C. H. does not send his name and address.—J. G. can bend sleigh runners by following the directions on p. 43, vol. 30.—C. K. will find recipes for waterproof glue on p. 379, vol. 30; for polishing iron and steel on p. 133, vol. 31.—H.C. K. will find a description of ice-making machinery on p. 243, vol. 30. Pure butter needs no artificial coloring.—F. C. M. will find instructions concerning induction coils on pp. 215, 218, 363, 378, 379, vol. 30.

(1) T. S. K. asks: What will be the proper size of a boiler for a cylinder 1½x3 inches, and what will be the size of the flues for such a boiler? Of what plate should it be made, and what amount of horse power will it give? A. You do not give sufficient data.

Will calcined plaster be fit for cores for small castings? A. Yes.

Will white metal wear as well, for a small engine, as brass? A. Yes.

(2) J. C. S. asks: Given the diameter of a circle, how can I find the length of a chord that will cut off one third of the area? A. The chord is about 0·964 of the diameter.

(3) H. W. asks: 1. Of what size and how set should a boiler be to run an engine of 1 inch bore by 2½ inches stroke at 200 revolutions per minute at 15 lbs. on the square inch? A. Vertical boiler 12 inches in diameter, 3 feet long, with 6 tubes, 1½ inches in diameter. Set it upright, with fire underneath, and casing around. 2. How thick should it be to hold 45 lbs. steam? A. One eighth of an inch. 3. Of what size should the safety valve be? What should be the distance between the notches, each notch denoting 5 lbs.? A. One quarter inch diameter. Distance between notches depends upon the weight.

How much steam will one gallon of water produce if confined in the same space? A. One gallon.

(4) G. E. asks: I wish to construct a small steam engine to run on a lathe of 7 inches swing. How large a cylinder will be necessary? What should be the area of ports? What should be the diameter and weight of fly wheel? What proportion should the connecting rod have to the length of stroke? A. Make the engine to develope about ¼ horse power. Ports 1-20 area of piston. Fly wheel, 6 miles diameter; weight, 15 lbs. Connecting rod, from 2½ to 3 times length of stroke.

Is there any work published for amateurs or others on the construction of small engines? A. There is no such book; but you will find many valuable hints and suggestions in back numbers of the SCIENTIFIC AMERICAN.

(5) B. R. asks: 1. What is meant by lap and lead of a steam engine, and what is the proper method of setting a slide valve? A. Consult Auchincloss on "Link and Valve Motions." 2. What power would a high pressure engine of 16 inches cylinder by 30 inches stroke, at a pressure of 60 lbs., running at 40 strokes per minute have, and what power would the same engine have with a condenser? A. You can answer this by multiplying the mean effective pressure of steam on piston by distance in feet that the piston moves in a minute, and dividing by 33,000.

What is a good work on bird stuffing? A. Brown's "Taxidermist's Manual."

(6) C. M. C. says: I am operating an engine with a cylinder 8¼ inches by 14 inches stroke; the bed frame sits fair on top of boiler. There are two 6 feet driving wheels; the crank shaft is 3¼ inches in diameter; the bearings of the crank shaft are 5 inches in length. The wristpin is 3 inches in diameter and 3 inches long. Key up the connecting rod as I may, the engine has a thump that can be heard 200 yards off at all speeds up to about 160 revolutions; above that speed the thump appears to cease; but as soon as the speed slacks, it commences again. If I tighten up the connecting rod brasses, they heat and cut in spite of all the oil that we can put on them; if I leave them slack, they cut without heat. The main journals will also heat if a little tight, and cut if slack. I have tried every plan that I have ever heard of. I have run it tightened up and slack. I have lengthened my main rod and shortened it. I have put in liners until the strap key would hardly enter. I have tightened my cylinder rings, and I have run them loose, and all to no effect. What shall I use for it? A. It appears from your account that the valves are not set properly. Possibly the piston may be loose. An indicator diagram would be very apt to show the cause of the trouble.

(7) J. W. E. asks: 1. If I have a number of blocks of ice, about 2 feet square and 1 foot thick, frozen all round 1 or 2 inches in thickness, there still being 8 or 10 inches of water in the center, and I store these cakes all together in an ice house, will they freeze solid? If so, will they keep as well as if they were frozen solid before being stored? A. They will not freeze solid. 2. Is there any book published on ice, or the proper construction of ice houses? A. We do not know of any. See answer No. 29, p. 251, vol. 31.

(8) H. C. asks: Please give me a formula for preparing cotton, to be not so explosive as guncotton, yet to burn rapidly and leave no perceptible ash? A. Sulphuric acid of specific gravity 1·70.6 ozs.; dried nitrate of potassa 3½ ozs.; water 1 oz. Mix the acid and water in a porcelain vessel, and add the pulverized niter, gradually stirring with a glass rod until the lumps disappear and the mixture becomes transparent. Place a thermometer in the mixture, and when it indicates between 140° and 100° Fah., the cotton should be immersed. Take 60 grains clean cotton, separate it into 10 or 12 bolls, and immerse the bolls separately; and leave the whole in the mixture for 10 minutes. The temperature should fall to 140°. Float the cup on boiling water, and maintain it between 140° and 150°. At the expiration of 10 minutes, lift the cotton with glass rods, and squeeze out the acid quickly; and dash the mass into a large vessel of clean, cold water, separating the mass so as to wash it thoroughly and quickly; complete the washing by immersion for several hours in running water, then spread it out to dry spontaneously.

(9) G. H. R. asks: What is the method of obtaining the latitude of any place by the use of the box or pocket sextant? Is there any work which explains the use of the sextant? A. You will find the information you desire in Loomis' "Astronomy."

(10) B. A. C. asks: How is lead pipe made? A. It is forced over a die by hydraulic pressure.

(11) H. M. asks: I am about building a cheap rain water cistern. 1. Is it practicable to dig my cistern to the required dimensions, and then to cement directly on the walls without the use of bricks, giving it two or more coats? If it can be done, would it make a substantial job? A. It is not safe to attempt the construction of a cistern on the plan you propose; but if your soil is hard enough to stand to the line when your excavation is made, you can line it with a 4 inch wall of brick laid up in cement and plastered with the same on the face. If this is laid hard up to the bank, it will make a tight cistern. 2. I wish to raise the water with a pump; can I construct a pump by rabbeting the sides together, using square buckets? A. If you inquire the price of pumps, you will find it more economical to buy one than to make it and risk the chance of failure.

(12) H. D. S. says: I am building a small engine, 1x2 inches. What sized boiler should I use, to run it, driving a sewing machine? Would copper or iron be best? A. Make one 12 inches in diameter, 2 feet high, with 6 flues, 1½ inches in diameter. Either copper or iron ⅛ of an inch thick will answer, the former being more durable of the two.

(13) G. A. B. asks: Suppose a rope is stretched moderately tight between two trees, and a weight of 140 lbs. is suspended from the center, what is the strain in pounds on the rope on each side of the weight? Is it 70 or 140? A. If t = tension of rope, w = weight, α = angle between parts of rope on each side of the weight, then $t = \frac{w}{2 \cos. \alpha}$. From this equation you will see that the tension of the rope is equal to the weight when the angle is 120°.

(14) D. H. E. asks: Will a stream 3 inches square in cross section under 8 feet or 6 feet head, afford power to run a 50 saw gin? A. No.

(15) M.A. asks: If a wheel rolls down an incline with nothing but inertia to resist its descent, where is its axis, theoretically? A. The axis is a line passing through the center of inertia of the wheel, which generally nearly coincides with the geometrical center.

(16) F. O. S.—In general, machinery can be driven with less power by belting than by gear wheels.

(17) H. W. G. asks: 1. What does the best flint and crown glass cost per lb., such as is used in the best achromatic object glasses? A. Chance's flint glass, such as is used in making small object glasses for telescopes, costs $2.50, and crown glass of the same quality $3, per pound. Camera glass, which is less expensive, is used for cheaper achromatic lenses and photographer's tubes. 2. To calculate the earth's distance from the sun by the transit of Venus, does not Venus' distance from the sun (or what is more likely, from the earth) have to be known before the problem can be solved? A. The relative distances of the planets from the sun being computed from their times of revolution by Kepler's third law, the earth's distance is to Venus' distance as 1,000 is to 723. The ratio of Venus' distances from the earth and sun is as 277: 723, and Venus' parallax measured on the sun's disk is in miles 2·61 times the distance in latitude between two observers on the earth. The linear value of a second of arc at the sun being about 460 miles, the solar parallax, or angle which the earth's radius subtends at the sun, will be about 9 seconds of arc, and his distance 91,500,000 miles.

(18) J. H. S. asks: How can I obtain a certificate as an engineer? A. You must apply to the local supervising inspector in your district. 2. To whom should complaint be made of a steamer, run, on an inland lake, by a common machinist who never ran an engine of any kind before, and is not a competent man in any way? A. To the inspector.

(19) M. M. asks: What is the best way to regild parts of a mirror frame? A. See p. 96, vol. 30.

How is it that when the moon is visible the aurora is not? Has the moon anything to do with the appearance of the aurora, or is it merely a coincidence? A. The light of an aurora is usually so faint that it is not visible except on dark nights.

Are atoms all of one and the same size? A. No.

(20) D. B.—The cost of an analysis would be larger than such a recipe would be worth.

(21) T. C. asks: In a small spring of water, near where the water emerges from the ground, I found a crab similar to the salt water crab, but of a darker color. Can you tell me how it came in such a place? A. A. Your description is too indefinite. It might have been a fresh water shrimp.

(22) H. W.—Filtering water through brick is commonly done, and is a most efficient method.

(23) H. I. H. asks: What is the rule for finding the number of square inches in any circle? A. Square the radius in inches and multiply by 3·1416.

(24) C. S. B. says: I have discovered a new rule for the solution of a certain kind of equation which I think preferable to the one usually given in the textbooks. It is applicable to all equations which can be reduced to the following form: $(x^2+ax)^2 \times b(x^2+ax) = c$. The rule usually given in books is this: Reduce by inspection the given equation to the above form; then consider the compound term as a single quantity, find its value by completing the square and extracting the square root of both sides of the equation, from which the value of x is easily found. My rule is this: Extract the square root of the left hand member of the equation as far as possible, which will show you a numerical quantity that must be added to the left hand member of the equation to complete the square, add this quantity to both sides of the equation, extract the square root of both sides, and you have an equation from which the value of x is easily found. The advantage of this rule above the one usually given is that it is sometimes very difficult to reduce the given equation to the above form, whereas that necessity is obviated by the last rule. A. We do not know that we understand your method thoroughly. We append two examples which are readily solved by the ordinary method. If you will send us solutions in accordance with your rule, we shall be better able to compare it with the old method. 1. $\frac{4x^2}{7} + \frac{2x}{7} + 10 = 19 - \frac{3x^2}{7} + \frac{58x}{7}$

2. $a^2+b^2-2bx+x^2 = \frac{m^2x^2}{n^2}$

(25) J. G. W. asks: Where can I get any information that will aid me in foretelling the weather by the aid of a barometer? There are times when the mercury is well up in the tube, and yet considerable rainfalls without much falling of the barometer. At other times when the barometer is falling, there is no rain. A. Read T. A. Jenkins' pamphlet on the barometer, thermometer, hygrometer, etc.

(26) M. A. asks: 1. Why is it that the contact breaker in an electro-magnetic machine stops and makes the current jump, very nearly stop, and then jump again? Is it because the platinum is not good? A. The spring and face of the hammer should be perfectly clean, as should also all connections. The trouble may lie in your battery and not in the coil. We do not understand your other question. Copper, not iron, wire is used in the coil.

(27) S. K. S. asks: How large a tube would be required for the barometer referred to on p. 331, vol. 30? A. From 3 to 4 feet long.

I made a storm glass according to the rule given on p. 234, vol. 29, but could not tell anything by it, the liquid remaining cloudy all the time. On the lowering of the temperature, it would form crystals like snow flakes. A. Your trouble is probably due to impure chemicals. These glasses are not considered as absolute indicators. Some claim that they are affected by electrical disturbances.

What is meant by the power of spy glasses, 10, 15, 25, etc.? In the last instance, does it mean that an object 25 miles off can be seen as plainly as it would if it were only one mile distant with the naked eye? A. Yes but this is not absolutely true, as the intervening atmosphere, with its varying density and humidity, is never taken into account.

(28) I. T. O. says: I tried to make marine glue after the recipe you give in your book; I first put the rubber in one bottle and the shellac in another and then poured, as I thought, enough ether on each to dissolve it; I put them on a warm stove, removing the corks to let the gas escape. Both bottles took fire and burst. A. Fill your bottles with ether, stopper tightly, and keep in a cool spot for forty-eight hours. The bottles, because of their extremely volatile and inflammable contents, should be kept cool, and at a safe distance from fire of every kind. We are sorry for your accident.

(29) O. S. C. asks: 1. How can a permanent gold color be given to metallic lead? A. By alloying it with a certain percentage of copper. 2. How can the specific gravity of metallic lead be increased? A. The specific gravity of pure lead is unalterable, but an alloy of lead with either gold or platinum may be made, the specific gravity of which will be greater than that of lead alone.

(30) H. D. M. asks: 1. How can I apply paraffin to heavy canvas to make it waterproof? A. Saturate with solution of paraffin in naphtha. 2. How shall I make it of a dark color? A. The paraffin is first melted and then digested for a short time with coarsely powdered or bruised anacardium nuts, the fruit of the *anacardium orientale*. This nut contains a black vegetable fat, which combines intimately with the paraffin.

(31) L. L. G. asks: Why does a piece of lead pipe become filled with holes when it runs through certain soils? A. There are many mineral salts which, when dissolved in water or when brought into contact in a moist condition with lead, corrode it. Which salts are present in the water or in the ground through which your pipe runs could only be determined by analysis.

(32) H. F. asks: What is the specific gravity of ordinary vulcanite, vulcanized for 2 hours under a temperature of 320°? A. We will determine the specific gravity of such a piece of vulcanite; but we have none at present in our possession.

(33) C. G. H. asks: 1. If a man built an engine, boiler, and boat, and put them together, would he be considered fit for an engineer, to run said boat? A. This is a question that could only be answered by the inspector. 2. What does a boat's certificate cost? What does an engineer's certificate cost? A. Licence for boat costs $25. Licences for captain, pilot, and engineer, first class, $10 each, second class $5.

(34) D. O. asks: In what part of Europe did the first locomotive engine run? A. In France, in 1769.

(35) L. P. asks: What proportion should the cooling surface of a condenser bear to the heating surface of a boiler? A. From one half to two thirds. Use thin tubes.

I send you a specimen of boiler scale. Of what is it composed? A. The scale seems to be formed from water containing salts of lime. It is probable that the use of tannate of soda would be advisable.

(36) M. M. asks: How should a square piston or abutment of a rotary engine be packed, and what kind of material is best for the packing? A. This is a matter that has engaged the attention of inventors for many years, and is, as yet, undecided.

(37) G. L. M. asks: Is there a simple solution of this problem: The area of a segment and the radius of a circle being given, to find the chord? A. We do not know of any rule.

(38) J. C. says: 1. I wish to make a flat bottomed sail boat, about 15 or 16 feet long, with center board. How wide and how deep should I make it to be nicely proportioned and safe? A. She should be 6 feet wide and 2 feet deep. 9. How can I bend the boards for the sides, having no steam box? A. You can either do it by making saw cuts, or by working it out in the proper shape in short lengths and joining together. 3. About what sized sail could she carry for speed and safety? A. About 8 feet high on the mast, with boom 11 feet long. You can add a topsail, if you find that the boat will stand it.

How is gold lettering done? A. Attach the gold leaf to the leather by pressure, then take the required letters (which must be of brass and heated), press them singly and heavily on the gold leaf, having first smeared the face of each letter on a greasy rag.

(39) J. B. asks: What quantity of water would be required to supply an engine of the following dimensions: 2 cylinders each 16x18 inches, working with 75 lbs. per square inch, at 100 revolutions per minute? A. You do not send sufficient data. You should state the point of cut-off.

(40) B. W. D. asks: Are there any self-regulating mills in use, so that, when the wind gives a high speed to the fans, they can be changed to present less flat surface to the wind, and consequently diminish the motion, and *vice versa*? A. Yes.

(41) J. C. asks: If the wind has a velocity of 1 mile an hour, it will exert a pressure on 1 square foot of surface equal to 0·005 lbs. On a surface 5 feet square, will the pressure be more than 25 times as great? A. Multiply the pressure per square foot by the number of square feet in the surface.

Where can I find a description of the Mammoth Cave, Kentucky? A. See p. 321, vol. 25.

(42) J. R. W. asks: When was ammonia gas first applied as a motive power? A. We could not give you the date of the first patents, without a search; 1859 was, we believe, the date of the earliest patent for an ammoniacal engine that attracted much attention.

What is the principal difficulty in using compressed air as a motive power? A. Its cost. Tests with this motor have not been very extended.

(43) H. F. M. asks: What sized engine will be required to propel a boat 70 feet long by 6 feet beam at the end and 12 in the center, against a current of 2 or 3 miles per hour at low water, and 4 or 5 miles at high water, the boat drawing 6 inches of water with considerable rake at bow and stern? The boat is to go empty up and come down loaded. A. An engine with a cylinder 12x12 inches.

(44) J. C. K. asks: What should be the diameter of an upright iron shaft 3 feet long, 2 feet 6 inches between bearings, with 4 levers each 10 feet long with a horse hitched to the outer end of each? The shaft should be of such size as to resist torsion. A. Allowing that each horse will exert a force of 200 lbs., the diameter of the shaft, to resist wrenching, should be about 4 inches.

(45) W. S. F. asks: How can I make a good and cheap boot blacking? A. Take ivory black 2 ozs., sweet oil ½ tablespoonful, and brown sugar 1½ ozs. Mix them well, and then gradually add ½ pint of small beer.

What colored liquid preparation (red preferred) can I place in small quantities in a bottle of alcohol and have it always remain on the surface and not become mixed with or dissolved in the alcohol? A. We know of none.

If a bag made of white rubber were filled with oil, what effect would the oil have on the bag? Would it soak through the rubber or rot it, in time? A. This depends upon the kind of oil used. For instance, sweet oil would have very little effect upon the rubber, while petroleum would dissolve or destroy it in a very short time.

(46) B. C. W. says: 1. I have a hydraulic press necessarily exposed to frost, sometimes as low as —5° Fah. What liquid can I use which will not congeal at this temperature, alcohol and kerosene being objectionable? Will glycerin diluted with water do? If so, in what proportion? A. The solution you speak of is much used where it is necessary for the liquid employed to stand a low degree of temperature. An aqueous solution of glycerin of specific gravity 1·024, containing about 10 per cent of glycerin, freezes at 30° Fah. With 60 per cent of glycerin, of specific gravity 1·127, the freezing point of the solution is below —31° Fah.

(47) S. W. asks: 1. During what period, after the death of Julius Cæsar, did the Romans (owing to a misunderstanding of the theory of the Julian year) intercalate a day every third instead of every fourth year? A. For 36 years. 2. In what year was the intercalary day changed from its position between the 24th and 25th of February to the end of that month? A. We cannot give you the date; but it was probably in the time of Pope Gregory XIII. Perhaps some of our readers can furnish the information.

Which do you consider the best work (not too costly) on astronomy, containing the mathematical formulæ and tables for calculating the planetary motions, and tables of the lunar perturbations? A. We do not think there is any single book that covers this ground. We can recommend Norton's and Bartlett's works on astronomy.

(48) M. C. asks: What will remove fruit stains from linen, etc.? A. Try hot soap and water; if not successful, try lemon juice; if again unsuccessful, try oxalic acid.

(49) J. H. F. asks: Would an achromatic object glass 1⅛ inches in diameter, and of 30 inches focus, answer the same purpose for a telescope as the meniscus described by B. on p. 7, vol. 30? A. It would be much better. Cheap achromatics are made of camera glass, and the lenses ground several at once upon the tool.

(50) J. S. A. says: Some clergymen take their regular full meals on Sunday and attend to their duties the same as other clergymen who eat very little food, and that of a light kind, till the Sabbath is over, when they take a full and substantial meal. Which is best for health? A. This is best solved by experiment. As a general rule, men of well marked bilious temperaments require more food than those of the nervous temperament. The best rule, however, is to eat at regular hours.

Some telegraph posts produce a sound which is much like that of a steamboat's whistle in the distance. The sound can be heard when the weather is perfectly still and at a distance of from five to ten yards. These posts are cedar and stand in a sandy soil. Their wires are connected with the post by glass insulators. What produces the sound? A. The wire forms a mammoth æolian harp; and when drawn unusually tight, an almost imperceptible breeze will cause it to give off this low murmur.

(51) H. J. J. says: I am running 5 fifty horse power tubular boilers. Our water is hard; and for three months in the year (the time I use the hard water) I find that scale accumulates to the thickness of 1-16 of an inch. I am pumping all of the feed water from a large hot water tank, containing one half water from the well; when the exhaust water from the trap does not heat it to 100°, I use a little direct steam. Yet the scale continues to form. Would you recommend the use of salsoda in the hot water tank to soften the water before pumping the same to the boilers? If so, in what proportion to every 100 gallons of water evaporated? A. We think that the soda, even if effective would be a very expensive remedy. Some other form of heater might be better, or perhaps you could trap more of the condensed steam. We advise you to consult an expert.

(52) O. M. says: Olmsted's "Astronomy" says that the next transit of Venus will occur on December 8, 1874, while all late accounts say it will occur on December 9. Possibly both are correct, according to the side of the 180° of longitude from Greenwich from which it is viewed. Is this the case? A. Yes. The astronomical day commences at noon, and is half a day behind the civil day. The transit of Venus commences astronomically at Bombay on December 8 at 18h. 42m., Irkutsk, on December 8 at 20h. 40m., Pekin, December 8 at 21h. 29m., Yokohama, December 8 at 23h. 0m., Melbourne, December 8 at 23h. 28m., Auckland (New Zealand) December 9 at 1h. 24m., Honolulu, December 8, at 3h. 4m., and is not half over at sunset. At the Cape of Good Hope, Alexandria, and Kazan the transit commences before sunrise. See Comer's "Navigation Simplified."

(53) S. H. asks: 1. What is the power of a field glass of 2¼ inches diameter of about 8 inches focus? How far could I recognize a person with it? A. Perhaps ten times as far as with unassisted vision. Short focus field glasses cannot equal telescopes in power. 2. What is the rule for computing the power of a glass? A. Divide focal length of objective by focal length of ocular.

(54) C. P. says: I read that, as alcohol can be converted into steam with much less fuel than water could, it would be economical to use it, provided a method of saving it by condensation could be devised. Is it safe to use it in a boiler used for heating purposes only, where all the vapor is condensed in the radiators and pipes and returned to the boiler? Should you deem it safe to use naphtha instead of water in the boiler, and would the steam, gas, or vapor made by heating it cause an explosion, if there were no actual contact of flame or fire? A. Both of the liquids mentioned would be dangerous if used with ordinary apparatus. The great difficulty in using volatile liquids is the prevention of leakage.

(55) J. W. B. asks: Is there any process by which fine grit of flint or quartz can be removed from fine earth or chalk deposits? A. By agitation in proper vessels with water and decanting off the liquid, holding only the finest particles in suspension from the heavier particles remaining at the bottom.

(56) C. B. asks: Please give me a recipe for printer's roller composition. A. Melt glue in water, and add molasses to keep it soft. Let cool, and you will see if it be of the right consistence. More molasses will be needed if it be too stiff. More glue is necessary in warm locations, as the composition readily softens as the temperature rises. Some makers use glycerin in combination with the molasses.

(57) S. C. asks: 1. Which is the best work on the medical use of electro-magnetism? A. "Galvanism, Animal and Voltaic Electricity," by Sir W. S. Harris, is both cheap and comprehensive. 2. Is there any difference in the currents of a medical battery and of a magneto-electric machine? A. In the former the current is stronger and more even.

(58) H. asks: Can the following problem be solved? If so, what are its roots? $x+y=xy$. $x^3-y^3=xy$. A. It cannot be solved by any of the ordinary rules of algebra, since there is only one independent equation for two unknown quantities. Moreover, from casual inspection, we are inclined to think that the independent equation is untrue.

(59) O. K. asks: How can I prevent rust on polished steel tools? A. Melt 1 oz. paraffin in 1½ ozs. petroleum, and apply with a linen rag.

(60) E. D. E. asks: What is the process for crystalizing flowers, grasses, etc. ? A. One process is to thoroughly dry the flowers and grasses, and then allow them to soak in a strong solution of alum.

What are the ingredients and proportions of the compound used for marking the name or brand on unbleached cottons? A. Iodide of potassium 1 oz., iodine 6 drams, water 4 ozs., dissolve. Make a solution of 2 ozs. ferrocyanide of potassium in water. Add the iodine solution to the second. A blue precipitate will fall, which, after filtering, may be dissolved in water, forming a blue ink.

Will a pure gold stud blacken a shirt bosom? A. Yes.

(61) M. C. asks: By what part of their bodies were the Siamese twins connected? A. The counecting link was an extension of the sternum of each; it was 4 inches long and 2 inches broad.

(62) J. C. K. says: According to Dr. Ure, amber is a solid mineral, disseminated in sand, clay, and lignite formations. In another place I find it under the head of resins, and described as procured from the vegetable kingdom. It has been elsewhere described as procured by diving, the divers tearing it from a reef. Is there more than one kind of amber? A. Amber occurs often in beds of wood coal, but is chiefly found after storms on the coasts of the Baltic, between Konigsberg and Memel. It consists of a mixture of several resinous bodies, which have not been accurately examined. There is but one variety.

(63) J. B. asks: How can I make a lac or paint to turn German silver black, and stand handling without losing gloss or color after drying? A. There is one simple method by which artists may be enabled to obtain all the different tints they require. Infuse 4 ozs. of gum guttæ in 32 ozs. essence of turpentine; and 4 ozs. dragon's blood and 1 oz. annatto, each in a separate dose of essence. These infusions may be easily made in the sun. After 15 days' exposure, pour a certain quantity of these liquors into a flask; and by varying the doses, different shades of color will be obtained. Black japan varnish, we think, would answer your purpose very well, and may be made as follows: Boiled oil 1 gallon, umber 3 ozs., asphaltum 3 ozs., oil of turpentine as much as will reduce it to the required consistence.

A barrel of cider vinegar nearly 3 years old was found to have turned black, the cause of which is attributed to the barrel having been burnt too much when new. What will make the vinegar clear? A. If the supposition is correct, the vinegar may be cleared by filtering.

(64) W. B. says: I find that my tea kettle becomes caked up with scale very often; in six weeks it will become one quarter inch thick, if left undisturbed. Is the water (from a well) likely to produce gravel, if drank without being boiled? A. There is no danger from this source. 2. How can I soften it for washing purposes, as it has been so dry here that we have run out of rain water? A. Boiling the water will render it softer, by expelling the carbonic acid and depositing the carbonate and a portion of the sulphate of lime held in solution.

(65) A. M. T. says: 1, How can I make an electrical machine with a glass plate 1 foot in diameter and ⅛ inch thick? A. Suspend your glass plate between two wooden supports, by an axis passing through its center, which is to be turned by means of a glass handle. The plate should revolve between two sets of cushions or rubbers, of leather or silk, one set above the axis and the other below, which can be pressed by means of screws as tightly against the glass as may be desired. The plate also passes between two brass rods, shaped like horseshoes and provided with a series of points on the sides opposite the glass; the rods are fixed to larger metallic cylinders which are called the prime conductors. Each rubber must be connected by a chain with the ground. 2. Will it do to make it of insulated wood coated with tinfoil? A. Yes. 3. Would a Leyden jar placed to the prime conductor be of any value? A. Yes. 4. Which is the simplest way to make one? A. It consists simply of a wide-mouthed bottle, lined inside and out to within about three to four inches of the top with tinfoil. A stopper of dried wood closes the mouth, through which passes a brass rod surmounted by a brass bell. A fine wire connects the inside coating of the jar with the end of the brass rod. 5. What is the rubber composed of, and how can I amalgamate it? A. The cushions may be made of silk stuffed with horsehair. Use common bisulphuret of tin amalgamon them. 6. How can I fix the axis firmly to the plate? A. The axis may be of light wood; the hole in the center of the glass plate should be square. 6. In Carré's electrical machine, described on p. 402 of vol. 28, how is the condenser made and applied to the machine? A. You will find that condenser described on p. 363, vol. 30. A Leyden jar would perhaps answer your purpose. 8. Cannot shocks be taken from the prime conductor without it? A. Yes. 9. What is the distance of the brass knob from the prime conductor in Carré's machine? A. The distance is not mentioned. 10. How are the ebonite disks made? A. Ebonite is rubber heated with half its weight of sulphur.

(66) Q. A. S. says: Imagine an engine made like an ordinary steam engine, but with an opening in the valve larger, and the ports larger, so that the air could go in freely, to be driven by atmospheric pressure. The exhaust is connected by a slide valve arrangement with two drums or chambers, which are heated to produce a vacuum. The idea is that the vacuum produces a suction which draws the air out of the cylinder from in front of the piston head, alternately and instantaneously, so that the atmospheric pressure of 15 lbs. to the square inch can drive the piston head back and forth, as steam does. How much actual pressure would there be on the piston head to drive it, provided a vacuum existed in front of the piston head? I know that a perfect vacuum only exists theoretically; but suppose that the drums are made so large and heated in such a manner as to suck the air out from in front of the piston head rapidly, and strongly, would this suction add to the atmospheric pressure and give the engine more power, or would there remain in the cylinder in front of the piston head a certain quantity of air, which would offset the atmospheric pressure on the back of the piston head to the extent of 4 or 5 lbs. pressure, and leave an actual working atmospheric pressure of only 10 lbs. to the square inch? A. Air expands about 1-491 of its volume for 1° Fah. that it is heated, and its pressure is inversely as its volume. Knowing, then, the temperature of the air in the drums, you can easily calculate the pressure, which will be the back pressure in the piston. There is, properly speaking, no such principle as suction. If the pressure on the side of the piston is less than that of the atmosphere, the unbalanced pressure of the atmosphere will tend to move the piston.

(67) E. A. W. asks: How many cubic feet are there in a perch of stone? The stonemasons say 6½. A. Webster gives the same figures; but a "rod, pole, or perch" is 5½ linear measure, which makes 30¼ superficial measure, which does not agree with 16½ feet solid in any respect.

(68) J. G. P. asks: How can I make a good bronze on polished steel or iron, such as hardware trimmings and the like? A. To 1 pint methylated finish, add 4 ozs. gum shellac and ½ oz. gum benzoin: put the bottle in a warm place, shaking it occasionally. When dissolved and settled, decant the clear liquid and keep it for fine work. Strain the residue through a fine cloth. Take ½ lb. powdered bronze green, varying to suit the taste with lampblack, red ocher, or yellow ocher. Take as much varnish and bronze powder as required, and lay it on the article, which must be thoroughly clean and slightly warm. Add another coat if necessary. Touch up with gold powder according to taste, and varnish overall.

(69) P. T. B. asks: How can I produce a verde bronze on brass? A. Dissolve 2 ozs. nitrate of iron and 2 ozs. hyposulphite of soda in 1 pint water. Immerse the articles till they are of the required tint, as almost any shade from brown to red can be obtained; then wash well with water, dry, and brush. One part perchloride of iron and 2 parts water mixed together, and the brass immersed in the liquid, gives a pale or deep olive green, according to the time of immersion. If nitric acid is saturated with copper, and the brass dipped in the liquid and then heated, the article assumes a dark green color.

(70) G. W. H. asks: Can you describe the sights used in the late rifle contest at Creedmoor, between the Irish and American teams? A. The back sights were disks with small holes in them, moved vertically on parallel bars by means of a screw. The bars were graduated and furnished with a vernier, and were attached to the stock of the rifle. The foresights were shaded by an almost circular cover. 2. Can you explain the plan of scoring? A. The scoring was according to the Wimbledon system, namely, 4 for a bullseye 3 for a center, and 2 for an outer.

(71) T. C. says, in answer to W. F. M. (No. 18, p. 250, vol. 31) in regard to using a ¾ inch pipe a short distance from the spring and then adding a ½ inch pipe: If you place a 1 inch pipe leading from the spring for about 2 rods, and then add the ¾, and then the ½ for the remainder of the distance, you will have a larger and more steady flow of water.

(72) M. P. B. says, in answer to F. A. McG.'s query: Why does a belt run to the highest point? A belt, in passing over a pulley, inclines to the outline of that pulley. This outline on a taper pulley crosses the line of the belt obliquely, which throws the first point of contact higher on the pulley than it is at the central point. As the first contact soon becomes the central point, the belt runs up.

(73) M. P. S. says, in answer to J. B. G. who asks how to make music by rubbing the fingers on the top edges of goblets: I have in my possession a musical instrument of rare purity and sweetness of tone called an harmonicon, which was made by my father very many years ago. The sounds are produced by thin flint glass hemispheres, supported by glass stems, and varying in diameter from 2½ to 7 inches, each one giving an absolutely perfect and unchanging tone. The instrument has a compass of three full octaves, with the semitones, and is enclosed in a mahogany case making a handsome piece of parlor furniture. Any composition, not too rapid in movement, can be played by a skillful performer. The tones far surpass in delicacy and sweetness any known instrument, uniting the softness of the æolian harp to the power of the violin. The pitch of each glass is determined in the blowing, and can be but slightly varied by cutting the glass lower at the edge. Water deadens the sound, and robs it of all its exquisite *timbre*. Many thousands of glasses had to be made before the perfect instrument was produced. It may be interesting to mention that, by means of these glasses, my father was enabled to divide a semitone into sixteen clearly defined intervals, the difference between any two successive glasses being so slight as to be almost undistinguishable.

(74) J. C. P. says: To make a carpenter's bench, take three pieces of 2x5 inches stuff, 3 feet long for supports for top. Take two 12 inch boards, 12 feet long and 1 inch thick, for sides; nail the side boards firmly on to the ends of the 2x5 cross pieces and put on a top of suitable material, and you have a bench without legs. Then take four pieces of 2x5 inches stuff of the desired hight for the legs, and frame a piece 1x3 inches across each pair of legs, 6 inches from the bottom of the leg, putting the legs at the proper distance apart for width of bench. Cut a fork or slit in the top end of each leg, so as to straddle the cross piece at the ends; put a 3½ x ⅜ inch bolt through each leg and the side board, and you have a good solid bench, that can be taken down in five minutes by simply removing the four bolts. It can also be taken through any door or window, or down or up stairs, or to any place required, thus saving a great deal of worry incident to trying to move the old style of bench. Besides, it is more easily made than any other form in use.

(75) G. M. says, in reply to A. O. W.'s query: Is there anything to make spelter flow more easily on copper? To do this, and on thin brass also, I file or rasp block tin into the spelter and borax (a small quantity), using my judgment for the mixture.

(76) A. S. says, in reply to N. S.' query: How can I put solder up in small bars, the size of knitting needles, without molds? Make a narrow trough of sheet iron about two inches in length, and punch a row of holes about 1-16 inch in diameter, ⅜ inch apart in the bottom. Affix a handle. Pour the solder from the ladle (quite hot) through the trough, at the same time moving the ladle and trough together rapidly over a plate of iron. He will find after practice that he can make the bars in this way very rapidly.

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

F. C. R.—No. 1 is a quartzite, containing hematite. No. 2 is principally iron pyrites and hematite.—J. B.—Your minerals and fossils were not received.—R. W. Z.—No. 1 is decayed shale, with red ocher. No. 3 is composed principally of red oxide of iron. No. 5 is a carbonate of iron. No. 4 is specular iron ore No. 5 is menaccanite. No. 6 is iron pyrites. No. 7 is hematite. No. 8 is aragonite. No. 9 is shale containing red oxide of iron, with seams of carbonate of copper. No. 10 is marcasite.—W. M. D.—No 1 is magnetic oxide of iron. No. 2 is titaniferous iron ore.—H. W.—It is iron pyrites in quartzite.—T. T. R.—No. 3 is a quartzite, depending upon a layer of dark sandstone, containing scales of iron pyrites. No. 4 is iron pyrites distributed in gray quartz rock. No. 5 is a schistose rock containing iron pyrites, quartz, and hornblende.

D. E. R. says that a man recently bought a whisky barrel, to haul water in; and after bringing it home, a child got hold of some matches, and tried to ignite them by scraping on the barrel head. He succeeded in igniting one, and in exploding the barrel with a report which was heard four miles off. How came an explosive gas in a whisky barrel?—C. A. G asks: How can I take oil stains out of brown stone or freestone?—J. C. M. asks: Can you give me a recipe for razor strop paste that will not cause the strop to become glazed in cold weather?—E. M. asks: 1. How do plumbers burn two pieces of lead pipe together, with a bolt and without the use of solder? 2. How do plumbers make a nearly square bend on the end of a large pipe?—E. B. G. says: Nearly every black bass I have caught since last spring has been full of worms in the gills, and all through the flesh; they appear like small white specks curled up in the flesh, but, when taken out, are alive. Fifteen years ago I caught a three pound bass full of worms about half an inch in length. Some old fishermen tell me that they are always so. Can any one give me information on this?—I. asks: Will goldfish breed in an aquarium?—A. P. asks: How can I deodorize rubber?—S. T. W. asks: Where can I find tables of the variation of the needle at the State capitals for the last fifty or one hundred years?—J. K. asks: Can you tell me of a good varnish to put on tracing cloth or paper that will allow of its being washed or cleaned after using in a machine shop.—B. C. W. asks Is rubber ever used instead of leather as a packing for hydraulic presses?