

E. T. C. asks: What kind of oil is best for a blacksmith's bellows? Is there anything not injurious to the leather or poisonous that can be used in the oil, that will prevent rats and mice from gnawing the leather?

R. H. D. asks: What advantage have turnbuckles over nuts and check nuts, for the shrouds, stays, etc., of small boats? The latter are so much cheaper, that I would prefer them if as good.

J. Q. asks: What is the difference in the crushing weights of a stamp that weighs 500 lbs., with a face six inches in diameter, and a wheel that is six feet in diameter and 18 inches face, and weighing eight tuns, rolling or twisting around on a circle of six feet in diameter.

A. Z. says: I have a portable steam engine, 120 lbs. power, 4 feet stroke, and 3½ inches bore; the length of the boiler is 6 feet, the diameter 38 inches, with 32 flues. In trying to run a 50 saw cotton gin, I hitched the piston to an ordinary wooden fly wheel with a drum of 5½ feet diameter. The gin runs perfectly well with 70 lbs. of steam, but soon the speed diminishes till it runs very slowly. What must be done to make it run? What is the reason it does not keep its speed? If I attach two small fly wheels to the main shaft of the gin, on one or both sides, do you think that it will help the steam to keep up a sufficient speed?

A. M. says: I am running a circular saw mill, making 500 revolutions per minute. The saw is 60 inch, friction feed; saw mandel is 3½ inches cast steel running in self oiling Babbitt lined boxes. The box next to the saw is hot all the time, but the box next to belt runs cool. I have refilled the box several times and in different ways without success. I use lard oil and have changed mandels twice in six months. It will get hot, whether the saw is on or not, if it runs one hour. Can any one explain?

H. C. D. says: I have an 18 × 75 foot open flat boat, which draws 4 inches: also have (and wish to apply to it as a power, by suitable cog gearing and pitman connections to a steam wheel) a 10 or 12 horse power portable engine of 150 revolutions per minute. I wish to know what are the best length and width of bucket, diameter of wheel, and speed of same. What size should the shaft be to drive said boat 3 miles an hour against a current of 3 miles an hour when the boat is loaded to draw 10 inches?

Answers to Correspondents

C. C. S. asks: How can I construct an ice boat? Answer: Read page 88 of our volume XXVI.

H. E. B. repeats B. W. C.'s query. Answer: See our reply on page 171 of this volume.

D. A. K. will find full directions for a bath for nickel plating on page 65 of our volume XXVI.

W. E. G. says: I received the SCIENTIFIC AMERICAN dated March 1st on February 22 containing "Index of Inventions for which letters patent of the United States were granted for the week ending January 28, 1873, and each bearing that date;" how can this be when you publish your paper and subscribers receive it on February 22? Answer: The SCIENTIFIC AMERICAN for each date is issued in the preceding week, and contains the latest Index of Patents published by the Patent Office. Our correspondent's statement is perfectly correct.

J. A. & Co. say: We put a set of new tubes in a small upright boiler; and in eleven months they were corroded so that we had to put in another set. Will you please inform us what ingredients and what proportion we ought to put in our tank (which we pump from) to prevent the corrosion in the boiler? Would it be best to use copper tubes? Answer: We should require a knowledge of the character of the impurities of the feed water before we could give an intelligent reply.

A. H. M. says: In your paper of March 1, you inform A. B. S. that the back pressure on engine is about ½ lb. per foot of submerged end of exhaust pipe. If this is correct, please explain this phenomenon. I have a steam pump, and within about ten feet of it stands a cistern, the bottom of which is 6 feet above the exhaust pipe of the steam pump. I placed an upright wooden pipe, 3 inches bore, between the pump and cistern, of sufficient length to reach from the ground to above the top of the cistern. I took the exhaust pipe (1½ inch gas pipe) into the side of the wood pipe, level with the engine, ten feet above, at the top of the wooden pipe. I run a 2 inch pipe horizontally over the top of the cistern and turned it down into the cistern, which is 4 feet deep, within a foot of the bottom. The cistern is usually full, or nearly so, of cold water. The pipes were all airtight from end to end, except a hole, ¼ inch in diameter, bored into the perpendicular wood pipe 2 feet below the exhaust pipe, intended to let off the condensed steam. Result: Upon starting the engine (pump), a stream of cold water started from the small opening with the force of say about 10 feet head. I enlarged the hole until, finally, I made it 1½ inches in diameter, which had only the effect of increasing the discharge of water. In fact, it made and maintained a continual siphon whether the pump was running or not. The speed of the pump did not appear to be affected, but it occasionally pounded as from water in the steam cylinder. I finally overcame the difficulty by a valve in the top of the perpendicular pipe opening inwardly, but held closed by a slight spring. Now when it inclines to draw the water over by the vacuum found in the siphon, the valve admits air which the next exhaust forces down into the cistern, keeping up a commotion at intervals of say three to five strokes of the pump. If there had been the back pressure stated, could a vacuum have been formed sufficient to have made a siphon? Answer: The arrangement described forms a pretty effective condenser, as first made. As modified, our correspondent will find, we presume, should he measure it, a back pressure such as we stated, so long as the mingled steam and air are being forced down into the tank. With a steam engine exhausting into its own feed water tank, the first effect, on starting the engine, might be to produce a vacuum in a similar manner, but, as the exhaust is capable of heating several times the weight of the feed to the boiling point, condensation would soon cease, the vacuum would be destroyed, and the back pressure would become a load on the engine.

W. S. B. says: I was with Mr. LeVan when he examined the boiler at Conshohocken, Pa. Mr. LeVan found the iron reduced to three sixteenths in one place, which was not where the boiler burst from the strain upon it, but where the mud drum was torn off. His statement that the steam gage ten minutes before showed a pressure of 53 pounds is incorrect, because there was but one gage in the mill, and the boiler was shut off from that one. There are today worse boilers in this mill working at from 60 to 125 pounds pressure. I saw one, this week, taken from the next furnace to the exploded one, with 18 patches on the fire sheets. I heard the proprietor say last summer, in reply to the engineer's opinion that they were carrying too much pressure, namely 100 to 110 pounds, that it was all nonsense, that those boilers were able to stand 150 pounds pressure. The trouble was that they wanted one man to do three men's work, and one man was doing it for less than one good man's wages, and he forgot to open the connection with the other boilers. The loss of 17 human lives was the result, with many more persons crippled for life. Please state at what pressure the safety valve, as described last week, would blow off. Answer: Such an arrangement of steam gage has been a cause of quite a number of explosions of old and worn out boilers. The effort to obtain the labor of three good men by paying a low price for the time of one man is another cause, which, perhaps, operates quite as often in producing explosions as almost any cause appertaining to the boiler itself. We fear it may be a long time yet before it shall have become a well recognized fact that nothing is ever saved in the long run by attempting to obtain service of any kind without giving the proper equivalent. Should other explosions occur, as apprehended by W. S. B., he will have the satisfaction of knowing that he has done a duty in the premises by giving fair warning through the SCIENTIFIC AMERICAN to those interested. We do not know to what safety valve the last paragraph refers.

J. W. S. says: I am firing a twenty-five horse portable tubular boiler with soft coal. How much more fuel will it take to fire with the furnace door open than with it closed? I run steam down hill to one 12 horse engine through 350 feet of 1¼ inches pipe, boxed in and packed with sawdust. Thinking that some of the power was lost in carrying steam so far, we fitted on a steam gage on steam pipe at engine and found 2½ pounds more pressure than the gage showed on the boiler. We then placed our gages together on the boiler and found them both alike, both standing at 80 lbs. How does this occur? I have seen it stated in your paper that steam loses one pound in passing through each ten feet of pipe. We also run steam up hill 300 feet, in 1¼ inches pipe to a 12 horse engine. Placing the gage there, it indicated 5 lbs. less than gage on boiler. But the pipe runs under a road, and the dampness may condense the steam there. Does it take more steam to run up hill than it does down? What is the difference (if any) in the pressure on top of a boiler and on the bottom? Take a very light carriage, something like a velocipede only three wheeled with one person on it. How many pounds of force is required to propel it one thousand yards, on level ground, in one minute, and how much on an iron track? The power is to be applied in the form of a weight.

C. E. G. says: I want to know how the black glove finish is put on to such articles as harness buckles. Answer: Dissolve three sticks of black sealing wax in half a pint of alcohol. Apply with a sponge.

J. L. J. asks: What do you mean by excessive priming? Answer: Priming is water carried into the cylinder of an engine by the steam, and it causes pounding of the piston and wears away both piston and cylinder. Dry steam alone should be admitted to an engine. In answer to your other question: Yes, very creditable. Persevere.

J. B. F. asks: Why is there a star marked in the constellation *Leo* (second star from point of the Sickle) called *Ras-al-Asad*, of the third magnitude, while it is not to be seen there? Answer: This star (called *Rasalas* in Procter's atlas) is to be seen at any time in the designated place.

Several correspondents have called our attention to an omission in the paragraph relating to the cone pulley on page 123 of the current volume of the SCIENTIFIC AMERICAN. The length of line B C is not given. It should be made equal to the difference between the least and the greatest radii of the cone.

N. C. M. says: On October 15, 1872, a short time before sunset, I saw a spot upon the sun with my naked eye. Viewed through a field glass of good power, it was resolved into two spots, very close together, and several other smaller spots were visible. The atmosphere at that time was quite hazy. Were the sun spots at that time remarkable for their size? Answer: November 10, 1872, and thereabouts was a period remarkable for the size and number of the spots on the sun; one double spot was to be seen as single with the naked eye. Taking into consideration the time of the sun's revolution on its axis (about 25 days) the same group would have been visible on October 15.

C. W. W. asks: When did the vernal equinox fall back from March 21 to March 20? Answer: The answer to the question in regard to the vernal equinox involves the whole theory of the construction of the calendar; it may be found in any encyclopædia and almost every work on popular astronomy. Lockyer's "Elementary Lessons in Astronomy" well discusses the subject, in the chapter on the measurement of time. Our correspondent falls into error in supposing that there is or ever has been any positive fixed date for the occurrence of the equinoxes. It is impossible to avoid some variations, as the time of the sun's revolution from one equinox to the same equinox again is not an exact number of days. It has been the object of all calendars to so correct the resulting errors that the variations are kept within as small a limit as possible. By the system now in use, instituted by Pope Gregory XIII in 1582, the vernal equinox is always reckoned on or near March 21. This year it happens on March 20.

J. W. P. requests us to publish information about how to make good hard soap, and the chemistry thereof. Answer: To make soap, boil fatty or oleaginous matter with a weak alkaline lye rendered caustic by quicklime, and add portions of stronger lye from time and time, the ebullition being still continued until these substances, acting on each other, combine to form a tenacious compound, which begins to separate from the water; to promote this separation and the granulation of the newly formed soap, some common salt is added and, the fire being withdrawn, the contents of the boiler are allowed to repose for some hours in order that the soap may collect into one stratum, and solidify. When this happens, it is pressed into molds or cakes and, when quite solid, cut into bars. If the soap be made from the cheaper kinds of fat, it will hardly acquire firmness to satisfy the thrifty washerwoman; but it can be prevented from melting too rapidly in hot water by the introduction of 5 per cent of fused sulphate of soda. Ure says that this addition not only hardens the soap, but improves its color.

W. R. J., Jr., asks at what rate and to what extent mercury expands on the application of heat. Answer: Dulong and Petit found that mercury expands $\frac{1}{5550}$ of its volume for each additional degree (centigrade) of heat up to 100° C. From 100° to 200°, the average expansion for each degree is $\frac{1}{5425}$, and from 200° to 300° $\frac{1}{5300}$.

E. C. H. takes exception to our reply to a correspondent that the rotundity of the earth is 8 inches per mile. By the rotundity of the earth, expressed in inches, we mean the distance of the surface of the planet from the extremity of a line whose other end is tangential to the curve. The common formula is: ⅔ of the square of the distance in miles will give the rotundity in feet. Square of 1 mile is 1; ⅔ of 1 foot is 8 inches.

P. L. D. asks: Can any of your readers give any information as to the best method of making paper transparent, but the substance used must not prevent the use of mucilage on the paper? Answer: Canada balsam and turpentine make a good preparation for tracing paper.

L. E. H. asks: What regions of the world produce gutta percha, and India rubber or caoutchouc? Answer: Gutta percha comes chiefly from Borneo and other islands of the East Indian archipelago, and caoutchouc from South America and the East Indies.

W. F. C. S. asks: 1. What proportion ought the tooth of a gear wheel to bear to the space between it and the next tooth? 2. We have a six wheeled switch engine with four equalizers, two on each side. The engine when started with a train of cars would cock up her front and duck her rear, as far as the vertical play of the jaws would allow. The fault was discovered to be caused by the front equalizer. How is this? 3. What is meant by the point of suspension being above the center of gravity? Is it as seen in a scale beam? Answer: 1. The side clearance in gear wheels will properly vary with circumstances. We have seen but a sixteenth allowed in a well cut mortise gear of 4½ inches pitch, and, on the other hand, that amount of clearance is none too great, in a rough cast gear of an inch pitch. 2. With the second arrangement, the engine was tied down forward, while, with the first, as we understand the two arrangements, the equalizers allowed the main frames to take a position in line of draft 3 Precisely.

H. P. & C. asks: In the construction of a hydraulic ram should the pipe that conducts the water from the ram to the place required be larger at the axle end or *vice versa*? Is tin lined lead pipe preferable to ordinary gas pipe for that purpose? Answer: A pipe of the same size all through will do. Tin lined pipe unnecessary.

J. B. J. says: You replied to P. R. S. who wanted to know how much water it takes to run a ten horse power steam engine per hour; your answer is from 50 to 200 gallons per hour, according to quality of boiler and machine. Is the answer correct? Should it not be per day? Answer: Our reply reads as we intended it should. A good 10 horse power engine with equally good boiler should require about 50 gallons of water per hour. This is something over 300 pounds, and it would be evaporated by 30 pounds of coal. Three pounds of coal per horse power per hour is extraordinarily good work for such small power. About 1,700 pounds, or 200 gallons of water requires frequently 200 pounds of coal for its evaporation, and a ten horse engine has been known to reach this figure on many occasions.

W. H. W. asks: How is petroleum applied to boilers to remove scales, I mean such as locomotive boilers, that cannot be got into? Is it not apt to make the boilers prime? Answer: When the boiler is empty, and just before filling it, put in the petroleum. Then turn on the feed, and as the boiler fills, the oil, floating on the water, reaches every part and saturates every square inch of incrustation.

M. J. D. asks: Will you give me the rule for finding pressure per square inch on slide valve? Answer: We know of no recorded experiments on this point. If our readers can give the information, we shall be pleased to receive it. We think that some of our friends of the Engineer Corps of the navy can enlighten us.

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 3⅛ 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 80feet 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 12inches? 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.

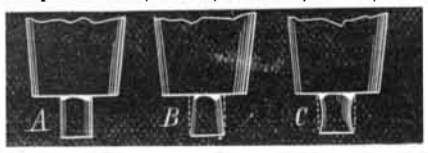
F. H. D. says: 1. How far is it practicable to carry steam from boiler to engine under about 60 lbs. pressure with pipe well protected? 2. How high vertically can water be raised with steam siphon through an inch pipe under same pressure? 3. Will coal tar do to paint tin roofs? 4. With 10 feet fall of 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 90feet.

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.

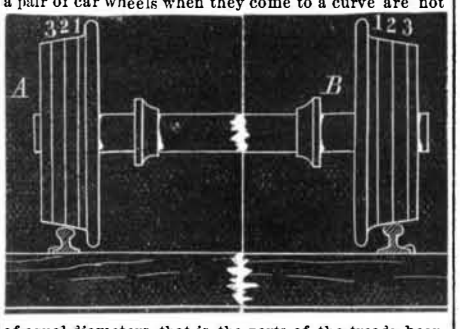
C. asks: If it is 14 feet from the rim of one driving wheel of a locomotive to the rim of the other, how wide should the tire of the driver be to remain on the track going around a 14 degree curve? 2. Is it, or is it not, atmospheric pressure which causes water to rise in a pump to fill the vacuum caused 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 holed, as at C? Answer: The straight punch will be preferable, as the others will be more easily broken.



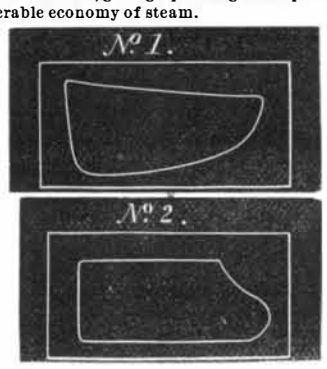
F. says: There are two lines of heavy shafting upon the same plane, but they are at an angle with each other of 33°. I wish to communicate 100 horse power from one to the other. The common mode, I am aware, is with gears, but in this case the noise is a serious objection. The driving shaft runs at a 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 3¼ 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. 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 stroke. 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.

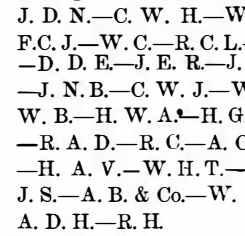


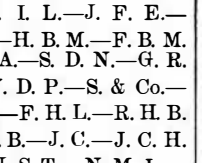
N. T. P. says: I propose to bore a hole 8 inches in diameter about 8 or 9 feet into permanent moisture, insert a lightning rod into this hole to the bottom, and then fill the hole nearly to the top with small scrap iron. Will this give sufficient dissipating surface? Answer: The ground connection which 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. G.—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.

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