(39) C. S. P. asks: 1. What size of boat, ribless pattern, will be large enough to carry 12 or 15 persons? A. Make it 30 feet long and 6½ feet wide. 2. What size of boiler is necessary for an engine 4x6 inches? A. Make a boiler 3 feet in diameter and 4 feet high. 3. What size and pitch of propeller will be necessary to run the boat as fast as possible? A. Propeller 2½ feet in diameter and of 3½ feet pitch.

(40) T. K. G. asks: 1. Will a simple coil of pipe do for a superheater? A. Yes. 2. Can there be any joints in the same, either of malleable or cast iron, without the difference in expansion causing a leakage of steam? A. We think that such joints might be made tight. 3. Is a check valve necessary between the boiler and superheater to prevent the return thereto of the superheated steam, in case the flow of steam at the outlet was checked or retarded? A. Some kind of valve is required. 4. Why is there no economy in fuel in distilling in *vacuo*? A. There might be some trifling economy if the cost of maintaining the vacuum were not counted; but it would be very slight, as the diminution in the total heat of evaporation would be very little.

(41) W. G. says: I have a steam pump with a 22 inch cylinder, 700 feet underground, and I am obliged to carry the exhaust steam to the surface. Of what size should the exhaust pipe be so as not to have any back action on the engine? A. The exhaust pipe should have an area at least as large as the exhaust port of the engine. 2. What is the cheapest and best material to make it of? A. Make it of galvanized iron.

(42) R. J. M. says: 1. I am about to construct an engine with a 4x1 inch cylinder. What should be the size of the ports and exhaust? A. About $\frac{1}{16}$ of piston area. 2. How large a fly wheel would I need? A. From 9 to 10 inches in diameter. 3. What should be the size of the boiler, using charcoal for fuel? A. Make it 10 inches in diameter and 2 feet long. 4. Could I use a wood cylinder, allowing the wood to be half an inch thick? A. Not with satisfactory results.

(43) I. Y. asks: Does it make any difference how high a dam is on a stream of water if the wheel uses all the water? For instance, we have a mill running 10,000 spindles, and it holds the water just inside the dam and no more. We want to run 2,000 more spindles; would raising the dam give us any more power? A. Under the circumstances stated by you, raising the dam and doing nothing else would produce no effect on the power.

(44) S. T. M. asks: Why is the letter E placed on the left hand side of an ordinary surveying compass, transit, or similar instrument, and the W is placed upon the right? A. Some instruments are graduated with the E on the right, but the more usual arrangement is as stated in your question. We do not know who first adopted the graduation; but the reason for it is easily explained. Suppose a line to which the compass is directed has an E bearing; then in an instrument graduated like a mariner's compass, the N end of the needle would point to W, because in taking a bearing the needle is stationary and the graduated circle revolves; so that a bearing to the right of N is read off from N towards the left, and *vice versa*. Hence, if the instrument were graduated as in the mariner's compass, it would be necessary to reverse the readings before entering them in a notebook.

(45) E. R. asks: How can I fix gold on picture frame moldings? A. First give the wooden frame a coating of hot size and whiting; both articles must be of the best quality. Smooth this coat down with a pumicestone and water, and thoroughly dry. Melt some glue size in water, and apply with a soft camel's hair brush. Let dry, and wet a part at a time as required, and press the gold leaf on lightly, and blow on it with the mouth to level it. Burnish with an agate tool.

(46) T. B. C. asks: 1. Does sulphuric acid lose its affinity for watery vapor by use? A. It gradually becomes diluted by absorption of the aqueous vapor, and becomes correspondingly less efficient. The rapidity with which this takes place depends altogether upon the apparatus itself and the method of working it, and it can be determined by experiment. 2. Is the acid decomposed or otherwise rendered worthless after using for a certain length of time? A. The acid is not decomposed, but combines with the water to form a hydrate. The acid may be recovered again with all its original strength by evaporating the liquid in large glass or porcelain lined vessels.

(47) F. C. R. asks: What size of engine is best for a boat 25 feet in length and of 7 feet beam? A. One about 4x6 inches would probably answer.

(48) F. H. asks: 1. Do the screw propellers used on ocean steamers have two, three, or four blades? A. They generally have either three or four blades. 2. What is the number of blades on the propeller screws used on the White Star Line? A. We believe that three-bladed Hirsch propellers are used on the steamers of this line.

(49) B. A. J. asks: Why do frozen mercury and red hot iron produce the same sensation? A. They both disorganize the flesh.

(50) T. M. D. asks: What would be a safe pressure to carry in a boiler 12 inches high and 10 inches in diameter, made of $\frac{1}{8}$ inch copper, with a 3 inch flue? A. Safe pressure will be about 15 lbs. per square inch. 2. Would the above boiler do for running a sewing machine with an engine 1½ inches bore and 3 inches stroke? A. Yes, if it be well set.

(51) C. F. and others ask for a recipe for a nickel-plating solution. The following is a good one: Digest the nitrate of nickel in ammonia until it will dissolve no more. Then add a cold, saturated solution of Glauber's salt (sulphate of soda) until a precipitate begins to form. Heat gently for some time, filter, and allow to cool. It is then ready for use.

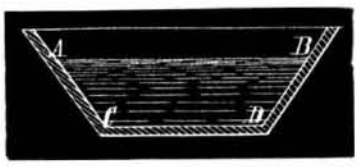
(52) I. F. F. asks: 1. Which is the deepest well in the world? A. The brine well at Kissingen, in Bavaria, is 2,000 feet deep. We believe there is one in Paris nearly 3,000 feet in depth. Perhaps some of our readers can tell us of deeper ones. 2. Can water be taken out of a well 20 yards deep by any other way than by steam, wind, animal, hand, or other power? A. No. Some kind of power he required.

(53) M. H. K. says: We recently melted some silver, using muriate of ammonia and borax as flux. On taking out the ingot it usually shows a granulated surface, similar to that frequently seen on zinc-coated articles. In this case the surface showed (under a glass) fine cracks following the lines of the granulations. Please explain both granulated appearance and cracks. A. The fissures were probably caused either by some impurities in the fluxes employed or contaminations in the metal. When silver is fused, it absorbs oxygen from the air, which is again liberated on cooling.

(54) C. J. A. asks: How much variation would the sixteenth of an inch at the muzzle of a rifle make in the flight of a ball, over 1,000 yards of ground, supposing the gun to shoot correctly, there being no wind to vary the ball in its flight? A. Length of gun from breech to muzzle, in feet :: 3,000 : : 0·0625: variation at target, in inches.

(55) J. P. B. asks: 1. How can I find the specific gravity of a fluid with a specific gravity bottle containing 100 or 1,000 grains? A. The liquid to be examined is brought to the temperature of 60° Fah., and with it the bottle is filled up to the mark. It is then weighed, the counterpoise being on the opposite scale pan. Divide the weight thus obtained by the weight of an equal volume of pure water at the same temperature. The quotient will be greater or less than unity as the liquid experimented upon is heavier or lighter than water. 2. How much ought a fluid to weigh before dividing it by the contents of the bottle, whose specific gravity is 1·2? A. The specific gravity of the bottle itself is not taken. A counterpoise of the exact weight of the empty bottle is made from a bit of brass, an old weight, or something of the kind, and carefully adjusted by filing.

(56) J. P. M. asks: What is the meaning of "area of way in square feet," and "wet perimeter in feet?" A. If water flows in a trough at



the level, A B, then the area of way is the area of the cross section of the water, A B C D; and the wet perimeter is the length of the line of contact, A C D B, of the cross section of the water with the cross section of the trough.

(57) R. S. M. says: 1. I want to run two 60 saw gin stands at the distance of 300 yards. What size of shaft shall I use? A. Use 2½ inch shafting. 2. What distance should the bearings be apart? A. From 7 to 10 feet. 3. Does the length of the shaft tend to weaken it? A. Yes.

(58) E. D. Z. asks: 1. In building a small sloop, what kind of putty shall I use in the nail holes? A. Mix 10 lbs. whiting with 1 lb. white lead, adding enough linseed oil to give the putty the proper consistence. 2. What size of iron wire rope should I use for the jib stay and for the shrouds, one on each side of the mast, for a main sail of 216 square feet and a jib of 106 square feet? A. Probably the smallest size made for ship's rigging will answer very well.

(59) S. A. C. asks: Would a process, by which the surface of wrought iron while being forged to the desired shape, could be made susceptible to being hardened by plunging red hot in cold water, be of any practical value? A. Yes.

(60) W. F. asks: Why will not smoke ascend through the flues and up the chimney of a boiler which has lain still for four or five days? A. Probably because the draft is imperfect and the connections cold.

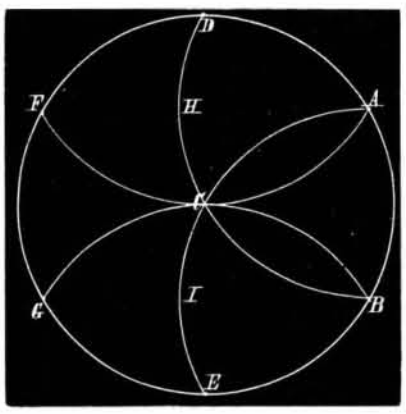
(61) S. D. K. says, in reply to S. H. B., who asked concerning building skiffs: Having decided on the length and width of the boat, take a piece of rough board, as wide as the boat is to be high, and as long as the greatest desired width of the boat. Saw the ends on a bevel of about 4 inches to 1 foot. Then select the boards for the sides, saw the ends to the same bevel as the cross section, and find the center of each. Then nail them by their centers to the beveled ends of the cross section, driving two nails each side half way in so that they can be easily withdrawn. Bring the boards together at both ends, fit stem and stern posts, secure them well, turn the boat bottom up, and true off with drawing knife and plane. Then nail on the bottom, turn over again, true off the top fit knees, knock out the cross section, and the boat is done. This will make a boat as fast as can be made, and of perfect shape. The boat, when finished, should be alike at both ends, and (for speed) about one sixth wide as it is long. The bottom should form a curve of about ¼ of an inch to a foot, both fore and aft and athwartships, as straight lines are not compatible with speed.

(62) J. M. M. says, in answer to J. E. J., who asks if an achromatic spyglass of 50 power would be of any use for astronomical purposes: I have a glass of 35 power, which shows the globular form of the planets, the moons of Jupiter and Saturn, rings of Saturn, sun spots, etc. I have also told the time of day from a clock 10 miles distant. I can discern a man over 20 miles away on a clear day.

(63) C. A. K. says, in answer to R. I. C.'s query as to power for grinding: I have run two pairs of 54 inch burrs with an engine of 25 horse power, grinding 100 bushels per day of 10 hours (60 bushels corn and 40 wheat). The speed of engine was 150 revolutions, that of burrs, 109.

(64) D. J. F. says, in reply to R T. C, who asks how much wheat should a 4 foot stone grind in a day: A 4 foot stone in good order, properly dressed and furrowed, should only grind from 10 to 12 bushels per hour, and do first class work. You can grind from 18 to 24 bushels per hour if you want to, but you cannot do good work at this pace.

(65) R. A. says, in solution of the problem of constructing a perfect square with compasses, without the aid of any other instrument: This is in the rigid sense, impossible, as a square is a figure bounded by right lines. The solution by W. S. D. (who assumes a line, though he omits it in the diagram) only determines the points through which (or to which) the lines should be drawn, but they cannot be drawn with compasses. But the solution is faulty, for he cannot measure half an arc with compasses alone: he only guesses at it. The following solution is subject only to the



objection first stated: From A and B as centers, describe the arcs, B C D, A C E; with C as a center, describe the circle, A B E G F D; with D and E as centers, describe the arcs, A C F, B C G; then will the points, A, B, G, F, form a rectangle, the portion of which between the points, A and B, and the points, H and I, where the right lines from A to F and from B to G would meet the arcs, C D and C F, is a perfect square. My square is not drawn, neither is W. S. D.'s, but the same process which is necessary to complete his will complete mine.

(66) E. R. H. says, in answer to F. A. R., who asks for a rule for measuring ear corn in a crib. Multiply the length, breadth, and hight in inches together, and divide by 3,888. The answer will be the number of bushels of shelled corn.

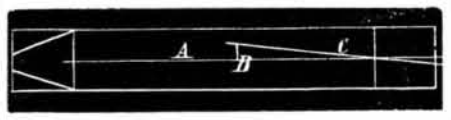
(67) M. R. says, in reply to a correspondent who asks for a remedy for corns: Bind raw cotton on your corn at night before going to bed, and then saturate the cotton with spirits turpentine. It will remove the most obstinate corn, either hard or soft, in four or five applications. The skin will be apt to peel off the toe, but this is rather an advantage, as it helps to remove the corn.

(68) O. P., of Rosloff, Russia, says: In reply to G. W. F., who asks in which position (top or bottom center) of the crank does a locomotive engine exert the most power, you say that there is no difference. I contend that there is a difference; for if the engine is going forwards, and the crank is at the bottom center, it has the full power of the whole area of the piston on it; whereas when the crank is on the top center, the piston rod takes up some of the area of the piston, thus giving less room for steam. When the engine is in back motion, the conditions are reversed. In engines with piston rods running through the whole cylinder, your answer would be correct. Am I right? A. No. When the engine is going forward and the steam is on the rod side of the piston head, the guide bars are relieved of the weight of the connecting rod, guide blocks, cross-head, etc., which quite compensates for the loss of area due to the piston rod.

(69) H. E. W. says, in reply to W. A. S., who asks how he can straighten wire: Put one end, after the wire has been annealed, in the lathe; and fastening the other end so that it cannot turn, start the lathe, and by thus twisting the wire will become perfectly straight and stiff, and not be injured in the least.

(70) C. H. S. says, in reply to M. J. M., who asked for a good rule for setting thimble skeins: The first thing is to lay out your axles correctly. For the gather, measure off on the bottom of the axle half the diameter of the wheel. Then make a point, at ¼ the amount of gather you want, back of the center of your axle at the point measured off. A line from this point, through the center of the axle at the shoulder, will give the gather. For the pitch: Measure as before ⅛ the size of the wheel on the side of the axle. Then measure up, from the bottom of the axle, ⅛ the size of your hind boxing at the shoulder and at the point you have measured off. At this point measure off, above the half diameter of your boxing, one fourth the amount of pitch you want. Thus: If you want your wheels to stand 4 inches wider at top than bottom, measure up 1 inch, etc. A line, from this point through the point at the shoulder will give the pitch. Then measure from this line, each way, half the size of your boxes, and your axle is laid out. To set the skeins, it is only necessary to square down on the end of the axle from the lines you have drawn, each way. Then using their point of intersection as a center, strike a circle the size of your skein inside, at the front end, and taper it to that, uniformly from the shoulder. As a cement to fasten them after they are thus fitted, you will find nothing better than white lead and linseed oil, made as thick as it can be applied nicely.

(71) E. D. P. says, in reply to M. J M.'s question in regard to setting thimble skeins: Draw a line, A, through the center of axle; measure back from shoulder one half the hight of wheel: then mark the dish of wheel, B; about the center line



from this mark, draw line, C, crossing center line at shoulder, and extend to point of skein, which will give you center of skein. Half the diameter of skein below this line will give side of skein at butt and point.

(72) J. E. T. says, in answer to the query as to the side of the largest cube that can be cut from a ball 12 inches in diameter: It is evident that the longest possible diagonal of the cube is 12 inches. Now the square of the longest diagonal of a cube is equal to three times the square of either side; therefore the square of diagonal=144, which divided by 3 gives 48. The square root of 48= 6·9282+ =side of square. [This answer is correct. A. I. F. and J. D. E. have sent similar replies. L. S. W.'s reply, on p. 267, vol. 34, is erroneous.—EDS.]

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. W. F.—It consists principally of salt, with some blue dye.—T. I. H.—They are rolled fragments of quartz.—I. R.—The principal constituents are silica, silicate of alumina, and oxide of iron. A complete analysis would show the presence of 5 or 6 other constituents. The cost of the analysis would depend upon its completeness. If you desire a qualitative analysis, with the total amounts of solid mineral and organic constituents, the cost would be $12, and the amount of water required will be ½ gallon; if a complete quantitative analysis, as well, the cost would be $35, and the amount of water required 2 gallons.—L. M. N.—It appears to be resin, containing tarry matters, borax, and paraffin.—W. M. S.—Your boiler scale is not dangerous. It is clay, oxide of iron, and carbonate of lime.—N. D. S.—It is decomposed granite. The shining scales are muscovite.—J. F. W.—It is aventurine, and a specimen of it is in every mineral cabinet.—G. B. L.—No. 1 is sulphide of zinc. No. 2 is oxide of iron and clay.—A. W. D.—No. 1 is sand, clay, and quartz, of no value. No. 2 is sulphide of zinc.—J. T.—We find only iron pyrites.—J. S. W.—It is celluloid.—S. L. S.—It is trap rock, containing a small percentage of iron. It is not an iron ore.—R. G. S.—It is sulphuret of iron and copper.—C. A. B.—From its appearance, it would be well to give it a practical trial as fire clay. It should be profitable.—L. W. S.—They are beautiful crystals of selenite, commonly called gypsum or sulphate of lime.—C. W.—It is principally nitrate of soda, with a small percentage of chloride of lime and magnesia.—H. E. B., of Wilson, N. C.—It is hydrated sesquioxide of iron or brown hematite. It is probably worth mining.—A. B. R., of West Burke, Vt. They are sulphides of iron and copper.—We have several letters from which the specimens have escaped in course of transit; and we recommend our correspondents to put each specimen securely in a box and mark it with the name and address of the applicant.

J. L. asks: What is the process employed in making photographic tin types?—A. P. B. asks: How is mica split?—C. A. K. asks: How can I find the area enclosed between the arc and the radius vectors of an ellipse (said radii being drawn from one of the foci), if the semi-axis major, the angle subtended by the radii, and the eccentricity of the ellipse are given?—J. T. asks: Can any one oblige me by describing the photo-engraving process and the photo-lithographic process?

COMMUNICATIONS RECEIVED.

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

On a New Hydrometer. By H. W.
On a Pendulum in a Mine. By J. M. H.
On the Glacial Epochs. By J. H.

Also inquiries and answers from the following:

C. J. R.—G. A. P.—J. T. H.—N. R.—E. A. D. P.—J. D. E.—N. M. W.—J. W. S.—C. C. L.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes lamp chimneys of tempered glass? Who sells drawing instruments? Who sells an engine worked by ignited petroleum? Who makes the best lenses for photographic portraiture? Why do not dealers in photographic chemicals advertise in the SCIENTIFIC AMERICAN?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.