Business and Personal.

The Charge for Insertion under this head is $1 a Line.

B. H. can answer his query as to the size of pipe to convey water a long distance by referring to p. 48, vol. 29.—A. Y. McD will find the directions on p. 59, vol. 24, for galvanizing iron pipes sufficiently explicit.—E. F. G. will find directions for making rancid butter sweet on p. 119, vol. 30.—G. A. B. will find a recipe for birdlime on p. 347, vol. 28.—T. D. H. will find recipes for fulminating powders on p. 96, vol. 31.—L. G. D. will find ample instructions for building an ice house on p. 251, vol. 30.—C. E. E. P. can polish stones by the process described on p. 138, vol. 30. A recipe for cement for aquaria is given on p. 274, vol. 30.—G. W. H. and G. P. will find answers to their questions as to suction and siphons on the editorial pages of this issue.—C. J. C. C. should consult a physician.—F. J. B. can bronze iron pipes by following the directions on p. 107, vol. 30.—B. M. & Co. will find a recipe for preserving harness on p. 264, vol. 30.

(1) W. J. R. asks: Is there a flexible pipe made that will stand the heat and pressure of steam, say from 50 to 125 lbs.? I want it to be limber, so that a little power will bend it to any angle when the pressure is on. A. Yes. It is not very flexible; but by giving it sufficient length, it can readily be turned in any desired direction.

(2) J. F. K. asks: What is it that eats away the ends of the enclosed glass tube of a water gage? The tube was packed with rubber, and had been in about one year, under a steam pressure of 50 lbs. A. The tube presents the appearance of having been cut by sand or grit.

(3) J. E. B. asks: I am running a blast engine at a furnace. Four cylindrical boilers, 60 feet long by 30 inches in diameter, in batteries of two boilers each, furnish the steam. There is a steam dome on each set, the domes being connected by the main steam pipe that goes to the engine. One of the batteries became charged with electricity. I opened a brass drip cock that was in the pipe upon the boilers, and left it open until I got the steam turned on. When I went to shut it, I felt a prickling sensation in my fingers, and opened it again. When I placed my finger within ⅛ of an inch of the cock, I could feel it very plainly. Can you explain it? A. It probably occurred from the friction of the water, contained in the steam, against the sides of the orifice.

(4) J. B. S. says: Our safety valve is 4¼ inches diameter; it weighs 5 lbs., lever weighs 5 lbs., and the weight is 75 lbs.; the distance from valve stem to weight is 11⅓ times the distance from valve stem to fulcrum. At what pressure should it blow off? A. If it works freely, it should blow off at about 67 pounds. 2. The engine is double, the cylinders being 12x24 inches, with a spur wheel (on crank shaft) of 2 feet diameter, geared to a wheel of 8 feet diameter. How many revolutions to the minute should this engine run without injury, working at 75 lbs. steam to the square inch? A. From 60 to 70. 3. We have two boilers set side by side, with 2 inch feed pipe, with check valve at the mud drum of each. Our steam connections are 4 inches in diameter, with a large valve on each boiler for disconnection. We have an equalizer of 4 inch pipe for water connection, with a stop valve in center. We never have any trouble with more pressure in one boiler than the other from unequal firing; when we try the water gages in one boiler, we are sure as to where it is in the other. We feed with either cold or warm, or nearly boiling water. I think if all boilers were connected in this way there would not be so many terrible explosions. A. This is a very good arrangement, and we are much obliged to you for the description. As to strength of boilers, see 193, vol. 29.

(5) G. H. A. asks: Will Babbitt metal make a good piston, if melted and run in a brass cylinder? A. Not very. Your other questions have been repeatedly answered in these columns.

(6) J. B. H. asks: How is the fine wire, of which a mile weighs only a grain, drawn? A. It is enclosed in a mass of other material, and the two are drawn together into wire, after which the casing is dissolved by a chemical preparation.

(7) H. A. T. says: I have an engine 12½x36 inches stroke. I run it without a balance wheel. It has a direct connection of valve stem to eccentric. What lead should it have, and at what point should the cut-off be? A. Give the valve ¼ of an inch lead, when cold. The point of cut-off will generally be regulated by the pressure of steam and the work to be done.

My railroad has a curve in it, about 10 feet in 100, 100 feet long, and then there is 100 feet of straight line. What is the best mode of running on the track so as to get the car 'round the curve? A. The tracks of street railroads have many such curves, and special appliances are used, which you can obtain from a manufacturer.

(8) C. J. B. asks: What is the process of gumming the parts of a newspaper together, to make it into book form? A. It is done by a machine which folds the paper and at the same time applies paste at the back of the leaves.

(9) E. T. C. says: I wish to put up a lathe for turning hard wood, such as oak and ash, of from 3 to 12 inches in diameter. I am thinking of having two pulleys on the mandrel. Of what diameter, and how broad on the face should they be? A. You can make one pulley 6 inches, and the other 4 inches in diameter. The face of each should be 2 inches. 2. What width of rubber belt should I use? A. Two inches. 3. How many revolutions per minute should the work make? A. From 500 to 800 revolutions per minute. 4. Would pulleys built up of pieces of wood, so as to present the end of the grain to the belt, give good results? A. The pulleys will do better if turned from solid pieces of wood, or lagged and turned off after being built up. 5. How large should a steel or iron mandrel be? A. Diameter of mandrel should be ⅜ inch. 6. What horse power would it take on 9 inch work? A. From ½ to ¾ of a horse power.

(10) H. P. asks: What would be the probable bursting pressure of a cylindrical boiler 28 inches in diameter, of plates ¼ inch thick, with a single row of rivets? A. See p. 193, vol. 29.

Does sharpening cotton gin saws aid in the cleaning of the seed, or does it only increase the speed of the gin? A. Speed is the more important item. The saws do not require to be very sharp.

(11) F. R. M. asks: Will you please give directions and formulæ for designing a good turbine water wheel of the vortex or central discharge kind? A. There have been volumes written on this subject. You will find it ably treated in Rankine's, Fairbairn's, and Weisbach's works. It is entirely too comprehensive for our columns. Moreover, if the best proportions were definitely fixed, there would be no more competition between water wheel manufacturers.

(12) D. asks: Can a band of steel, ½ inch broad and of sufficient thickness to sustain a strain of 150 lbs., be used as a belt on pulleys 4 inches in diameter? A. A piece of the best saw steel, about 1-40 of an inch thick, might answer, but it would be liable to break.

(13) D. M. says: I want to build a small furnace for melting iron. Of what size should it be to work properly? Would a furnace of 12 inches inside diameter and 36 inches high be large enough to make good sound castings? A. The above dimensions will probably give good results. 2. I have read that melting iron on a small scale is never successful. What is the trouble? A. Very small masses of iron are apt to oxidize quickly, which causes the difficulty. 3. What sized of fan blower, with 4 fans, running about 2,500 revolutions per minute, would be required for the above mentioned furnace? A. A blower 9 inches in diameter will do, if properly constructed.

(14) E. D. P. asks: How can I tin gray iron? A. Clean the pieces thoroughly, cover them with a solution of sal ammoniac, and dip them into melted tin.

(15) J. W. S. asks: 1. How many strokes does the sickle or knife make to one revolution of the ground wheels of an ordinary mowing machine? The one which I am planning makes 128 strokes to one revolution of the ground wheels, and works the gear wheels by a screw. A. The speed of the knives is proportioned, in a good mowing machine, to the speed with which the machine advances. 2. Is the machine that makes the most strokes of the knife generally the best? A. Not necessarily.

(16) J. L. G. asks: 1. A saw mill is drawn by a portable engine of 25 horse power. The flues in the boiler leak badly on some days, and on others they will not leak at all. Sometimes the water will stand in the ash pit in a considerable quantity. Is such a boiler safe? A. We would like to have further particulars in regard to this case, such as kind of feed water used, and whether the tubes leak by fits and starts, or after blowing down or cleaning the boiler. 2. How often can the flues in a boiler be upset with safety? A. The tubes can be upset as long as there is enough material left, and sometimes a ferrule can be forced into the end with advantage. 3. The boiler is calculated to carry 100 lbs. steam: is it dangerous to run with 50 or 60 lbs. of steam on? A. If you have a good pump, and are careful, the boiler is not particularly dangerous on account of the leaky tubes, nor would it be unsafe to run the engine as suggested.

(17) W. asks: Why is it that, if you take two musket balls (both alike) and two similar charges of powder, and load them into two guns, one rifled and the other a smooth bore, the ball from the rifled barrel is thrown with so much more force and precision than the ball from the other? A. The greater precision of the ball from the rifle is due to the rotary motion which is imparted to it, and its greater force is probably due to the decrease of windage, and the greater pressure exerted by the exploding powder upon it.

(18) M. B. asks: How can I dye wood black? A. Boil ½ lb. chip logwood in 2 quarts water, add 1 oz. pearlash, and apply hot with a brush. Then take ½ lb. logwood, boil in 2 quarts water, and add ½ oz. verdigris and ½ oz. copperas; strain, and put in ½ lb. rusty steel filings, and with this go over the work a second time.

(19) C. E. E. P. asks: How are carbon plates made for galvanic batteries? A. The carbons for Bunsen's battery are made as follows: The fine dust of coke and caking coal is put into a close iron mold of the shape required for the carbon, and exposed to the heat of a furnace. When taken out, the burned mass is porous and unfit for use; but by repeatedly soaking it in thick sirup, or gas tar, and reheating it, it at length acquires the necessary solidity and conducting power. The carbon that forms on the roof of gas retorts is harder and better than the carbon thus made but it is difficult to work, and the supply of it is limited.

(20) A. B. C. asks: Can more than one wire be supplied from an intermediate battery, all the wires being through wires? For instance, two or more wires work from New York to Philadelphia, with a main battery at Trenton; can both or more lines be supplied without dividing the battery? A. They cannot. An intermediate battery constitutes a portion of the main circuit, and connecting in another wire would have the same effect as crossing the wires.

(21) S. W. says: A few days ago, on examining one of our fire alarm boxes, I found lumps, or solid crystals, of sulphate of copper adhering to the kerite insulation of the wire inside the box. The box is some four or five squares from the office. I am positive the crystals were not on the wire when it was put in the box. The question is: How came the sulphate there? A. It was probably placed there at some subsequent time by some one having access to the box, for the purpose, perhaps, of exciting your curiosity.

(22) J. O. C. and others.—Belts will move towards that part of the pulley where the radius is the greatest.

(23) J. E. H. asks: How can I silver plate a watch case or other articles? A. Place the articles in a bath consisting of two grains of cyanide of silver and two grains of cyanide of potassium in every two hundred grains of water. Connect the zinc poles of a battery of three or four cells to the article to be plated and the copper pole to a piece of silver, which is also plunged into the bath. The passage of the current decomposes the salt, deposits silver on the object, and causes the dissolution of an equal quantity of metal from the silver electrode. The time required for the operation depends on the thickness of coating required.

(24) J. F. A. asks: How many feet of silk covered wire, and of what size, is required for the secondary coil of an induction apparatus capable of producing an inch spark? What is the length of the primary coil? Will the ordinary soft iron of commerce do for the core? A. An induction coil of that capacity would require about 40,000 feet of silk-covered copper wire of 0·0055 inch diameter, or No. 26 Birmingham gage, for the secondary coil. The primary coil consists of two layers of copper wire of 0·1 of an inch diameter or No. 12 Birmingham gage. Ordinary soft iron of commerce will answer very well for the core, but Norway iron is the best for this purpose.

(25) F. C. B. asks: How is an induction coil arranged so that the drawing out of the core increases the strength? How is a coil arranged so that a tube enclosing the coil regulates the current, drawing it out increasing, and pushing it in decreasing, its strength? A. There is no arrangement whereby the withdrawal of the core can increase the inductive effect of a coil. A primary coil when enclosed in a brass tube loses its inductive effect upon the secondary coil, because the induction currents circulate within the tube instead of passing into the secondary coil. By drawing the tube out, and leaving the primary coil within the secondary, the currents circulate in the latter, and thus the inductive effect is increased in proportion as the tube is removed.

(26) C. D. C. asks: What are the characteristics of the Leclanché battery? Is it as intense as the Grove? A. The Leclanché element consists of a zinc rod in a solution of ordinary commercial sal ammoniac; the negative pole is a prism of carbon, tightly packed into a porous vessel with a mixture of peroxide of manganese and carbon, in the form of a coarse powder. The zinc unites with chlorine, forming chloride of zinc, while ammonia is set free at the negative electrode. Its electromotive force is 1·48 volts, while that of a Grove is 1·9 volts. There is no waste of material when the Leclanché battery is not in action; and if the evaporation of the liquid is prevented, it may be allowed to remain untouched for months without losing power. It is, therefore, admirably adapted for working telegraph wires where the open circuit is used, and where the telegraph is not in constant use, as well as for electric bells. When placed in short circuit, it polarizes very quickly, and is therefore not adapted for working local circuits, or for working ordinary main line telegraph circuits on the American closed circuit system.

(27) L. V. R. asks: How can ivory be made ductile, or be reduced to the consistence of putty, so that it could be worked into any desired form? A. Soak it in a solution of pure phosphoric acid, and it will become flexible. Exposure to the atmosphere will harden it, but it may be made again pliable by immersion in hot water.

(28) R. N. asks: Does the 11 seconds of lunar acceleration, per century, mean a total acceleration of 11 seconds in that period, or that the lunar month is now 11 seconds shorter than it was a century ago? A. The total secular acceleration of the moon's mean motion amounts to between ten and eleven seconds per century. See Herschel's "Outlines of Astronomy," pp. 412-419. Lunar perturbations are almost numberless, and are compensated. The retarding influence of the ether of space must be immeasurably small.

(29) C. S. O. says: I have some photographs, the faces of which are somewhat marred; they look as if they had been piled together before the varnish had dried, and then pulled apart. How am I to make them appear all right? They are perfectly new. A. For restoring the surface to photographs, etc., if the scratches do not go through the albumen, wax them. Formula: Dissolve 1 oz. white wax in 2 ozs. turpentine by a hot water bath. Add a few drops oil of lavender which facilitates the solution of the wax, and neutralizes the odor of the turpentine. This has the consistence of butter. On an imperial sized photograph, take a lump the size of a pea, and, with cotton flannel, rub it over the print. Burnish with a clean piece of flannel. This gives a high polish.

(30) N. S. asks: What is put inside casks to prevent alcohol from soaking into the heads and staves? A. Dissolve in a water bath 1 lb. leather scraps and 1 oz. oxalic acid in 2 lbs. water, and dilute gradually with 3 lbs. warm water. Apply this solution to the inside of the barrel, where (by oxidation) it will as

sumes a brown color and become insoluble in alcohol. It will close all the pores of the wood, and will not crack or scale off.

(31) J. J. asks: What are good recipes for composition bronze, and bib and bell metals? A. A good bronze is made of copper 7 lbs., zinc 3 lbs., tin 2 lbs. Another: Copper 1 lb., zinc 12 lbs., tin 8 lbs. Metal for bib and other cocks: Copper 20 lbs., lead 8 ozs., litharge 1 oz., antimony 3 ozs. Bell metal for small bells: Copper 3 lbs., tin 1 lb. For large bells: Copper 100 lbs. tin from 20 to 25 lbs.

(32) N. F. C. says: I have a 2½ inch achromatic telescope, of 44 inches focus; and with the Huygbenian eyepiece I get a power of 80. How high a power will it stand, and how must I construct the eyepiece? A. It will bear 125. Then $44 \div 125 = 0{\cdot}352''$ = equivalent ocus $\times 2 = 0{\cdot}704''$ = focus of field lens: and $0{\cdot}704 \div 3 = 0{\cdot}235''$ = focus of eye lens. showing $0{\cdot}704 - 0{\cdot}235 = 0{\cdot}469''$ = distance apart. 2. How close will it bring, apparently, the moon to the earth? A. Moon's distance in miles, 240,000 ÷ 125 = 1,120 miles.

(33) B. F. H.—Get Webb's "Celestial Objects," third edition. It contains an account of all objects likely to interest the amateur astronomer.

(34) T. M., of Roorkee, British India, and others.—The SCIENTIFIC AMERICAN, bound, will cost you $3 per volume. Volumes 26, 27, 29, are not on sale at present. *Science Record*, three volumes, $6.50 together.

(35) W. P., of Dublin, Ireland, and others.—Captain Simpson's "Report on the Naval Ordnance of Europe" is to be issued by the Navy Department, Washington, D. C.

(36) C. Roggenkamp, Appingedam, Holland.—Subscription to SCIENTIFIC AMERICAN, prepaid postage, $5.08 per annum.

(37) J. T. B. says: 1. In your issue of October 31, you say that it is not safe to cement directly on the walls of an excavation. My father has built hundred of cement cisterns, cementing directly on the eart walls, and I have not known one of this kind of cistern of his make to fail for want of strength. Put on three good trowel coats (the last one containing a little larger proportion of cement), and a brush coat for hard finish, made by mixing cement in water to the consistence of thick cream, and add a pint of fine salt for a large pailful of the finish. Wherever the soil is stable enough to hold its place as the cement is laid on, the brick wall is in no sense needed. It is only money wasted. Of course all cisterns should be protected from frost. A. There are some soils sufficiently hard and permanent to admit of the treatment described by our correspondent, and no doubt such is the nature of the ground in the section of which he writes; but such construction is not safe in all soils, and it is liable to be damaged by surface water in any soil. In most sections of country, cisterns so constructed would be attended with a great deal of risk. It is not merely the looseness and friability of the soil that we have to contend against, but the pressure of the surface water as well, which, when confined by an understratum of clay, is sometimes very considerable, and forms the main difficulty in the construction of dry cellars. This pressure tends to wash away the earth behind the cement, and when thus weakened to break it. Unless H. M. has had the matter proved in his immediate neighborhood, therefore, it will be with him in the nature of an experiment.

1. Suppose I have a pump whose bore is 2½ inches and stroke 4 inches, and (connected with the pump by a two way stopcock) two pipes, one with an inch and the other ½ inch bore, the pipes both leading to the same cistern: How much more water will be supplied to the pump at each stroke by the former than by the latter? A. If the pump is worked with a slow motion, its cylinder will be filled at every stroke, the same by the small pipe as by the large one, the difference being in the greater velocity of the water and consequently greater friction in the small pipe than in the large one; and for this reason, with the small pipe, greater power would be required to work the pump. But the quantity of water drawn at each stroke will be the same in each case. 2. What kind of pipe is best to bring water in, from a well at a distance, the water to be pumped up? A. Iron pipe coated with coal tar would stand well. 3. Which will last the longest ordinarily, underground, iron or lead pipe? A. In some soils, lead pipe is the best, but others soon destroy it.

(38) S. R. M. asks: What is the effect, on the complexion, of gum benzoin dissolved in alcohol? A. Gum benzoin contains about 80 per cent resin and from 15 to 20 per cent benzoic acid. As it is soluble in alcohol, the solution would be a varnish, and would have no more effect than any other varnish, though there is a slight chance of the benzoic acid being irritant to the skin.

(39) A. L. C. asks: 1. How many rings has the planet Saturn? A. Saturn has three principal rings or streams of satellites; the innermost is the gauze or crape ring. Five of the eight satellites should be seen in a four inch achromatic. 2. Do they all revolve around the planet in the same time? How does the time of their revolution compare with the rotation of the planet on its axis? A. Saturn rotates in about 12 hours; the rings revolve more slowly. 3. Does the rotation of the planet on its axis appear to be in the least affected by the attractive force of the rings? A. No. 4. If I understand the principle of the whirlpool, it is that the speed of the water is increased as it nears the center; am I right? If a ball constructed of some floating material be dropped into the whirlpool near the outer edge, where a slow projectile motion would be imparted to it, would it at the same time take a slow rotary motion? A. Fasten a bullet to a thread and let it revolve around a stick. As the Pendulum shortens, the bullet moves faster. 5. As the ball comes nearer to the center of the vortex, would its rotary motion be increased at a corresponding rate to its projectile motion? A. No.

(40) B. S. says: I have two lenses, one of which has a focal distance of 5¾ inches, and a diameter of 1¼ inches; the other is 1 inch in diameter with a focal distance of 12 inches. Putting them together in the form of a telescope, the objective being the small glass, 12 inches being the distance, an object at a distance of 3 or 4 miles is plainly seen. How can I combine them so as to see plainly at a good distance, being near-sighted? A. Place your lenses 17¾ inches apart.

What is the process of photography from the clean paper to the development of the picture? A. See Carey Lea's "Manual," or Dr. Vogel's "Handbook of Photography."

(41) G. M. H. asks: 1. Can the achromatic lens of an ordinary photographic camera be used as an objective for an astronomical telescope, to any advantage? A. We find by experiment that view tubes and portrait combinations may be used as telescopes, taking out the stops, with a focussing glass or pocket magnifier as an eyepiece. 2. What power of eyepiece would be most desirable for a lens, of 1¾ inch diameter and 10 inch focus? A. The power should be low, about 30, and the glasses well centered, or collimated.

(42) A. L. C. says: 1. As the eclipse of the moon was passing off, on Sunday morning, October 25, the northwestern edge was first made luminous, being nearly opposite the point of contact. How do you explain that phenomenon? A. Because the moon passed through the earth's shadow very near its edge. 2. Is there any difference, by actual measurement, between the equatorial and polar diameters of the moon? A. A stereograph of the moon shows a bulge or projection toward the earth. The invisible side is supposed to be thirty miles lower than the visible one. 3. Can the polar axis of the moon be other than perpendicular to the plane of its orbit? A. The moon's axis is inclined to the ecliptic 1° 30 10,·8″. Its orbit is inclined 5° 8′ 47·9″. 4. What is the average diameter of the satellites of our solar system? A. They range from Titan, sixth satellite of Saturn, which is over half the diameter of the earth, and Jupiter's satellites, respectively 2,240, 2,192, 3,579, and 3,062 miles, to the minute spheres forming the rings of Saturn, and the meteorites, which are the *debris* of comets. 5, How do you find the parallax of the sun? A. By measuring the displacement of Venus on the sun's disk, with the distance in latitude between two observers as a base line. 6. If I were standing on the equator, I should see the pole star in the horizon; but if I am in latitude 42°, do I see more than 42° below the pole? A. No. 7. Why does the pole star appear so much nearer to the zenith than the horizon, to one thus situated? A. The pole star is about a degree and a half from the pole.

Why does more fruit fall during the night than during the day time? A. If the fact is as stated, it is because the deposit of dew makes fruit heavier at night.

(43) J. D. L. asks: 1. What is the best work on grinding and polishing lenses, one that contains all or nearly all the modern practice of opticians? A. We should be glad to hear of such a work, modernized. As any person can make an achromatic by following directions, with patience, intelligence, and "warranted" glass, the lesser opticians at times conceal their improvements. Our special information on achromatics has been collected by an amateur, and will not be found elsewhere. Among the leading opticians, Steinheil and G. & S. Merz determine whether a lens has the requisite curvature by placing a lens of correct and opposite curvature above it, and illuminating through a piece of tissue paper. If the parallel rainbow diffraction bands, crossing the lenses, are straight, then the surfaces are alike; if the bands are curved, they are unlike. Clark uses a home-made wooden spherometer, and works to the two hundredth part of an inch, whereas the continental opticians follow Fraunhofer, and endeavor to have their work correct to the thousandth of an inch (see Prechtl's "Dioptrik"), and to dispense with local correction, which is necessary after all. Steinheil cuts a prism in two by hand with a steel wire bowstring armed with diamond dust, instead of a lap. The force for his little hypocycloid polishing machines is supplied by the left arm of the workman turning a horizontal fly wheel. Clark uses a steam engine for rough grinding, and a vertical iron wheel fed with sand and water instead of the traditional lead grinder. In subsequent operations, he puts the iron grinder on the stump of a tree, and walks round it, moving the lens to and fro by its handle. He does pitch polishing by hand, with rouge and a wooden disk, the surface cut into one inch squares and diagonals, retouching with the forefinger dioped in rouge, if zones of different focus have formed in polishing. Fitz and others use the machine for local correction, nearly as figured by Draper. Foreign opticians fasten a lens with uniform drops of pitch half an inch apart, while ours use it solid. 2. What is the best method of bending a plate of glass in a true spherical concave? A. It is better to grind out and polish the cavity. A plate of glass will curve slightly without buckling when sufficiently softened by heat, and take the shape of an iron mold beneath it.

(44) N. Y. asks: 1. What quantity of water converted into steam is used in computing the horse power of boilers? A. There is no fixed standard. 2. What is the horse power of a locomotive firebox boiler, with a grate 42x44 inches, and a cylindrical part 4 feet in diameter, with 43 three inch tubes 12 feet long, and dome 24x24 inches? A. There is no rule that applies to this question. 3. What would be a fair evaporation per pound of coal in such a boiler? A. From 7 to 8 pounds.

(45) D. D. asks: If a boiler and a tank are placed 50 yards apart, and connected by a 1 inch pipe, would the pressure be the same in both? A. Yes.

Does brass expand as iron does, when heated to the same degree? A. No.

When the boiler of the fireless locomotive is filled, do they force any steam in with the water? A. Yes.

(46) W. H. says: I am about to build a current wheel to be used in the Niagara river, where the current runs about 5 miles per hour past my wharf, depth of water being from 12 to 15 feet. The wheel is on the principle of a windmill or propeller wheel, and is to be wholly submerged. I wish to utilize the power to the extent at least of 12 to 15 horse power. What size of wheel and number of fans would you advise? How many square feet should there be on each fan? A. Your plan is somewhat novel, and you will have to make experiments in order to determine the best proportions.

(47) M. H. asks: What is the most approved method of putting locomotive cylinders in line with the main slabs? A. It would require too much space to make the method plain, and you will get a much clearer idea by personally inspecting the work.

What are the best works on mechanical drawing, and on the link and slide valve? A. Professor Warren's works on drawing are very thorough; and Auchincloss "On Link and Valve Motions" is the standard authority.

(48) W. B. says: 1. I am building a small boat engine; it is vertical, 3½ inches stroke x 3½ inches bore, to run 900 revolutions per minute, and to use steam for the whole of the stroke, of 125 lbs. pressure. My boat is a common row boat, clinker built, 18 feet long by 4 feet 4 inches beam. Of what size should my boiler be to supply the requisite amount of steam? A. Make a boiler 2 feet in diameter and 3 feet high. 2. Of what size should my screw wheel be? A. From 20 to 24 inches in diameter. 3. The boat draws about 6 inches, will it be weighted down enough to immerse the wheel when the machinery and 6 persons are in it? Its full depth is 21 inches. A. You can readily determine whether your boat will come down enough by placing weights in it. 4. Of what size should the pump be? A. Large enough to throw twice the quantity of water required.

(49) J. A. B. says: 1. I am building a boat, 32 feet long by 8 feet beam, and 3 feet deep. I am putting in a boiler, 8 feet long by 24 inches diameter, and an engine 5 inches bore by 12 inches stroke, to drive a screw wheel, geared with a 3 feet, a 2 feet, or a 1 foot wheel. By which should I get the most speed? A. A few experiments will be your best guide in gearing the propeller wheel. 2. How many miles an hour will it make? A. The boat will probably go from 5 to 6 miles an hour. 3. What size should the propeller be? A. Make the wheel as large as convenient.

(50) H. H. says: I purpose building an oil tank, ten feet square and four feet deep, of two inch plank, as a plain wooden tank would leak. I think of lining it with ordinary galvanized sheet iron, with soldered joints. Is there anything objectionable in this plan? A. No. It will answer very well.

(51) G. L. L. asks: How can I make and arrange a kerosene lamp for the purpose of heating a small boiler? A. Your best plan will be to buy one. There are a variety of such lamps in the market, many of which give satisfactory results.

What is white metal? A. Parts by weight, tin 82, lead 18, antimony 5, zinc 1, copper 4.

(52) N. O. V. asks: In what manner can two steam governors be tested to ascertain which is the best? A. Belt them from the same shaft, and see which will lift the most weight under variations of speed, and also which is the most sensitive, when running at a high velocity, to a slight change of speed.

(53) D. C. H. says: I am running a horizontal steam engine 12x6½ inches cylinder, with the valve face against the side of the cylinder; the slide valve consequently rides on its lowerside. The valve annoys me very much by a constant clicking noise, by being forced away from the face and then back again. Why is this? Should not the pressure in the steam chest keep it up to its place? The valve has nearly 1-16 inch lead, which gives about ⅜ inch lead to the exhaust. Could the feed water heater cause a back pressure sufficient to force the valve from its face? How can I make it work quietly? A. It is quite likely that the exhaust closes too soon, so as to cushion above the steam pressure.

(54) C. C. H. asks: Does melting and remelting lead make the pure metal any lighter? A. Some of it will be probably vaporized.

What is the philosophical reason that a circular saw cuts better at a certain speed than it does if run faster? A. We do not know that this is a fact.

(55) H. B. asks: What should be the exact dimensions of the different parts of a small steam engine, the cylinders of which measure 2½x1½ inches? What sized boiler, with what number of tubes, should be employed to furnish steam to two cylinders of the above dimensions? A. You will find the most of these dimensions in back numbers.

Is there any solder for soldering brass, of the same color? A. Yes. Take copper 52 parts by weight, zinc 29 parts, tin 1 part.

What work on the steam engine would you advise an amateur to read? A. Bourne's "Catechism of the Steam Engine" is one of the best.

Would a combination of pulleys and bands serve to reduce the speed of a foot lathe as well as a back-geared head? A. It would answer, but not as well as gearing.

Would the above described engine be large enough to run a lathe swinging eight inches? A. Yes.

(56) J. C. P. asks: If a perfectly tight vessel, of 4 gallons capacity, contains 1 gallon of water, and is of sufficient strength to resist any amount of pressure by heat applied to the same, would any portion of the water evaporate? A. It would all be converted into steam, if sufficient heat were applied.

(57) F. O. asks: How can I make fruit trees bear well? Last season the plum and pear trees were full of blossoms; but they bore little fruit. The apple trees were loaded, but the apples fell to the ground with worms in them. A. You must remove all the worms, and coat the trunks and roots with a preparation which you can obtain from a seedsman.

(58) H. M. asks: How many inches high inside must I make a box to contain one barrel, if the inside measure of the box is 10x16 inches? A. Divide the number 1256·64 by the cross section of the inside of the box in inches. The quotient will be the hight of the box in inches.

(59) G. S. S. asks: When a pair of scissors cut paper or any material, which blade does the cutting, the upper or lower, supposing that both blades are closing together? A. Both blades exert a shearing force, in such a case. If one blade be kept still, the other will do the shearing.

(60) W. J. S. says, as to the difference between a perspective view and a photograph: A photograph taken with a non-distorting (architectural) lens is absolutely identical with a correct perspective drawing taken from the point at which the lens is placed. Any one may prove this by placing the eye at the point where the lens was, and tracing the view on a piece of glass interposed between the eye and the view. If the distance between the eye and the plate is the same as the focal length of the lens, the two will absolutely coincide. A. We have never seen a non-distorting lens, and doubt if it can be made.

(61) G. F. T. asks: How can I tin the inside of a copper boiler? A. Clean it thoroughly, and then put it into melted tin to which sal ammoniac has been added. Move the boiler about, so that the melted metal will cover every part.

(62) J. H. P. asks: 1. Do oxygen, nitrogen, and carbonic acid, when heated, expand similarly, according to their volumes? A. The greatest expansion is between 32° and 212° Fah.; 1 volume of hydrogen, at 32° becomes 1·36613 at 212°, and one volume of carbon dioxide at 32° becomes 1·37099 at 212°. Such slight differences are observed in nearly all gases; but practically speaking, all gases expand 1-273 part of their volume for every 1·8° Fah. of increase of temperature. 2. Is moisture contained between the particles of gases? A. No.

What accounts for the colors of the African and Caucasian races respectively? A. The deep color of the African is due to a pigment in the cells of the epidermis. The pigment and epidermis of a negro were analyzed by Scherer, with the following results:

	Pigment.	Epidermis.
Carbon	58·27	50·34
Hydrogen	5 97	8 31
Nitrogen	13·78	17·22
Oxygen	21·98	25 63
	99 98	100·00

This would prove the color to be due to an excess of carbon.

Is there a substitute for tobacco that can be manufactured into cigars? A. We know of none.

How is bronzing on steel done? A. The usual method is that of coating the metal with good size varnish and then dusting over it the metallic bronze powder. When dry, it is again varnished over. As to the mastodon's tooth, write to the Academy of Natural Sciences Philadelphia, Pa.

(63) W. W. H. asks: 1. What degree of heat is required to kill trichinæ in cooking? A. 212°. 2. Will boiling kill them sooner than frying? A. Yes

(64) O. A. F. asks: 1. Can you give me a recipe for a good hair oil? A. Castor oil, 6½ pints, alcohol 1½ pints, oil of citronella ½ oz., lavender ½ oz. Shake well before each application. 2. What solution will do to wash the head with, and not injure the hair? A. See answer to J. L. on this page.

(65) J. L. asks: What is the best thing for washing the head with, which will make a lather and not injure the hair? A. Take aqua ammonia 3 ozs., salts of tartar ½ oz., alcohol ½ oz., and soft water 2½ pints; perfume with bergamot. In applying, rub the head until the lather goes down, then wash out.

(66) W. S. B. asks: What preparation can I use on my hair to keep it soft and make it retain its color, and at the same time keep the scalp clean? A. If your hair is losing its color, hair oil will not make it retain its hue. See answer to J. L. on this page.

How can I clean thin buckskin gloves? A. Try benzine.

(67) W. V. G. asks: How can I destroy graybacks in clothes that cannot be washed? A. Sprinkle your clothes with chloroform, and pack them in a chest excluding the air. Two days under the influence of chloroform should exterminate them.

(68) S. R. asks: 1. Will sumac grow best in rich or poor ground? A. Put in a dry loam, though it will grow well in any common soil. 2. How far apart should it be planted? A. Four feet would be plenty; if it be a small kind, three feet would be sufficient. 5. After planting, should the ground be cultivated? A. That is a matter of experiment. It grows as well on poor as on rich soil, and we should say very little cultivation is necessary. 4. How is the curing done? Should I spread it on the ground like hay? A. With the best varieties, the plant is usually cut while in a soft state and carefully dried till the leaves can be pounded when it is thrashed with flails, the stems and coarse sticles raked out, and the leaves packed in barrels sold.

(69) J. B. says: Every few months I suffer severely from an attack of the cramp in the stomach. I have frequently tried as a remedy brandy, whisky, morphine, etc., but have secured relief only on the application of a strong mustard plaster. Will you explain the nature and cause of these long cramping spells, and how the mustard plaster effects a cure? A. The cramp of which you speak may arise from a variety of causes, chiefly, however, from the accumulation of gases in the canal. The distension paralyzes the proper muscles to such an extent as to prevent its expulsion. The plaster seems to set up a nervous reflex excitability, probably through the medium of the sympathetic system, and a proper tone is restored. This is, however, entirely inferential.

(70) O. asks: How does gelatin clarify coffee? The action of gelatin in clarifying coffee is due to its combination with the tannic acid which is a large constituent of the berry. In boiling the geletin in coffee, it forms a precipitate of tannate of gelatin, which acts precisely like albumen in collecting all sedimentary matter; but a much longer time is required for the precipitate to settle. The bulky precipitate of the egg separates at once when the solution reaches the boiling point.

(71) C. S. H. says: Passing a house recently, the owner remarked that he had a show, and invited me in to see it. Entering, I found myself in a hall or entry about six feet square, with a door on each side. Opposite the front door was a blank white wall. Placing me in the left hand front corner of the hall, he directed me to look at the blank wall above spoken of. I saw nothing but darkness at first: but in about a minute and a half a faint tinge of a ocher color showed through the darkness. This increased in clearness and distinctness until, in about four minutes, a perfect picture of the house on the opposite side of the street stood outlined upon the wall; the color, the windows the folds of the curtains, the fences, and the foliage of the trees, were distinct and beautiful, in a picture about two feet square. A little examination showed that the picture was transmitted through the keyhole of the front door; but by what process it is magnified and so vividly produced is a mystery to me, as to all others who have seen it. It is only three days since it was first discovered by accident. Can you explain it? A. When luminous rays, which pass into a darkened chamber through a small aperture, are received upon a smooth white surface, they form images of external objects. These images are inverted; their shape is always that of the external objects, and is independent of the shape of the aperture. In the camera oscura, the brightness and precision of the images are increased by means of lenses. The principle is the same in both cases.

(72) E. W. F. asks: How are the sheets used in manifold writing prepared? A. Take soft printing paper, and smear with any clean grease mixed with plumbago or lampblack. Leave for 12 hours in a dry place. This is for black paper. Other finely ground pigments may be used to produce the desired color.

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

W. D. S.—The fragments are part of a fulgurite or lightning tube. For full information, see pp. 3, 274, vol 31.—O. P.—Your specimen contains carbon, but burns with such difficulty that it is doubtful (as far as we could judge from such small specimens) whether it could be used for coal.

L. K., of Konigsberg, Austria, asks: How can I make carbolic soap?—T. M., of Roorkee, British India, asks: What is the greatest length of railway that has ever been built in one day of 12 hours, in the United States?—S. asks: How is the ordinary rim or flange cartridge charged? Is it possible to recharge the copper shells without expensive apparatus?—G. F. S. asks How can I recolor coral when the original color has been drawn by heat?—E. A. D. asks: What is the composition used on the back of postage stamps?—F. J. H. asks: Can any one tell me of a means of calculating the distance between two points on the surface of a globe, angle and length of the two radii (which, of course, are in the same plane) being given?—A F. asks: How can I clean point lace, which has grown yellow with age?