ANSWERS TO CORRESPONDENTS

J. E H. will find results of experiments on the tensile strength of steel in Trautwein's "Engineer's Pocket Book."—F. C. B. will find directions for making pickles on p. 181, vol. 27.—H. W. C.'s queries as to elevator belts and mill gearare incomprehensible.—J. M. E. will find descriptions of pontoon and other bridges in Mahan's "Civil Engineering."—W. P. D. will find directions for preserving entomological specimens on p. 404, vol. 29.—W. P. can repair his damaged looking glass by the process described on p. 203, vol. 30.—G. L. H. will find a recipe for paraffin varnish on p. 91, vol. 31.

E. H., Jr., asks: What is the proper length of the inside of a link for an engine of 3¼x4 inches, whole throw of valve being ¾ of an inch? A. There is no general rule. Make it of such a length that it seems well proportioned to the other details.

C. H. C. asks: What is the theory or philosophy of the improvement of a violin by age? Is it the use of the instrument, or its age, or both, that produces the improvement? A. Violins doubtless improve by age, as they become better seasoned; and the superiority of a few very old violins is due to their excellent manufacture.

G. I. E. asks: Will a siphon pump answer the same purpose as a steam pump? Will a siphon pump lift the water 28 or 30 feet and deliver it 20 feet? Will it take as much or more steam to run the siphon as a regular steam pump? We use a steam pump, 800 feet from mill, to draw water from well and through it to mill, sufficient to make steam for a 20 inch cylinder engine. We take steam from mill to steam pump. A. We think that your present arrangement will be more satisfactory than the one that you propose.

W. H. asks: How is the common governor of a horizontal stationary engine made to govern the steam as it goes through the pipe to the cylinder? A. Either by closing or opening the throttle valve, as occasion may require, or by changing the period of admission of the steam to the cylinder.

How many lbs. of coal would be required to reduce 40 tuns of 2 $Fe_2 O_3$, 3 HO? A. It would depend somewhat upon the process. You should consult a good work on metallurgy.

C. F. S. asks: Can I use a round belt to run at quarter twist from a 24 inch pulley (running at 100 revolutions per minute) to a 16 inch pulley? A. Yes. As to your other question, consult a manufacturer.

W. R. H. asks: When is it 12 o'clock, when the clock strikes the first stroke, or when it strikes the last stroke? A. At the commencement.

A. Z. says: I made a tin blower, 10 inches in diameter, with 4 fans, square at ends; the fans measure 9 inches from end to end. I have a 2½ inch pulley on fan shaft, and a 48 inch fly wheel on foot lathe, from which I take the belt. I run the fan as fast as I can, but it does not blow worth a cent. The opening in side is 8 inches, outlet is ¼ of an inch. What is the matter with it? A. Probably you have made the fans so that, instead of forcing out the air, they just keep it in motion within the case.

S. says: 1. I have a hydraulic press, the pressure on the ram being 2½ tuns per square inch. How much pressure is there on the walls of the cylinder? Does the pressure vary on the walls of the cylinder as the ram is being pushed out? A. The pressure per square inch on the side of the cylinder at any time, is approximately the same as that on the ram. 2. By what rule do you ascertain the necessary thickness of cylinder to withstand any given pressure? A. You will find rules for proportioning thick cylinders in the SCIENTIFIC AMERICAN for June 21, 1873.

S. & M. say: We have a 6 inch pipe in a 60 foot well. Can we attach a 2½ inch cylinder and pump water as easily, as if we used a 1¼ inch pipe? A. Yes, under ordinary circumstances.

A. A. J. says: In a large steam sawmill, we have to take water from a swamp, and a great deal of mud is pumped into the boilers and fills the gage cocks and steam gage with finely powdered earth, which also gets into the cylinder and completely fills the ends up, notwithstanding that we have a pipe leading from the main pond to a large wooden tank, which the water goes into and from which we take the water. What is the best means of purifying the water? Do you think it could be filtered, and what would be the best kind to make? We use about 2,000 gallons per day. A. You could readily filter that amount by means of a filter bed composed of gravel and sand. By having two tanks, from which to draw on alternate days, the water might be purified sufficiently by simply allowing the heavy particles to settle at the bottom.

A. P. A. asks: Is it possible to store up motive power in compressed air? How far can atmospheric air be compressed by mechanical power? What amount of power can be evolved from compressed air, proportionally to the size of receptacle containing it? A. Air can be compressed and used as a motive force, in exactly the same manner as any other permanent gas. We have heard of its being compressed to 300 atmospheres.

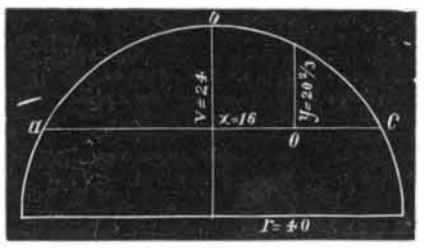
What is the name of the metal whose existence in the sun was discovered, through the spectroscope, before its discovery in our planet? A. We never heard of it.

W. S. B. asks: What force can be resisted with a lever 4 feet long, placed upon a shaft 6 inches in diameter, with a pinion 12 inches in diameter? It is to work similarly to a sawmill carriage, only to be applied vertically. A. Neglecting friction, the pressure produced by the pinion on the rack will be 8 times as great as that applied to the lever.

M. J. B. asks: Is six inches of air space, lined with two coatings of heavy manilla paper, between the double wooden walls of a refrigerator room as efficient as a non-conductor as the same space filled with hair? Is it equal to three inches of hair? A. Dry air will be the best.

T. McK. says: I desire to construct a kaleidoscope in such a manner as to enable me to photograph the numerous designs therein produced. I propose to make it 26 inches long between the object or design, and the plate holder, the photographic lens to be midway between the ends and enclosed in the case. 1. Can I obtain light enough through the ground glass of the object end, to take a good picture? A. Yes. 2. What kind of lens must I use? A. A good achromatic glass of about 13 inches focus. 3. Is it necessary, in taking photographic pictures, to expose the lens of the camera to all the light possible, or can a picture be taken with the lens enclosed or shielded from all light, except that from the object photographed, if that object be well lighted? A. No light should fall on it except that from the design.

J. B. S. asks: What is the best practical method of finding the lines for a curved rib, when the radius is 100 feet? A. By ordinates, as follows:



(1) $y = \sqrt{r^2 x^2} - r - \sqrt{v}$

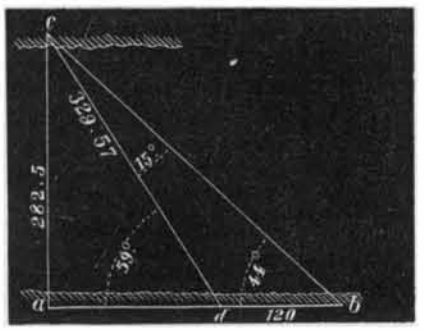
$y = \sqrt{40^2 - 16^2} - 40 - 24$

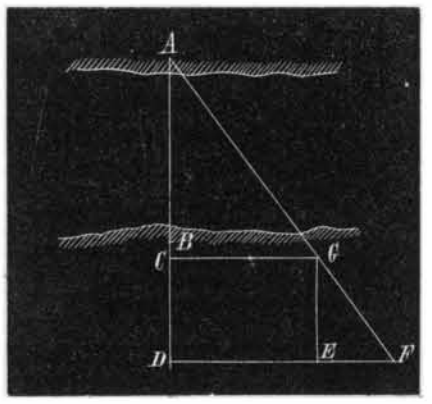
$y = (\sqrt{1344} - 16) = 36{\cdot}66 - 16 = 20{\cdot}66$

In the segment *a b c*, the hight at the center, or the versed sine, is 24 feet, and to trace out a curve whose radius shall be, say 40 feet, take any point, as *o*, and draw an ordinate, *y*, at right angles to the chord, *a c*. The length of this ordinate depends upon the distance, *x*, that it is from the center of the segment, and is equal to the square root of the difference between the square of the radius and the square of the distance, less the difference between the radius and the versed sine, as expressed by the formula (1). Thus the length of any number of ordinates may be found, and the curve traced; and in the same relative manner the curve for the segment of a circle of any radius may be found.

What is the best method of saw-kerfing a piece to fit any required circle? A. No good work of this kind can be made by saw-kerfing; but the best will be when the saw is held radial to the curve.

How can I measure across a large stream for the purpose of building a bridge? A. There are various methods of doing this; by the following, if you have an instrument to measure angles, you may obtain either the direct or the oblique span: Stake out the line, *a b*, parallel with the course of the river, and measure *a b*=120 feet, the angle *c b d*=44°, and the angle *c d a*=59°. Place a stake, *a*, at a point observed to be where a line at right angles to *a b* will cut *c*. Then 59°—44°=15°= angle *d c b*. Then as the sine of 15° is to 120, so is the sine of 44° to 329·57=*d c*. And as radius is to 329 57, so is the sine of 59° to 282 5=*a c*. If you cannot command the use of surveyor's instruments capable of measuring angles, the problem may be solved by the following method, which has the merit of being very simple: Select two points, A and B, one on each bank of the river, as the points, the distance between which is required Upon the ground stretch a line from B to D, so as to range with the point, A, on the opposite bank. At some convenient place, where the surface is nearly level or nearly in a plane, stretch a line, as D F and at B, or near it, in the line B D, as at C, set a stake, and from it stretch a line to and beyond G, parallel to the line D F. The angle C D F need not be a right angle, but the distances C D and G E must be equal, so also the lines C G and D E must be equal. Now select the point F in the line D F, so that it will be in range with G and A. These points definitely established by stakes set in the ground, they afford homologous triangles, by a comparison of which the desired distance from A to B may be ascertained. For example: The triangle E G F is homologous with the triangle D A F, having all its respective lines and angles in proportion. Therefore,





$E F : E G :: D F : D A$; and from this, $D A = \frac{D F \times E G}{E F}$

or the distance D F multiplied by the distance E G, and the product divided by the distance E F, the quotient will equal the distance D A. Having this, and deducting the distance B D, the residue equals the distance A B. Example: Let C D=55 feet and D E=80 feet, and upon trial let it be found that E F=40 feet; then, 40 : 55 : : 120 : 165=A D, and 165—55=110=A C. Also, as the triangle A B G is proportionate to the triangle G E F, therefore, 40 : 55 : : 80 : 110=A C.

Is the annexed rule correct for finding the radius when the chord and versed sine are given? Rule: Add the square of half the chord of the arc to the square of the versed sine, and divide this sum by the versed sine. A. No; there is an error in your statement of the rule. You must divide by *twice* the versed sine.

F. S. C. says: Sidney Whiting, describing the royal carriages in the sun. says: "In form, too, the carriages were conchial, and were furnished with wheels without tyres; for by a peculiar contrivance, each spoke possessed an elastic spring just at the point of its articulation with the nave, so that at every evolution an onward motion was imparted, independent of any power the driver himself might exert." Can such a thing be arranged so as to be practicable? A. We cannot answer for what takes place in the sun; but on the earth, we are confident that no peculiar contrivance will enable power to be utilized without the expenditure of power

E. W. St. J. says: I am running an engine and I have been troubled about the pump in raising water. I have been pumping about as high as the pressure of the air will raise it, and had no trouble until I tried to pump from a barrel that was supplied with water from another well by means of a steam jet pump. Now the barrel is placed in the old well, some two or three feet higher up than where I pumped from before; but I cannot make the suction pump raise the water from the barrel to the engine room. It seems as though it ought to pump better now, as the water is two or three feet higher up than it was before. The water from the new well is not pure it is of a light color, and gets this from the blue clay in the well, and the water from the jet pump is warmed by the steam. What is the trouble with the water or the pump? A. The warm water seems to be the cause of the trouble.

S. H. C. asks: At what part of the stroke of the piston should the steam be cut off, in a Corliss engine, to be the most economical? A. Let your engine do the required work, and then set the cut-off as near the beginning of the stroke as possible.

E. asks: Is glass a conductor or a non-conductor of heat? A. Glass is one of the poorest of heat conductors.

J. S. asks: Is there a patent instrument by which the correct distance of an object can be told without measuring? A. We know of no such machine.

J. G. H. says: I have been running an engine; and to get speed to thresh wheat, I had to increase the driving pulley, which I did by putting on wood, from 24 inches in diameter up to 47 inches. The engine is rated at 4½ horse power, and works very well while attached to the thresher, and runs steadily; but in running alone it runs very irregularly, and sometimes will stop. The governor seems to act freely, and the engine works well when attached to or doing work. Why will it not run as well when doing nothing but pumping? A. The trouble may be either with the governor or the pump. We could not give a positive opinion, from your account.

H. asks: What are meant by the following, viz.: engine lathe, Monitor lathe, friction pulley, and blowing cylinders? A. An engine lathe is a lathe having a face plate and generally a short bed, being suitable for chucked work. A Monitor lathe is one with a revolving rest, having several tools fastened in it at the same time; it is generally used for small work. A friction pulley is a pulley which drives or is driven by the friction caused by its face being forced against another face. A blowing cylinder is the air compressor in blast engine, used in iron-smelting, etc.

T. H. W. asks: How can I best anneal iron boiler tubes, so as to make necessary flanges on the ends when inserting them? A. Heat them to a red and allow them to cool in fine ashes or slaked lime. 2. Would not some method by which the tubes of locomotive boilers could be removed or replaced more readily than by the present system, be valuable? A. Yes.

1. Can fulminate of mercury, about an ounce in quantity, be safely sent through the mails? A. It would be highly dangerous and criminal to send it by mail. 2. How is it made? A. See p. 90, vol. 31.

When small brass work is finished in a lathe or with a file, with what should it be coated to preserve its polish? A. With lacquer.

J. B. says: I have no appetite, and am quite weak, with cold sweats every night. What should I do? A. Take a 1 grain citrate of iron and quinine pill every night before retiring.

C. R. asks: Can boiled starch be kept fresh for some time, without getting sour? A. Yes, from two to four days, by adding sulphate of copper.

F. C. K. asks: Is there any process for rendering woolen cloths impervious to water? A. Cloth is rendered waterproof by simply passing it through a hot solution of weak glue and alum. To apply it to the cloth make up a weak solution of glue; and while it is hot add a piece of alum (about 1 oz. to 2 quarts), and then brush it over the surface of the cloth while it is hot, and then dry it. Cloth in pieces may be run through this solution and dried. By adding a little soap, the goods will feel softer. Woolen goods are prepared by brushing them first on the inside, and then with the grain or nap of the cloth. It is best to dry this first in the air, and then in a store room at low heat. Cloth thus prepared is impervious to water, but pervious to air.

C. B. N. asks: What do brewers use to make beer sparkle when filled into the glass? It is evidently due to carbonic acid gas; but what is the process by which beer is charged with this gas? A The effervescence you speak of is due to carbonic acid generated by fermentation.

G. J. E. says: Conch and similar shells, when held close to the ear, produce sounds similar to that of the Gulf heard from a distance. What is the philosophy of this? A. It is caused by irregular concentration and reflection of sound.

N. A. W. asks: What is the resulting compound from mixing an acid and an alkali, and its known or probable effect on the human system? A. A complete answer to your question would require too much space. The compound resulting from the combination of an acid with a base is what is known as a salt, of which there are many hundreds. Their effects on the human system are as numerous and as varied; for instance, muriatic acid and soda combine to form common table salt, comparatively harmless, while hydrocyanic acid and potash forms one of the most deadly poisons known.

Is light bread, made by using an acid and an alkali, wholesome? A. The utility of yeast, baking powder, etc., as used for the leavening of bread, is due to the quantity of carbonic acid gas generated by them under certain circumstances. That amount of gas taken into the stomach is not injurious. The small quantity of the alkaline salt formed seems to aid rather than retard the digestion of the food containing it.

J. S. asks: What is the color of the pure juice of lovage? A. "*Ligurticum levisticum* (lovage) is an umbelliferous plant, growing wild in Southern Europe, and often cultivated in gardens. The whole plant has a strong, sweetish, aromatic odor, and a warm, pungent taste. When wounded it emits a yellow, opaque juice, which concretes into a brownish, resinous substance, not unlike opoponax. The roots, stems, leaves, and seeds have all been employed, but the last have the aromatic properties of the plant in the highest degree.' —*United States Dispensatory*.

E. F. B. asks: When will a balloon rise more easily, when the air is heavy or when the air is light? A. The ascending power of a balloon does not depend upon the state of the atmosphere; for, as the barometer sinks, the gas expands or increases in volume in exactly the same ratio as the air.