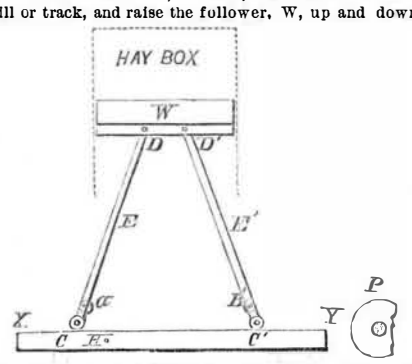
Notes & Queries

C. C. says: I have a hay press which works in the following manner: E and E′ are levers with track wheels at the lower end, C and C′, which roll on X Y as a sill or track, and raise the follower, W, up and down



in the hay box. A chain is fastened to a pin in the side of the track, H, then passes over a pulley at B, thence over a pulley at A, thence over a second pulley at B, thence over a second pulley at A, thence to the power, P. A power of 1,600 lbs. is pulling on the chain at P; what will be the pressure on W, when the levers are 3 feet farther apart at the bottom than at the top? The levers are 8 feet 8 inches long. What power is gained by the 4 pulleys when one end of chain is fixed as above? [Problems involving the principle of this machine have been solved in our paper on several previous occasions. But as this is rather an ingenious combination, perhaps some of our readers may like to work it out.—EDS.]

E. C. M. proposes the following problem: A hemisphere has its base fixed in a horizontal position, and a body, under the influence of gravity, moves down the convex side of it from the highest point. How far from the base will the body be when it leaves the surface of the hemisphere? [This is a very interesting problem, which we throw open to competition among our readers, as we judge it will be more profitable for them to answer the question themselves, than to read our solution. It will be necessary to assume some force acting which will impel the body down the surface of the hemisphere with a given velocity, as it is evident that, if the body were balanced at the highest point, it would remain at rest.—EDS.]

W. J. asks: Is there any kind of gas that will cause iron to rust, or to form a hard coating on it in 12 or 24 hours?

W. J. B. asks: How can I prepare umber from the crude earth?

W. asks: How is silk numbered? Woolen yarn is in runs of 1,600 yards to the pound, that is, 10 runs yarn is 10 times 1,600 yards to the pound: cotton is in hanks of 840 yards to the pound, so that No. 100 cotton is 100 times 840 yards to the pound.

Z. Y. asks: Will some one please explain the best way to make a wagon wheel?

G. C. McC. asks: How can I enamel bricks so that they will not take in water from the outside of the wall?

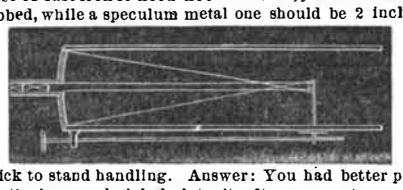
C. M. N. asks: How can I make out the dates on worn coins? I am aware of course of the use of the microscope, but is there not something else?

Answers to Correspondents

E. B. H. will find information for making a microscope on pp. 276 and 298, vol. 27.—F. W. P. can make linseed oil varnish by following the directions on p. 150, vol. 28. The lifting power of balloons is detailed on p. 89, vol. 25.—J. C. W. should consult a local geologist. We do not know the nature of the soil in which the tree was found.—J. P. J. will find directions for making hard rubber on p. 378, vol. 28. Type metal is composed of lead, tin and antimony; it can be readily cast in a plaster of Paris mold.—J. C. G. can make his blackboard by following the directions on p. 299, vol. 28.—G. T. H. will find the explanation of time around the earth on p. 401, vol. 28.—J. H. W. will find that the three formulas are the same, and it matters not which form he uses. Muspratt is undoubtedly correct.

D. asks: What is mildew on textile fabrics? Can it be removed, and how? Answers: 1. Mildew consists of microscopic fungi, the growth of which is produced by moisture and a close atmosphere. 2. A remedy for mildewed linen is as follows: Soap the surface of the articles well and rub into them, while wet, finely powdered chalk.

S. D. E. says: I want to construct a 15 inch reflector in this wise: First, I make a reflector of cast iron, and a grinder to match, and grind the surfaces to a proper curve: then I tin the reflector over, and put a sheet of pure nickel, say one thirty-second of an inch thick, between the shell and grinder, and heat till the tin flows. When cold, I grind till the two meet all over, coat with pitch, and polish. Will this make a good reflector? If so, what should the focal distance be of the above size and how large must the small reflector be? Gregory's plan (see illustration) was to reflect the light back through a hole in the large reflector. Is this plan the best? If not, what is? I want to construct the instrument in the most approved manner. I can easily polish a reflector, but cannot make a refractor. By making the base of cast iron it need not be over ½ inch thick, if ribbed, while a speculum metal one should be 2 inches



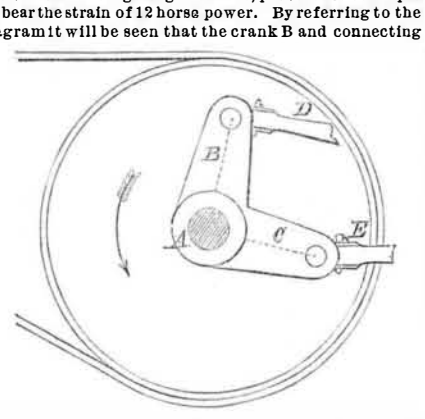
thick to stand handling. Answer: You had better polish the iron, and nickel plate it after you get a good figure. The Newtonian plan is most convenient. The diagonal mirror reflects the cone of rays at right angles to the eyepiece at the side of the telescope tube. Your previous inquiry was answered on page 139 of our current volume.

J. W. asks: Is there any liquid which will take blots or writing off paper without spoiling the appearance of the paper? Answer: Try a strong solution of oxalic acid, applied with a camel's hair brush. Heat the solution if possible before using. Oxalic acid is a poison.

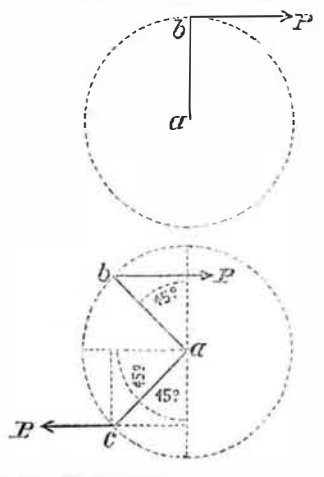
G. G. asks: What is a cheap and durable mode of putting gilt or silvered lettering on glass to have it look neat and tasty? Answer: Glass can be gilded or silvered by blending powdered gold or silver leaf with gum water and a little borax and applying the mixture, or painting the letters on the glass by means of a camel's hair pencil. The article is then heated in an oven or furnace to burn the gum and vitrify the borax, which cements the gold or silver to the surface. It is afterwards polished with a burnisher.

J. B. P. asks: How can I increase the draft of my furnace? The boiler has 39 three inch tubes; smoke stack is 24 inches in diameter and 40 feet high. Would an addition of 5, 10 or 15 feet, to hight of stack, help it? Would a blower introduced into smoke stack above the flues be of use? Answer: Apply your blower in the usual way, below the furnace.

W. D. N. says: I am not satisfied by your answer to Y. E. about his engine and shaft. If, as you say, a shaft were just strong enough to transmit 12 horse power, of course the thirteenth horse would be the feather that would break the camel's back. But I claim that twice (approximately) the power may be transmitted without endangering the shaft, provided it be ample to bear the strain of 12 horse power. By referring to the diagram it will be seen that the crank B and connecting



rod D are at a right angle, at which point (if I comprehend you) is the maximum moment of strain. The crank, C, and connecting rod, E, are nearly on the back center, and consequently are exerting no particular force at all. But as soon as that cylinder takes steam, C and E begin to exert a twisting or wringing force upon the shaft A; increasing it until they reach the point occupied by B and D. In the meantime, B and D have been relaxing their force as fast as C and E have increased theirs, and at the same time; therefore it follows that the shaft is not endangered because the force is no greater at any point of stroke, but more power may be transmitted for the reason that this same maximum moment of strain is continuous during the entire revolution, each engine being an auxiliary to the other to assist it over the dead centers, without suffering a relaxation or suspension of force (not motion) during any part of the stroke or revolution. Answer: We will try

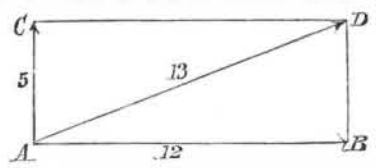


and make our meaning plain, by the aid of the accompanying diagram. In the case of the single engine, exerting a pressure P on a crank a b, supposing, for the sake of simplicity, that all the positions of the connecting rod are parallel, the maximum twisting moment is P×a b. Now add a second crank, at right angles to the first, with same pressure P on the second crank pin and the position of maximum strain, or the point at which the greatest twisting moment is exerted, will be as represented in the sketch, when each crank is 45° from a vertical position. In this case, the twisting moment is P×a b×cos. 45°+P×a c×sin. 45°=P×a b×2×sin 45°=P×a b×$\sqrt{2}$=P×a b×1·413. Hence the maximum strain in the second case is 1·413 times as great as in the first.

C. H. H. says: I am running a 9x14 engine in a saw mill, driving a 60 inch circular saw with a 30 inch top saw. Sometimes the piston rod makes a grating noise in the stuffing box; at others, it runs still. I have partly overcome the trouble by raising the ways. What is the cause? Answer: The trouble may be caused by leaks, for want of oil, or because the engine is out of line. It would be necessary for us to make an inspection, before giving a decided opinion.

J. E. H. asks: 1. What is the philosophy of hardness, that is, what is there about one substance that makes it harder than another? 2. Let iron and steel be the substances: why is it that, by heating iron and plunging it into cold water, it will harden the iron? 3. How many elements will fire take out of wood? 4. Will light pass through common window glass faster or slower than, or in the same time as, through the atmosphere? Answers 1. Hardness is the quality of bodies by which the molecules maintain their relative positions when a force is applied. One substance is harder than another, when it takes more force to disturb the position of its molecules. 2. When a metal is hardened by being tempered, it is supposed that a different arrangement of the molecules takes place. 3. Wood contains water, carbon, oxygen, and from 1 to 5 percent of ash. When the wood is burned, all the constituents, except the ash, combine with the oxygen of the air. 4. Light passes through glass more slowly than through the air.

E. C. M. says: A force, A B, acts at A in the direction east, while A C acts at same point, A, in the direction north. By the familiar laws of the parallelogram of forces, these two forces, relatively 5 and 12, acting at right angles, produce the resultant 13, which



we are taught in works on mechanics is equivalent to the components 5 and 12. This we can admit in the sense of equal in effect, but as indicating measure of force, 13 is not equivalent to 5+12=17, evidently. What has become of this force 4, which appears in components and not in the resultant? Answer: It is well known that if we apply a force to produce motion in a given direction, only so much of that force as acts in the required direction tends to produce motion. The rest of the force is, in general, apparently lost; but in reality, it is converted into something else. For instance, suppose that pressure is applied to a pump handle in a direction oblique to its axis; then some of the force either compresses the fibers of the handle, in which case it is converted into heat, or it produces greater pressure on the pivot of the handle, when it appears as friction. Take the case given in your illustration, and suppose that a force of 13 acts obliquely on the pump handle: it may be replaced by two forces, one of 12, at right angles to the axis, tending to produce motion, and another of 5, in the direction of the axis, producing end pressure. Here we have replaced a force of 13 pounds by two forces having a volume of 17 pounds, and it may be asked, how did we obtain the additional four pounds? But the answer to this question is, quite evidently, that we gained pressure by making the force act in a different direction, and that all the apparent gain was counteracted by the fact that part of the increased force acted at right angles to the direction of the motion.

F. L. S. says: A book tells that "the area of a circle is found by multiplying the circumference by half the radius." Elsewhere it says: "It follows, then, that the area of a circle is equal to the square of the radius multiplied by the circumference, or 3·1416." It seems to me there is great difference between the half radius and the square of the radius. There must also be a great difference between the circumference and the ratio between circumference and diameter. The number 3·1416 I take to be the ratio. Can you explain this? Answer: The circumference of any circle is equal to the product of the diameter and the ratio of the circumference to the diameter, which latter is constant for all circles, and is expressed approximately by the number 3·1416. Hence the second rule, as quoted by you, making the circumference of any circle and the number 3·1416 synonymous, is wrongly expressed. The number 3·1416, besides representing the ratio between the circumference and the diameter of any circle, is the circumference of the circle in the particular case in which the diameter is equal to one. You can readily correct the rule, by inserting, after the term "circumference," these words: "of a circle whose diameter is unity."

W. H. Y. says: In your answer to T. O'N., you say: "When transmitting power with a quarter turn belt from one horizontal shaft to another, also horizontal, at right angles to it, guide pulleys are generally employed." Not so if said shafts are directly over one another, or at any reasonable distance, providing the receiving side of pulley be in a line with the delivering side. Answer: The case you mention is a special one, and does not militate with the statement that in general guide pulleys are employed. We are glad, however, that you have called attention to the matter; and it would have been better if we had mentioned the exceptional case in our answer.

S. M. asks: In the case of a cast iron plunger, about 3 inches long and ⅞ inch in diameter, having to work perpendicularly, how will it do to have the hole in which it works cast large, and fill in Babbitt metal around the plunger to make it work steadily? Will it work true and run well if not oiled? The plunger is flat on one side of its section. Is there any other composition that would do better? Answer: The device mentioned by our correspondent has been tried with satisfactory results.

E. M. K. says: On page 362 of volume XXVII, C. E. G., tells D. G. N. to use a butterfly valve on his engine. We are running a 35 horse power engine at 75 revolutions, belting on to 52 feet of 3 inch line shafting, and thence to a saw mandrel. When we are sawing wide boards (with a 52 inch saw) the governor does not let steam on quick enough. Why cannot we use a butterfly valve on it, and let our saw run well, instead of slacking down in the log from 12 to 24 inches? We use the same engine to run a grist mill with—4 run of stones, 2 grinding wheat and 2 corn. The saw mill stands still when the grist mill is running. I have been thinking of putting a string on the rod that carries the pea that steadies the governor so as to open the governor quicker. Will it work, and will the butterfly valve work on this engine? The balance wheel weighs about 3,600 or 4,000 lbs. Answer: There are governors in the market with valves that will give full opening. The butterfly valve, arranged as you propose, is often used.

B. W. asks: Will wire rope wear well in suspending clock weights? Answer: We think you will find it very durable.