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Bolt Makers, send for descriptive cuts of Abbe's Bolt Machine, to S. C. Forsaith & Co., Manchester, N. H.

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ANSWERS TO CORRESPONDENTS

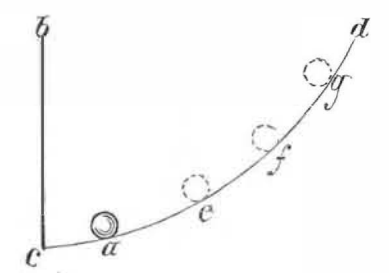
J. E. R. should try to blue his steel articles by the process mentioned on p. 107, vol. 26.—C. H.D. will find a method of making bone phosphate detailed on p. 343, vol. 26.—R. W. should read the answer on p. 362, vol. 25, for a good black dip for metal articles.—E. C. M. will find a description of the horticultural fertilizer on p. 401, vol. 28. It should be phosphate of ammonia, not biphosphate.—D. R. is informed that the published accounts of phospho-bronze do not mention the proportion of phosphorus, which can doubtless be ascertained by experiment.—H. J. H.'s query as to the names of the steam engine is incomprehensible.—T. A. C. can find the proper weight of ball proportioned to length of lever for a safety valve by applying the formula on p. 106, vol. 25.—S. H. W. should read some elementary work on chemistry, and had better advertise for the other information.—J. T. L.'s query is a trade matter; he should consult an engineer.—We are obliged to G. & C. for their correction; the mistake was not ours.—P. P. can bronze cast iron by using the process described on p. 58, vol. 26.—B. L. B.'s equation is a catch; the answer may be either 18 or 2, as the *data* are not properly expressed.—W. B. J. will find the needed information as to mold for plaster ornaments on p. 138, vol. 29.

E. F. L. asks: Would two steam boilers of equal capacity, one an upright and not walled in, the other a horizontal and return tubular, walled in, each having thirty-three feet of smoke stack, do the same work with the same coal? Which would be the most economical, and what per cent will the one save over the other, and why? Answer: We suppose the horizontal boiler would be the most economical, because it would be better protected against loss of heat.

G. D. asks: Does it require more force to bring a moving body to rest than it does to give it the motion? I should say not; yet it would seem to be so, if I rightly understand your reply to J.B.T., page 77 of the current volume. I reason that if an engineer can jump from his engine at the rate of 15 miles an hour, it makes no difference, so far as his relation to the engine is concerned, whether it is in motion or at rest. If the engine is moving west at the rate of 15 miles an hour and the engineer jumps east with the same velocity, when he strikes the earth he will be motionless. Is not this so? I think J. B. T. mistaken in thinking that "engineers, etc., invariably jump in the direction of the moving train." It is true that they face in that direction, but they usually jump with a swinging backward motion, making the head and body move as rapidly as possible in the direction opposite to the train. If an engineer jump backwards with a velocity of ten miles an hour, and the train is moving in the opposite direction at the rate of 25 miles an hour, he strikes the earth with the velocity of only 15 miles an hour, the force of which can easily be resisted by an ordinary man. Active base ball players frequently fall without injury when running with a speed of from 19 to 20 miles an hour. Answer; It is true that it takes no more force to stop a moving body than is required to impart the motion to it; but the question of time plays an important part in many cases. We will try and make this plain, by a few simple illustrations. Suppose a train is moving at the rate of 30 miles an hour, and strikes against something which stops it instantly. Now if a man were standing up in that train, facing to the rear, the effect would be the same as if he were to jump with a velocity of 30 miles per hour; and on our correspondent's theory, he ought to remain standing and uninjured. On the contrary, we know that he would perform a few involuntary somersaults, and the chances would not be very favorable for his escaping with his life. This is because, though just as much force was brought to bear to stop his motion as had been used in producing the motion, there was an amount of work stored up that required time as well as force to overcome it. A train moving from a station starts slowly, and gradually acquires speed, so that the passengers are not much affected by the increasing velocity. But if the train started abruptly at a speed of 30 miles an hour, couplings would break, passengers would be thrown in all directions, and general havoc would be the result, for the same reason as before, that time is required to impart a rapid motion to a body, if it is to be done without shock. We might multiply these illustrations to any desired extent. Suppose we have a fly wheel with a heavy rim and crank attachment, and that a man working on this crank makes the wheel revolve at a high velocity. Now let him try to stop it suddenly, and he will find that the power stored up in the wheel is sufficient to lift him off his feet, and throw him to some distance. The case instanced by our correspondent, of base ball players, will also serve as an illustration. Probably one of these players rarely runs faster than at the rate of 18 miles an hour, and so many accidents have happened at first base by the difficulty of stopping suddenly without injury that the rules have been amended, and a player on reaching first base does not have to hold it, but may run over it and cannot be put out, until the ball has been returned to the pitcher. Our correspondent is right in remarking that persons jumping from a moving train face in the direction of the motion, and hold back. Some years ago, a man in Schuylkill Haven used to excite the admiration of all who saw him by jumping from a train which was moving at the rate of 25 miles an hour. He may still display his agility and nerve, for aught we know, although it must be confessed that this proceeding was somewhat risky. His plan was to go to the rear platform, place his feet on the buffer and his hands on the rail, leaning back as far as this position would allow. When he reached the place where he desired to stop, he would dexterously release his hands and feet simultaneously, and reaching the ground in an upright position, would walk off to his work with an unconcerned air. We are not relating this incident to induce our readers to go and do likewise. If they are very desirous of experimenting et them try it on a street car, where the only results of failure will be a few bruises and the derision of the bystanders. We once knew a man who jumped from a canal boat, in a direction contrary to that in which it was moving. He made some miscalculation, apparently, for, instead of landing gracefully on his feet, his head collided with the ground, and he went home a wiser and a sadder man. We think there is one case in which a person could jump backward from a moving train, if everything were propitious. Let him start at the front end of a platform car, and run back as fast as the train was moving forward; then he could jump with safety. But a slight miscalculation might disarrange the experiment.

W. H. M. says: In your answer to M. C., in No. 8, Vol. 29, you say: Multiply the diameter of the cylinder by the decimal .7854; is this not an error? Should it not be the square of the diameter? Do you deduct anything for friction? 2. What books should a young man read so as to get a good idea of machinery in general, and about what would they cost? Answers: 1. It should be the square of the diameter, of course. In calculating the indicated horse power of an engine, no deduction is made for friction. We endeavor to avoid mistakes of this character, and will thank our readers to point out errors whenever noticed. 2. Appleton's "Dictionary of Mechanics," price $20.00, will give you a good general idea of machinery. Spon's "Dictionary," now in course of publication, by the same author, is later and more complete.

C. H. A. says: Suppose a ball, *a*, to be revolving around an axis, *b*, say 60 times a minute; is it possible to draw a curve, from *c* to *d*, such that its tangent shall be at right angles to the resultant of the forces of gravitation and centrifugation acting on the

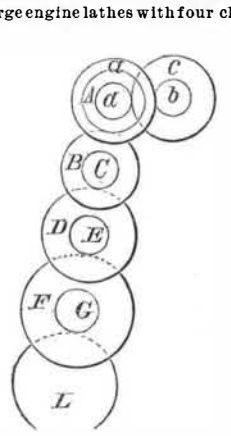


ball at whatever point of the curve the ball shall be placed, say at *e*, *f*, or *g*, the number of revolutions being constant? Answer: The curve is a parabola, with vertix at the lowest point. We would be glad to receive a solution of this problem (which is quite simple) from some of our readers.

R. L. asks: Can a correct test of the strength of a bridge be made from a model, one inch to the foot and in exact proportion to one of full size? Answer: Small models are generally stronger, in proportion to their size, than the actual works.

F. P. says: In constructing a pair of scales, as sensitive as possible, (1) is there any rule as to the relative length of beam, and chains or threads to which the cups are attached? 2. The two holes being made at each end of the beam, and a straight line drawn, how far above the line in the center of the beam should the pivot be, to make the most sensitive results? Will the scales be more sensitive with the pivot just as near the line as the beam will equipoise than if the pivot were farther? 3. Will the knife-edged pivot be as delicate a mode as any? 4. A friend says that the index above the pivot must be of a certain length and weight to make the scales sensitive. I contend the index is merely a pointer and has nothing to do with the sensitiveness. Which is right? Answers: 1. This does not affect the sensibility. 2. By placing the pivot as close to the center of gravity of the beam as is practicable, the sensibility will be increased. 3. Yes. 4. You are right.

N. H. T. asks: 1. What is the cost of a first class locomotive? 2. What number of pounds strain will it produce in a rope or chain fastened to some immovable body? 3. In what position should the cranks of a double engine be placed, to act to the best effect, they being keyed on to the shaft at right angles to one another? 4. Give a rule for compound gearing used on large engine lathes with four change gears. Answers:



1. About $12,500. 2 About 5,000 pounds. 3. Each 45° from middle position. 4. Let t = threads per inch on lead screw, and T = threads per inch to be cut; n = revolutions per minute of lead screw to one of main spindle. Then T × n = t. To find n, for any number of change wheels: Let A = number of teeth in gear on cone spindle. B = teeth on 1st stud wheel. C = teeth on 1st stud pinion. D = teeth on 2nd stud wheel. E = teeth on 2nd stud pinion. F = teeth on 3rd stud wheel. G = teeth on 3rd stud pinion, etc. L = teeth in wheel on lead screw. Then if N = number of revolutions of lead screw to one of cone spindle, $N = \frac{A \times C \times E \times G}{B \times D \times F \times L}$. And if M = number of revolutions of main spindle to one of cone spindle. n = N ÷ M. To find M. a = teeth in wheel on cone spindle, b = teeth in 1st wheel on back speed shaft. c = teeth in 2nd wheel on back speed shaft. d = teeth in wheel on main spindle. Then $m = \frac{a \times c}{b \times d}$. The accompanying engraving will probably make the rules clear.

F. E. H. asks: What would be the average difference in weight of a loaded freight car and one unloaded? Answer: Weight, nine tuns empty, nineteen tuns loaded.

A. K. asks: 1. Would it pay to own and run a grain separator where coal is cheaper than wood? Coal is $8 per tun at the bank, distance to be hauled from 2 to 12 miles. 2. How much coal would be consumed by a 20 horse power engine in a day's work of 12 hours? Answers: 1. We think so. 2. Probably between 1,500 and 2,000 lbs.

W. H. L. asks: How can I get a grease spot from a book? Answer: Apply refined benzine with a sponge or rag, to the grease spot.

H. F. U. asks: What shaped nozzle will send the longest and most solid stream from a fire engine, *cæteris paribus?* Answer: The nozzle which has the form of the contracted vein, (see article on "Efflux of Steam," page 113, current volume.)

A. K. asks: How much of an inch square must a steel barbe made, to support a weight of 3,000 lbs. the bar to rest on supports 2 inches apart? What are the formulas, if weight or the distance of the supports be increased? Answer: The amount of cross section will depend upon the form, and the distribution of the weight. We will give you two rules for a steel bar, and you can assume different depths, weights and distances between supports, to find the various widths required under different circumstances. 1st. If the weight is suspended at the center the width of the bar in inches is equal to the clear span in feet multiplied by the weight in pounds, divided by the square of the depth in inches multiplied by 1,000. 2nd. If the weight is uniformly distributed, the width of the bar in inches is equal to the length of clear span in feet multiplied by the weight, divided by the square of the depth in inches multiplied by 2,000.

A. B. asks: Why is it that a saw heats on the rim in sawing hard timber, when in soft timber it runs very well? 2. Ought a circular saw to be hollowing on the log side, or perfectly straight? Answers: 1. Your saw is undoubtedly what saw makers call open on the rim, or possibly it may not be in proper line with the carriage; generally board circular saws are lined with the front or cutting portion a little nearer to the carriage than the back part of the saw, in order to prevent the teeth cutting or scratching the timber; this causes the saw naturally to incline towards the log and bear against the guide. The harder the timber, the more resistance it requires to keep the saw in proper position; consequently the greater friction, in sawing hard than soft timber, causes it to heat on the rim. If it is more open at the rim than in the body of the saw, the least amount of heat expands it, and causes it to heat still more. 2. A saw should be flat on the log side, and not hollowing. It had better be a very little full or convex on the log side, but in no case so much as to permit any portion of the plate to touch the timber.—J. E. E., of Pa.

L. S. says: I noticed in your answer to J.H., page 123, current volume, you recommend him to use Davies' "Algebra" and Legendre; but you will find that although they were the best in your day and mine, they are far behind Robinson's "Algebra," especially his "University Algebra," and Greenleaf's "Geometry," which, on examination, you will find very practical. However, the Legendre style (which they follow) never satisfied me. There is none of that solid reasoning found in Playfair's "Euclid" or Potts' "Geometry." The latter is an English work reprinted in New York. Answer: We are quite familiar with the works you mention, and mentioned the most suitable text books, according to our judgment, At the same time we are glad to receive the opinion of others. In an article recently published we have intimated that it was of more importance how the subject was studied, than what text book was used.

N. D. H. asks: In building an engine to propel a boat with twin screws, would friction gear work to more advantage than cog wheels? The latter are often used on such boats on the Western canals, and make a rumbling and disagreeable noise, and are liable to get out of order. Answer: Friction gear will work very well, if properly constructed. It is well to have V shaped grooves in the wheel or pinion, having V shaped projections on the other.

D. asks: 1. How can I make chloroform, and how is it administered to make a person sleep one hour? 2. How is acidulous mineral water made? 3. How is lemon syrup made? 4. Whose work on chemistry would you advise me to get, that is, whose is the most complete? Answers: 1 Chloroform is made by distilling a mixture of alcohol and chloride of lime. It is administered by means of a saturated sponge or handkerchief placed over the mouth of the patient, but we would advise you in no case to attempt to experiment with reference to its anæsthetic properties, as serious results might follow. Its administration should be left entirely to an experienced physician. 2. By charging water, with which the proper chemical ingredients have previously been mixed, with carbonic acid gas. 3. By mixing lemon juice or citric acid with sugar syrup. 4. As an elementary work, Roscoe's or Bloxam's.

J. P. asks: Is there any method of preparing cloth or thin leather so as to render it impermeable to air without destroying its pliability? The ordinary rubber cloth is not, and I am told cannot be made, thoroughly air tight. Answer: We should judge that the cloth, from which what are known in England as mackintoshes are made, might serve your purpose. This cloth is prepared by coating two sheets of cloth on one side only with india rubber varnish and then pressing the varnished sides together by means of rollers so as to make one sheet. Thin leather might be treated in the same manner.

R. C. asks: 1. What is the difference between gold-bearing quartz and common quartz? 3. How is gold separated from quartz? 3. Does common sand contain gold; if so, about how much to a bushel of sand? 4. What are crucibles made of? 5. How can I separate brass? 6. What work on chemistry is the best? 7. How is phospho-tungstic acid made? Answers: 1. No difference, except that one contains gold and the other does not. If gold is present, it can generally be detected by the eye. 5. Gold is generally separated from quartz by crushing and grinding the rock into a fine flour; then by means of water the quartz is washed away, leaving the heavier gold in the vessel. There are other methods of separation. 3. Common sand does not contain gold. 4. Crucibles are made of black lead or graphite, also of clay. 5. By heat. 6. One of the best is Bloxam's. 7. We do not know what our correspondent means unless it be a mixture of phosphoric and tungstic acids.

J. H. K. says: I have an orchard of apple trees about 15 or 20 years old. For the last two or three years I have been greatly troubled by the ravages of the canker worm; and unless a stop is put to them, I shall probably lose the trees in a year or two. Please inform me if there is a remedy. Answer: The female of the canker worm is fortunately without wings, and is obliged to crawl up the trees to lay the eggs. If you can prevent this, you can put a stop to the depredations of this insect plague. Various methods have been devised for this purpose, such as the application of tar either directly to the bark itself, or on strips of cloth, paper, etc wound around the trunk, Melted india rubber has been recommended in England, but we should think tin troughs filled with cheap oil, fixed to and encircling the whole trunk, near the ground, would be a good plan. This plan indeed has been tried with success on a small scale. When the worms are on the leaves, showering with a mixture of whale oil soap in water (1 lb. soap to 7 gallons water) will kill the worms without injuring leaves or fruit. See Dr. Harris on "Insects Injurious to Vegetation."

F. T. H. asks: What will take nitric acid stains from cloth? Answer: Try strong ammonia or hartshorn. Apply with a small piece of sponge or cloth and afterwards wash the place with water.

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