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Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

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Diamond Drills, J. Dickinson, 64 Nassau St., N. Y.

Lansdell's Steam Siphon pumps sandy and gritty water as easily as clean. Leng & Ogden, 212 Pearl St., N. Y.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

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Talley's Hydraulic Engine (see description and cut March 9, 1878), as a simple, cheap, effective and economical power, is unsurpassed, and is meeting with great success. Economy Hydraulic Engine Co., Kansas City, Mo.

Notes & Queries

E. T. M.—The sample of insulated wire sent is rather coarse, but it will answer for the purpose.

J. J. B.—It appears to us that your best course is to seek some position in a telegraph office, in which you will be apt to receive a thorough practical education in the art.—D. W. D.—See p. 165, SCIENTIFIC AMERICAN, No. 11, vol. 35; and p. 229, No. 15, vol. 35. By arranging the slide valve to cut off at about three quarter stroke, the proposed engine would probably answer.—G. D. B.

—Gas carbon may be cut into plates by means of a common hand saw.—J. A.—See answer No. 42, p. 396, SCIENTIFIC AMERICAN, December 22, 1877.—F. J. S.—There are a number of treatises on the subject, in addition to the more complete arithmetics, which you should consult as the discussion would be too extended for these columns.—J. H. H.—You can probably obtain this information by inserting a notice in the "Business and Personal" column, which is especially intended for such inquiries.—T. M. Co.—You will find a résumé of the subject of spontaneous ignition in Birá's "Protection against Fire," pp. 122-137.—E. C. N.—The word "cover" should read "core."—C. H. L.—See answer No. 18, SCIENTIFIC AMERICAN, April 13, 1878.—F. W. S.—The sample of sheet iron inclosed is rather heavy for a telephone diaphragm, but it will answer.—D. B. T.—Consult any elementary astronomy. The discussion would occupy more space than we have at command.—M. V. D.—Perhaps if you will apply to a commission merchant doing this kind of business you may obtain particulars.—D. G.—We do not get a very clear idea of the arrangement from your letter; but if, as we understand, you are trying to overcome what some call the loss of power by the use of the crank, our advice would be to stop trying, as there is no such loss as supposed.—J. F.

—The result is certainly unusually good, if there is any proof that the steam was dry.—E. H. L.—You do not send sufficient data about the engine. The flues will answer for boilers if in good order. They can be set in brick, like ordinary cylinder boilers. It might be better to connect one to the other than to set them side by side.—C. E. C.—The details sent are not sufficient. You will find rules in Trautwine's "Engineer's Pocket Book," which will enable you to solve the problem.—W. F. A.—You can make a boiler of copper $\frac{3}{4}$ inch thickness, 4 inches in diameter, and 12 inches long, with rounded heads. You can obtain information as to cost from a coppersmith.—W. J. P.—From the data sent we are unable to explain the matter.—L. G.—See answer to A. B. P., this page.—T. J. F.—You cannot make such an alloy. For mode of boring gun barrels see SUPPLEMENT, No. 25, p. 387.—G. L. D. & Co.—See answer to F. H. T., next page.—R. S. L.—For description of the telephone see SCIENTIFIC AMERICAN, No. 14, vol. 37. The ordinary telegraph wire is the only connection required. See answers Nos. 15, 19, and 22, p. 155, March 9, 1878. The general principle is not patented.—C. C. S.—The only way which occurs to us is to add fillings of metal to the plaster.—C. S.—The word "subornation" does not necessarily mean to cause a person to commit perjury, but in its broad sense "the crime of procuring one to do a criminal or bad action" (Webster), and therefore the phrase "subornation of perjury" is not tautological.

(1) G. H. A. writes: I have a small galvanic battery, the zinc of which is broken. Would the same metal answer, if melted and moulded over again? A. Yes.

(2) L. W. C. asks for a recipe for preparing a gold (or bronze) ink that will flow from a ruling pen and leave a bright clear line. A. Honey and gold leaf, equal parts; triturate until the gold is reduced to the finest possible state of division, agitate with 30 parts of hot water and allow to settle. Decant the water and repeat the washing several times; finally dry the gold, and mix it with a little weak gum water for use.

(3) A. H. L., referring to the article in the SCIENTIFIC AMERICAN of March 30, p. 197, relative to the need of efficient means of destroying dangerous wild beasts, as in India, suggests that placing poisoned meats in the habitats of such animals would be a speedy and cheap means of exterminating them, and more effective than hunting them down.

(4) G. J. S. asks for recipes for making copying, black, and red inks. A. 1. Bruised Aleppo nutgalls, 2 lbs.; water, 1 gallon; boil in a copper vessel for an hour, adding water to make up for that lost by evaporation; strain and again boil the galls with a gallon of water and strain; mix the liquors, and add immediately 10 ozs. of copperas in coarse powder and 8 ozs. of gum arabic; agitate until solution of these latter is effected, add a few drops of solution of potassium permanganate, strain through a piece of hair cloth, and after permitting to settle, bottle. The addition of a little extract of logwood will render the ink blacker when first written with. Half an ounce of sugar to the gallon will render it a good copying ink.

2. Shellac, 4 ozs.; borax, 2 ozs.; water, 1 quart; boil till dissolved, and add 2 ozs. of gum arabic dissolved in a little hot water; boil and add enough of a well triturated mixture of equal parts indigo and lampblack to produce the proper color; after standing several hours draw off and bottle.

3. Half a drachm of powdered drop lake and 18 grains of powdered gum arabic dissolved in 3 ozs. of ammonia water constitute one of the finest red or carmine inks.

(5) C. C. B. asks: What should gold fish eat? I have kept two gold fish for several months in a small glass aquarium, changing the water only once a week, and have not fed them anything. They seem perfectly well and lively. A. In a natural state they live principally on animalculæ. It is best to feed them very seldom, and they are sometimes kept without feeding at all. A little bread or cracker is as good as anything.

1. Does a locomotive drawing an ordinary passenger train use as much power in running 20 miles an hour against a head or quartering wind—blowing at the rate

of 20 miles an hour—as one running 40 miles an hour with no wind, other things equal? A. We think not. 2. Which would offer the most resistance, a head or quartering wind? A. A quartering wind, nautically speaking, is one abaft the beam; but, as we understand the question, a wind not quite ahead would probably cause greater retardation than one directly head, owing to the friction caused by the jamming of the wheel flanges against the lee rail.

(6) J. I. asks: Is there any other substance which can be used in place of lime in the oxyhydrogen lights? A. Magnesia alone and with lime—as from dolomite—has been used, but lime is preferable as it is much harder and as refractory.

(7) A. B. P. asks: 1. Will common flower-pots serve as porous cups in a battery? A. Yes; moderately well. 2. Is a two-cell Daniell a good battery for electro-plating? A. Yes.

How can I make sulphocyanide of mercury? A. To solution of potassium or ammonium sulphocyanate (sometimes called sulphocyanide) add solution of mercuric nitrate; mercuric sulphocyanate is precipitated as a white powder. This, thoroughly washed, formed into little cones and dried, constitutes the toys called Pharaoh's serpents.

(8) G. F. M. asks how to make ferric oxalate in small quantity. A. Add a small quantity of neutral potassic oxalate to solution of a ferric salt (ferric chloride answers); the yellow precipitate is ferric oxalate. The same salt is formed by treating ferric hydrate with a quantity of strong oxalic acid solution just insufficient to dissolve it. It is almost insoluble in water; its solution in oxalic acid soon reverts to ferrous oxalate under exposure to sunlight.

(9) W. D. asks: What is ozone and what are its properties? A. There has been considerable discussion about the nature and composition of ozone; but the most trustworthy experiments seem to show that, in whatever way produced, it is merely a modified form of oxygen. Ozone is insoluble in water and in solutions of acids or alkalis, but is absorbed by a solution of potassium iodide. It is decomposed by heat, gradually at 100° C., instantly at 290° C. It is an extremely powerful oxidizing agent, possesses strong bleaching and disinfecting powers, corrodes cork, caoutchouc, and other organic substances, and rapidly oxidizes iron, copper, and even silver when moist, as well as dry mercury and iodine.

(10) F. R. McG. asks how to make an aquarium watertight. A. A good cement is composed of 3 ozs. of linseed oil, 4 ozs. of tar, and 1 lb. of resin. These are allowed to melt together over a gentle fire. If too much oil is used, the cement will run down the angles of the aquarium; to obviate this, it should be tested before using by allowing a small quantity to cool under cold water, and if not found sufficiently firm, allowing to simmer longer, or have more tar and resin added. The cement should be poured in the angles of the aquarium while in a liquid state, but not when boiling, or it would most assuredly crack the glass. The cement will become firm in a few minutes, and the aquarium may then be tilted up in a different position while a second angle is treated likewise. This composition adheres firmly to the glass, is so pliant that it may be pressed into any shape by the fingers, and it does not communicate any poisonous quality to the water.

(11) J. C. E. writes: When an electric current is passed through water decomposition takes place. Is there any liquid which will conduct electricity (with great or little resistance) without decomposition? A. Mercury.

(12) A. B. asks for a cement to join leather. A. Ten parts of carbon disulphide and one part of oil of turpentine are mixed, and as much gutta serena added as will readily dissolve. The surfaces of leather must be freed, with a hot iron, from grease or oil, and the parts once joined should be well pressed until they are firmly united.

(13) J. P. S. asks: 1. What can I melt or mix with asphaltum to make it tough enough for water pipes for use on my farm? A. Fine sand, lime, and straw or other vegetable fiber have been used in this connection. 2. In digging a well I struck a vein of gas 15 feet beneath the surface. If I bore down 50 or 60 feet further, will the flow of gas be likely to increase? A. It is uncertain. 3. Is there any danger of my losing it by boring? A. No. 4. Can it be used to advantage for lighting a dwelling, and also for fuel? A. You will find a reference to this subject on p. 52, present volume of the SCIENTIFIC AMERICAN. 5. Close by the gas well are a number of asphaltum springs. Are the asphaltum and gas an indication of petroleum? A. Not necessarily.

(14) A. M. H. asks: 1. Does prepared sulphate of nickel and ammonia need the addition of cyanide or anything else to make the bath for nickel plating efficient? A. No. 2. Can brass articles freshly turned and perfectly cleaned be nickel plated without first copper plating them? A. Yes; better pickle them in dilute acid first. 3. In gilding watch cases, is it first necessary to copper plate them, no matter what the metal may be? A. No. 4. Please tell me how the inclosed pieces of plating are done. A. The pieces appear to have been electro-plated. Consult Napier's "Manual of Electro-Metallurgy."

(15) E. J. R. asks: 1. What cement is used in mending rubber shoes? A. Incorporate by fusion equal parts of gutta serena and genuine asphaltum; use warm. 2. What will mend china and glassware so as to stand ordinary dish-washing? A. 1. Isinglass dissolved in spirits of wine to a thick paste, 2 ozs.; pale gum-ammoniac (in tears), 10 grains; triturate together until solution is complete. Then add six large tears of gum mastic dissolved in the least possible quantity (over a water bath) of rectified spirit. 2. Boil 4 ozs. of shellac and 1 oz. of borax in water till dissolved; concentrate to a paste by heat.

(16) G. D. asks: How are the hypophosphites of iron and soda made? A. Hypophosphite of soda is formed by boiling a grain or two of phosphorus, a few grains of sodic hydrate, and about a quarter of an

ounce of water until phosphureted hydrogen (spontaneously inflammable) ceases to be evolved. The mixture filtered, yields solution of hypophosphite of soda. Care must be taken against explosion. Hypophosphite of iron is formed by dissolving ferric hydrate in cold aqueous hypophosphorous acid, and evaporating the solution.

(17) G. D. asks whether dynamite is as "harmless as putty," and whether there are any well authenticated cases of its exploding in an unexplained manner. A. Dynamite, as it is now made, is recognized as among the safest of all explosives. It would be absurd to call it as harmless as putty, but, when handled carefully, there is slight danger. When ignited in the open air it burns quietly, and neither light, electricity, nor ordinary shocks cause it to explode. The chief dangers are in connection with the fulminates used to explode it, and in the possibility of the exudation of nitro-glycerin from careless manufacture or as a result of thawing after freezing. However, although dynamite in its various forms is used extensively in mining, we know of no recent accidents in which the cause was not directly traceable to carelessness; and not long ago, during a fire in San Francisco, a large quantity was burned without explosion.

(18) B. W. S. asks: How can I remove ink stains from a book cover, common cloth binding? A. Try a weak solution of oxalic acid; dry with warm blotting paper or pipe clay.

(19) H. L. B. asks: What is the best and cheapest way of polishing a hard wood floor? A. After it has been planed as smooth as possible, rub down with sand paper, and then oil.

(20) P. L. W. asks: How do scientists prove that ether (which conducts light and heat from the sun) is imponderable? Or what reason do they have for believing that it is? A. The existence of the ether is assumed to account for various phenomena, but has not been proved by any physical tests. "Energy cannot exist except in connection with some material substance," says Dr. Maxwell. Hence, since in the space between the earth and sun, the luminous and thermal radiations possess energy, the amount of which can be measured, this energy must belong to matter existing in the interplanetary spaces. By imponderability is meant, not absolute absence of weight, but want of appreciable density, as is shown by the fact that the ether does not sensibly retard planetary motions.

(21) D. E. J. asks: How can I make a mirror? A. It is more advisable to purchase one already made, but you may proceed as follows: On a perfectly level, smooth piece of marble, spread a piece of pure tinfoil, smoothing out every wrinkle and crease. Pour a little clean mercury on the foil, and spread it quickly and uniformly by means of a roller of woolen stuff; then pour mercury in the middle until the foil is covered to a depth of $\frac{1}{4}$ of an inch, and slide the glass plate (previously thoroughly cleaned and dried) on the table in such a manner as to carry off the supernatant mercury. Place a weight on the glass, and slightly tip the table to allow the excess of mercury to run off. The plate must then be covered with thick cloths and heavily weighted for several days.

(22) W. T. R. asks: How can the scraps of waste leather produced in the manufacture of boots and shoes be utilized? A. Chips, parings, etc., of shoe leather having the grain on are about valueless; they are sometimes mixed with superphosphates for fertilizing purposes. Leather shavings free from grain can be used in glue manufacture or made into so-called leather board or pancake leather, used for brush backs, inner soles, heels of shoes, etc. These shavings bring in the market from \$15 to \$20 a ton, dry.

(23) T. T. R. asks: What will cause the wrought iron arms of a light cast iron pulley wheel to adhere and prevent it from blowing or casting hollow? A. Dry the moulds and heat the arms before running the metal.

(24) P. B. C. asks: Is there any rule for setting the valves on locomotives while on the road, without taking the chest cover off? A. They can be set by trial, opening the cylinder cocks, and turning the wheels, so as to move the piston. Or the valve stem, shaft, or eccentric may be marked in the shop, so that the adjustment can readily be made.

(25) J. R. S. asks: Is a two-bladed propeller 30 inches in diameter, 44 inches pitch, run at 300 revolutions, likely to do as good work with a boat 30 feet long as one of 3 or 4 blades, same diameter and pitch? Which will shake the boat most? A. The three bladed propeller gives steadier motion, and is usually more efficient than the one with two blades.

(26) W. S. N. asks: What is meant by a miner's inch? A. The miner's inch is the amount of water flowing in one second from an orifice 1 inch x 1 inch, under a head of 6 inches, measured from the upper side of the orifice.

(27) B. W. writes: After one melting, silver works very easily under the hammer; after re-melting two or three times it becomes quite brittle and cracks when hammered. What are the cause and the remedy? I melt in sand crucibles with a little borax. A. It probably requires to be annealed.

(28) C. M. B. asks: Is there any way to prepare vulcanite set squares, etc., so that they will not soil the drawing paper, without altering the exactness of the squares? A. Clean them frequently with a little pure benzole and chamois skin.

(29) P. C. asks: What is the cause of the cracking of marble, as seen in the monuments in our cemeteries? The same thing is not observable, at least to an equal extent, in the blocks used in building. A. It is usually due to the action of frost and storms. The monuments are ordinarily more exposed than the stones of buildings.

(30) H. S. T. asks how the common nickel salts are formed. A. Chloride of nickel is formed by dissolving metallic nickel or its oxide in hot hydrochloric acid and evaporating the solution (after filtering) to complete dryness, redissolving the residue in

water and crystallizing out the salt by evaporating the solution at a gentle heat. The sulphate of nickel is prepared from the oxide in a similar manner, using hot dilute sulphuric acid in place of hydrochloric. For the double sulphate of nickel and ammonia, dissolve four parts sulphate of nickel in a small quantity of hot water and add two parts of aqua ammonia; crystallize the solution by evaporation.

(31) P. H. asks: Does frost have a tendency to make steel brittle? A. Dr. Styffe comes to the conclusion that the absolute strength of steel is not diminished by cold, but that the elasticity is, and therefore steel at low temperatures, when subjected to a sudden blow, is more apt to crack. Consult Sandberg's experiments, described in the American Cyclopaedia, under head of "Iron." The breakage of steel rails in winter is also ascribed to the increased rigidity of the road bed.

(32) W. W. M. asks: What will clean metallic zinc? A. Dilute hydrochloric acid and sharp sand, an emery wheel, or file.

(33) E. T. M. asks: Will anything remove indelible ink from linen or cotton cloth? A. Most "indelible" ink marks may be removed by treatment with tincture of iodine or sodium hypochlorite, and, after washing, with strong ammonia water, sodium hyposulphite, or solution of cyanide of potassium. The latter should be used with care, as it is very poisonous.

(34) J. P. asks: What will remove India ink tattooing? A. The particles consist of carbon, which is insensible to any solvent applicable. It can be removed by the scalpel and, in some cases, by cauterizing.

What can I polish steel with to make it look new and like a penknife blade? A. Emery and sand oil.

(35) W. W. asks for a recipe for making a sympathetic ink to be developed by some agent other than heat. A. 1. Write with solution of ferrocyanide of potassium; develop by pressing over the dry invisible characters a piece of blotting paper moistened with solution of copper sulphate or of copperas. 2. Write with pure diluted tincture of iron; develop with a blotter moistened with strong tea.

(36) F. H. T. asks: 1. What will prevent flour paste from moulding and souring? A. Use a few drops of carbolic acid. 2. Ordinary mucilage lacks the requisite body for rapid work in wrapping up newspapers. Can you recommend a good solution for the purpose that will not spoil by freezing? A. Try the following: Four parts, by weight, of glue are allowed to soften in 15 parts of cold water for some hours, and then moderately heated till the solution becomes quite clear; 65 parts of boiling water are now added with stirring. In another vessel 30 parts of starch paste are stirred up with 20 parts of cold water, so that a thin milky fluid without lumps is obtained. Into this the boiling glue solution is poured, with constant stirring, and the whole is kept at the boiling temperature. After cooling, 10 drops of carbolic acid are added to the paste. The paste must be preserved in closed bottles to prevent evaporation of the water, and will in this way keep good for years.

(37) L. S. S. writes: Please inform me how I can purify block tin that has been a little overheated in a crucible. It leaves a wavy surface on the article plated, with streaks of cross. Can the metal be brought back to its former state? A. Cover the molten tin with charcoal mixed with rosin, oil or tallow. The cross may be recovered by strongly heating with excess of fine charcoal in a luted crucible.

(38) J. W.—What you refer to is doubtless a modification of Franklin's "pulse glass," consisting of a tube connecting two bulbs, and half filled with colored ethylic ether, air being excluded; the heat of the hand in contact with one of the bulbs expands the ether vapor and forces the liquid into the other bulb with ebullition. The violence of the ebullition is a rough index of the temperature of the blood circulating in the hand of the person grasping the bulb.

(39) F. E. P. writes: With an engine having two boilers of unequal sizes, not heated by the same fire, but both having the same pressure, if one boiler be cut off from the cylinder, say the smaller one, and the larger one will do certain work with 100 lbs. of steam, will the smaller one do the same work, provided the steam could be kept at the same pressure while working? Or, in other words, will a certain unit or pressure of steam do equal work, no matter from what sized vessel it comes, in equal cylinders? A. If the pressure could be kept at 100 lbs. in the small boiler, it would do the same work, but if the large boiler just furnished steam enough, the pressure in the small boiler would fall when it was connected directly to the engine.

(40) G. H. writes: I wish to increase the weight of my feed stone by putting more plaster upon the back of it. In what way can I do it so that it shall be solid? I have already put three new backs on, but soon after the setting I find the new plaster has risen from the old, leaving a space of from a quarter to half an inch between, rendering it impossible to turn and dress it. A. You might secure the new part by a casing, or cut grooves in the old portion so as to form a lock joint with the plaster that is added.

(41) W. G. W. writes: Suppose a young tree, say 10 feet high, has its lowest shoot 2 feet from the ground. As the tree grows will the branch get any further from the ground, or does the tree grow in length only on the top? A. The youngest parts of the tree grow faster than the older. Up to the point when the woody fibers become set the branch will rise, though slowly in comparison with the growth of the newer portions.

(42) B. T. asks: 1. What is the principle upon which the revolving gas burner works? I do not mean the one which works by a fan wheel on top and has its loose joint sealed with water, but the one which, I think, works by pressure and reaction of the gas. A. The burner revolves just as a rocket ascends, because there is unbalanced pressure in one direction. 2. How is the joint made, and what seals it? A. The revolving arm is fitted nicely to the upright pipe, generally without packing.

(43) B. M. R. asks: How can I wash India ink stains from marble? A. Use plenty of hot water, and if necessary rub with a little rouge on a soft cloth.

(44) G. S. N. writes: I want to arrange some way for communicating between mill and store. Which would you advise, telegraph or telephone? Will the noise of the mill interfere with the working of the telephone? A. In your case the dial or printing telegraph would perhaps be best.

(45) E. J. asks: How many degrees of heat can steam be heated to, by passing it in pipes through a furnace? A. With a proper arrangement of pipes, we think the steam could be heated to any temperature that the pipes would stand.

(46) T. H. writes: I am an apprentice in a railroad repair shop; have served two years, and have two more to serve. What book will help me to fully understand the working of an engine, and also how to take proper care of the boiler? A. No one book will give you this information, and much of it is not contained in books at all. Forney's "Catechism of the Locomotive," Bourne's "Catechism of the Steam Engine" and "Hand Book," Auchincloss on "Link and Valve Motions," and Rigg's "Practical Treatise on the Steam Engine," will form a good selection for a commencement of a course of reading on the subject.

(47) J. G. writes: In books on the steam engine it is said that some valves have too much lift, and some too little, but they do not say what is too much and what too little. What is the rule? A. The general idea in proportioning the lift is to give sufficient area of opening. It frequently happens, however, that on account of the size of the valves or the speed of the pump the valves seat heavily, in which case the lift can sometimes be reduced advantageously; but the exact amount of reduction can best be determined by experiment.

(48) T. R. W. asks: What time does it generally require to become an expert stenographer (Pitman's system) and what salary is paid? A. So much depends upon the capacity of the learner, that a general answer cannot be given. Some learn in three or four months, with one or two months' additional practice. The pay is not very high at present, as the supply rather exceeds the demand.

(49) L. D. L. asks: How can I restore the color of ink in faded manuscripts? A. Carefully wash the manuscript in a weak and cold decoction of ground nutgalls. In regard to other inquiry, consult advertising columns.

(50) T. W. asks: How can pins of metal be safely and securely fastened in holes in glass? Will not the metal expand and break the glass? Should the glass be moulded on and over the heads of the pins, and would this prevent breaking of the glass? A. Under ordinary conditions of temperature there would probably be no danger. It would be better, however, to use a cement. If not required to stand very high heat, melted resin with a little calcined plaster stirred in, thinned with boiled oil, and applied warm, would answer.

(51) W. E. K. asks: 1. What process have electro-platers for finishing steel knives that are corroded? The knives will not stand grinding down and refinishing, as the spots are sometimes opposite each other; if they were all ground out the blades would be too thin for service. A. There are several ways of doing this. One good way is to fill the depressions with silver, by repeating the operation of silver plating, and polishing until a flat surface is obtained. 2. Is there any machine made for burnishing silver-plated articles, or does it have to be done by hand? A. Yes; but fine burnishing is done by hand.

(52) F. B. writes: 1. I inclose a piece of wire which I intend using for telegraph purposes. Is it large enough to conduct a current from a small battery? A. The sample is of about 19 gauge, and will answer for the purpose. 2. Is it necessary to have it galvanized? A. No.

(53) M. C. writes: About 20 years ago, while living in Wisconsin, I saw hundreds of large white grubs, dead, with a vegetable sprout issuing from their backs. They were ploughed up by my neighbors in the spring. The shoots looked like young corn, having two straight and beautiful leaves. The grubs had turned to a dark color, nearly brown. I planted several of the shoots, but they failed to grow. I think that this is a tough nut for Mr. Darwin. A. Darwin is not an advocate of spontaneous generation. The natural explanation of the fact mentioned is that the grubs, after swallowing the plant germs (which were probably something smaller than grains of corn), were killed in some way, and the seeds in sprouting found congenial nutriment in the bodies of the larvae.

(54) W. A. M. writes: I am endeavoring to construct a telephone, but find many difficulties in the way. The distance over which I wish to use it is, say, 150 yards. I have a single copper wire, a sample of which I inclose. I also have a Leclanché or open circuit battery, and at the opposite end of line I have an electric bell. Now I wish to use the electric bell for calling attention to the telephone in my factory, where there is some noise caused by the working of machinery. 1. Can I work the telephone successfully on the single wire—same wire used by the bell and battery? A. Yes. 2. I inclose a sample of wire wound on my spools on magnets; spools contain $\frac{3}{4}$ oz. each. Is the wire not too fine or light? A. The sample is of about No. 40 gauge copper wire, silk insulation, and is of the right size and quality to give a good result. 3. Is the quantity too small? A. That will depend on the size of the magnetic core on which it is wound. 4. I find difficulty in wrapping wire evenly on spools. Is it important to have it wound very evenly, like thread on spools? A. It is best to have it wound evenly, but not necessary. 5. If so, how can I do it? A. By winding the spool in a machine constructed on the principle of the screw cutting lathe. 6. Is the sample of sheet iron (tin type) too heavy for the diaphragms for the tele-

phone? A. The plate is of the right thickness (about $\frac{1}{16}$ of an inch), but there is too much lacquer and colloid on it. This you can easily remove by making the plate red hot.

(55) H. A. H. writes: I have been making some batteries of the following description, costing 8 cents per element. Will you please tell me how many elements I shall need to produce an electric light of 20 candle power? Glass tumbler 5 cents, small flowerpot 2 cents, zinc, etc., 1 cent. A. About 300 of them, if the sulphate of copper solution is used as an excitant.

(56) O. C. M. asks: What is the mode of nickel plating without a battery? A. Herr Stolba's process for nickel plating iron and steel without a separate battery is as follows: To a dilute solution (5 to 10 per cent) of pure zinc chloride, there is added enough sulphate of nickel to color it distinctly green. This is heated to boiling in a porcelain or porcelain-enameled iron vessel. The objects, being completely cleaned of grease, are then suspended in the liquid so that they do not touch each other. The liquid is boiled for an hour, water being added to replace that lost by evaporation. If during boiling the solution partially loses its color more nickel sulphate must be added until the intense green color is restored. The plated work must be thoroughly washed on removal from the bath in hot water holding fine chalk in suspension. It dries quickly on withdrawing from the hot water, and may then be cleaned with chalk and polished. The nickel bath, after exposure to the air for a time, may be filtered and used again.

(57) K. S. J. asks for a recipe for tempering and case-hardening small steel castings. A. Good cast steel will harden if heated to cherry red and quenched cold in clean water. If the steel is inferior, add salt to the water, and apply powdered prussiate of potash to the steel while heated.

(58) A. J. S. asks: 1. What is the cause of the drumming noise made in the firebox of a locomotive burning soft coal? A. It is probably due to careless firing, holes being allowed to burn in the fire. 2. Why does the noise increase when running through a cut or over a bridge? A. It is especially noticeable when the surroundings are such as to reflect back the sound or act as sounding boards.

(59) W. A. asks: Is there any more danger in running a boiler that leaks than one that does not leak, everything else being equal, the leaking boiler kept well supplied with water? A. It is not especially dangerous if the attendant is careful, and the pump is of ample capacity, but it is not a very creditable practice.

(60) G. B. C. asks: How can I make a bright green writing ink? A. Use a strong solution, in water, of Pirrier's methyl green. Gum dextrin may be added to the solution if required.

(61) S. B. M. asks: How is the nickel solution for plating prepared? A. Dissolve sulphate of nickel and ammonia in water— $\frac{3}{4}$ lb. to the gallon. 2. What kind of nickel is used? A. Metallic nickel in cast plates is used for anodes.

(62) J. N. D. asks: How much fine gold does the American twenty-dollar piece contain? A. It contains 516 grains 900 fine; that is, 464.4 grains pure gold.

(63) R. M. asks: How can India rubber be dissolved so as to be capable of being moulded? A. The best solvent for caoutchouc is bisulphide of carbon, to which about 6 per cent of absolute alcohol has been added. Caoutchouc is usually moulded by softening by steam heat and pressing the dough-like substance into the moulds. Solution of alum may be used on plaster of Paris moulds to prevent the rubber from adhering.

(64) J. B. asks: What are the tests for linseed oil? A. The following tests may be applied: 1. The specific gravity should be 0.9347. 2. A few drops of the oil under examination should be poured into a small porcelain capsule and exposed to the heat of a spirit lamp. The odor which is evolved is characteristic. 3. By mixing a small quantity of concentrated sulphuric acid with some of the oil (in proportion of 1 or 2 parts of the former to 100 parts of oil), very intense action immediately ensues. The temperature increases, and the mixture becomes colored a dark brownish-red, which is gradually converted into a brownish-black. 4. Add 1 drop saturated solution of bichromate of potash to 20 drops of oil: small brown lumps are formed on a ground colored green by the chrome.

(65) S. J. F. asks: How can I make what is called a "lead tree"? A. Suspend several small scraps of clean zinc by a cord in a strong aqueous solution of acetate of lead. The vessel should be sealed, to prevent loss of water by evaporation and contamination by dust.

(66) J. N. W. asks: How can I separate the hydrogen from the oxygen in water, and preserve both separately? A. The decomposition of water may be effected by voltaic electricity. When water is acidulated so as to render it a conductor, and a portion interposed between a pair of platinum plates connected with the extremities of a voltaic apparatus of moderate power, decomposition of the liquid takes place; oxygen in a state of purity is evolved from the water in contact with the plate belonging to the copper end of the battery, and hydrogen is disengaged at the plate connected with the zinc extremity. By inverting small graduated jars (previously filled with water, which the gases supplant) over the platinum plates, the gases can be collected and measured.

(67) J. A. H., Jr., J. H. S., E. C. W., and others ask for a recipe for ebonyizing wood. A. Brazil wood, powdered nutgalls, and alum are boiled in water until a blackish color is obtained; the liquid is filtered and applied to the wood, which is then washed in a liquor made by digesting strong vinegar and a little oil of vitriol for some time with excess of iron turnings; thoroughly wash the wood, dry and oil.

For staining fine woods the following is applicable: 4 ozs. of gallnuts, 1 oz. powdered logwood, $\frac{1}{2}$ oz. green vitriol, and $\frac{1}{2}$ oz. verdigris are boiled with water, and the solution, filtered hot, is applied to the wood, which

is then coated with a solution of 1 oz. fine iron filings dissolved by digestion in a small quantity of hot wine vinegar. See also pp. 191 and 219, current volume.

(68) C. M. asks whether the use of corrosive sublimate for destroying moths is dangerous. A. Camphor is safer.

(69) L. E. L. asks how to make chloride of cobalt. A. Dissolve oxide of cobalt in hot hydrochloric acid, on the water bath; filter, evaporate to dryness. The residue (chloride of cobalt) is soluble in water.

(70) J. E. L. asks: On connecting a battery with a pair of Bell telephones they work louder. Would it be detrimental in any way to the telephones to work them with the battery? A. Not if you connect the battery so that its current, in passing through the spool of wire in the telephone, will tend to increase the magnetism of its core, as may be shown by a compass placed near the spool end of the telephone. See answer 15, p. 155, of SCIENTIFIC AMERICAN of March 9, 1878.

(71) F. D. S. writes: I wish to make a cellar bottom impervious to dampness. Would coatings of pitch with 3-ply felting paper accomplish this object? A. If the cellar is properly drained this, if well laid with sand and floored with wood, will answer. A good cement would, however, be preferable.

(72) E. T. and J. W. Y. ask for a recipe for varnish suitable for walnut, etc. A. The following is recommended: Japan, 2 quarts; coach varnish, 1 quart; turpentine spirits, 1 quart; beeswax, 4 ozs. Shave the wax up thin, put it in the turpentine in a tin vessel, and place the latter in hot water until its contents are fused; then add it to the other ingredients and shake well. The varnish should be of the best quality. The mixture dries without tack and has a beautiful soft appearance; it is suitable for either inside or outside work.

(73) F. H. asks: 1. What amount of steam pressure per square inch would be required to secure a pressure of 40 lbs. to the square inch of compressed air? A. It will depend on the arrangement of the compressing apparatus. With direct compression, a steam pressure of from 45 to 50 lbs. will generally be required. 2. How many degrees of heat does air compressed receive for every 10 lbs. of pressure? Air compressed to 70 lbs. per square inch is expanded in a cylinder: what amount of pressure per square inch would it exert upon a press? A. See question 26, in SCIENTIFIC AMERICAN for October 7, 1876. 3. Does air compressed offer a greater resistance to power applied in proportion to the pressure per square inch obtained? A. As we understand your meaning, no.

(74) C. H. H. asks: 1. Would there be any more harm in leaving the fire in a steam thrashing machine, when moving, with 75 lbs. of steam, than there would be in pulling out the fire and reducing the pressure to 40 lbs. or less by pumping in cold water? Would the fires be more apt to leak by leaving the fire in and carrying the higher pressure? A. No. 2. If there is a piston head expanded by steam, ought they to leak when the back head of the cylinder is off, the driver blocked, and steam is turned on, and ought the pressure to make any difference whether it is 60 or 120 lbs.? A. They should be tight under the circumstances. 3. Which is the more economical, an automatic cut-off or a governor on an engine with a common slide valve? A. The former, generally, as the two styles are constructed. 4. How do you compute the power of an engine by the friction brake? A. Multiply the weight on the brake in lbs. by the distance it would move in feet per minute, if free to revolve, and divide the product by 33,000.

Are the days and nights on the equator of the same length the year round, and would any perpendicular object be without a shadow at 12 noon? A. No.

(75) C. W. R. asks: How is the case hardening done, which produces a variety of colors, such as you will see on fine guns? A. Surround the articles with animal or vegetable charcoal, and inclose them in a tight case. Expose to a dull red heat for from 2 to 8 hours, according to the depth of hardening required. A quicker process is to heat the iron, sprinkle prussiate of potash upon it, expose to a dull red heat for a few minutes, and then temper in water. See (57).

(76) H. M. R. asks: 1. How shall I manage to make a few castings for a small horizontal engine? A. You will find it very troublesome to make such castings yourself, and had better send the patterns to the foundry. For full particulars how to mould a pattern see SCIENTIFIC AMERICAN, Nos. 2 and 15, vol. 35. 2. What is the process by which a metal is hardened after being cast? A. By heating it to a red heat and cooling it quickly; but cast iron is apt to crack if plunged in water, and is therefore hardened by being chilled in an iron mould. 3. How are the metals brought to such a fine polish, such as I have seen on the principal parts of small models and fine machinery? A. By fine filing and burnishing.

What battery is required for running a small electric engine (horizontal) about double the size of engraving on p. 301, SUPPLEMENT, No. 19? A. Two Bunsen cells would probably run such an engine.

(77) S. D. C. writes: What is the best press for hand power to strike medals in bronze, say 2 to 2½ inches in diameter, also amount of power required for same? A. For hand power we know of nothing better for the purpose than the drop hammer. To force them into shape by a pressure exerted slowly, would require the use of a hydraulic press (such as is used at the mint) and capable of exerting a pressure of about 100 tons.

(78) H. S. asks: How can cracks in marble be obliterated? A. Use a mixture of powdered marble of suitable color and a little pulverized flint glass with a thin paste, made by dissolving 4 parts pale shellac and one part borax in hot water and concentrating by heat. The ground tint of the marble must be imitated by addition of suitable pigments if necessary. Emery and rouge are used to polish when sufficiently hardened.

What is a good walnut stain? A. See SCIENTIFIC AMERICAN, July 7, 1877, p. 11 (8).

How can a fine polish be put on walnut? A. Rub the work over with boiled linseed oil, and when nearly dry, rub it over with a stiff brush. Take a strip of wooden

cloth about two yards long, roll it up into a hard roll. Dip one end into the boiled oil, and add a few drops of shellac varnish, and rub the work previously oiled with that until a fine polish is obtained.

How can I mend a rubber hose having small holes in it? A. With rubber cement, which you can obtain from dealers in rubber goods. Caoutchouc, dissolved in chloroform, will fill very small holes.

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

J. McE.—It is a rich ore of lead—galena.—S. C. C.—A poor iron ore—argillaceous limonite—W. A. M.—The incrustation consists for the most part of lime sulphate and carbonate, together with a little silica, alumina, iron, and organic matter. The remedies suggested will, in time, soften but not remove it.—C. F. B.—Quartz, of no especial value.—J. H. P.—No. 1, Quartzite with specular and titaniferous iron. The green piece contains copper oxide, silicate, sulphide, and carbonate, together with much iron. No. 2, A limestone. No. 3 resembles No. 1. Nos. 4, 12, and 13, conglomerate. No. 5, Hematite with crocidolite. No. 6, Quartz containing siderite. No. 7, Lithographic stone. No. 8, Limestone with pyrites and a trace of copper sulphide. No. 9, Red jasper. No. 10 contains specular iron. No. 11, Limestone. No. 14, Barite—impure barium sulphate. It occurs commonly in beds or veins of metallic ore.

COMMUNICATIONS RECEIVED.

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

Progress of the Plow. By F. W. J.
Preventing Explosions in Mines. By F. P. and A. D.
Safeguard against Counterfeiting. By E. A. H.
Locomotive Strokes. By W. St. L.
Our Earth Motionless. By S.
The Locomotive Engine. By F. I.
The Polariscopes as a Photometer. By P. H. V.

OFFICIAL.

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FOR WHICH

Letters Patent of the United States were
Granted in the Week Ending
March 12, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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