

A. Barrel 26 to 32 inches for the rifle. The recent international match demonstrated the superiority of the metallic shell (for breech loaders) provided the loading is done by the individual. Factory cartridges are not reliable. For general use for a 12 gauge gun, 28 or 30 inches is the best length; but for a 10 or 8 bore duck gun, 32 inches is a good length for the barrel.

(38) C. A. T. asks how to stereotype ordinary sized letter heads; has tried plaster of Paris and paper, but the metal will not go down in the impression. A. Paper makes an excellent matrix if rightly applied. Oil the form and place on it first a sheet of tissue paper, then a sheet of soft printing paper, which must be pressed evenly on the tissue. Cover with a damprag and beat the paper evenly in upon the type with a stiff brush. Then paste on a piece of blotting paper and repeat the beating, after which three more pieces of soft tenacious paper must be pasted on and used in a similar way. Finally back up with cartridge paper and dry under moderate heat.

(39) A. G. asks: What is mixed with the white of eggs for size in gilding edges of books? A. The edges of the leaves are gilded while in the hydraulic press. The composition applied is 4 parts Armenian bole and 1 of candied sugar ground together with water and laid on with the white of egg with a brush.

(40) C. H. D. asks how to lay out steam ports in trunnions of oscillating cylinders of two inch bore? A. The ports should be proportioned in a similar manner to those for other engines, that is, they should have such an area that the velocity of the steam shall not exceed 100 feet per second.

(41) T. R. & Co. ask (1) how fast a lathe should run to grind skates? A. It depends on the kind of emery wheel used, the speed varying between 3,000 and 5,000 circumferential feet per minute. 2. What is the size and grade of emery wheel best adapted to the purpose? A. The size of emery wheel depends upon the amount of concave you want; we should say about 4 inches for edge and about 15 inches for sides of blade. Grade number, 50 for roughing and 120 for finishing.

(42) W. B. writes: Will you tell me of a simple plan to construct a galvanic battery? A. Into an ordinary glass tumbler drop a few crystals of sulphate of copper until the bottom is just covered, and on this lay a disk of thin sheet copper, having metallic contact with an insulated copper wire, running up and over the edge of the tumbler and forming the positive terminal, or pole, of the battery. Sprinkle a few more crystals of the sulphate of copper on the disk, until its surface is covered; and about one inch above this, suspend a disk of ordinary stove zinc, similar in size and shape to the copper disk below it; and suspended by a strip of zinc running up and over the edge of the tumbler: this strip forms the negative pole of the battery; the zinc disk with its strip can be cut at once from a sheet, so as to save joining the strip to the disk. Now pour in clean cold water until the zinc disk is covered; it is in fact a miniature gravity battery, and will give quite a good and steady current in about one or two hours.

(43) C. H. B. writes (1) for a list of the different conductors and non-conductors. A. We have not room to mention all, but as conductors, silver, copper, gold, all the metals, then the acid and salt solutions. As non-conductors or insulators, hard glass, silk, hard rubber, shellac, etc.; for a more complete list, see "Parker's Philosophy." 2. A so, is there any non-conductor that would do for the cylinder and other parts of a little electrical engine that I am making that have to be non-conductors? A. Hard rubber is the material most generally used as an insulator, in any form of electric engine.

(44) L. I. F. asks: How can I make a small battery suitable for plating, out of a stone jar and earthen pot? A. Place within the jar a porous cup of earthenware containing a strip or roll of zinc; fill up the space between the cups with a strong solution of copper sulphate (blue vitriol) in water, and immerse in this a sheet of copper bent around the cup. Fill up the inner cup with water containing about 10 per cent of zinc sulphate in solution. The current will pass from the copper to the zinc through a wire and other conductors joining them.

(45) L. R. asks: What length should the wire in the coil of a Bell's telephone be? A. That will depend on the gauge of the wire? See previous answer in this column.

(46) W. writes: I wish to build an electro-medical machine of such power that, when a man of ordinary strength takes hold of the handle and the full force of the battery is turned on, it will knock him down. I wish to know: 1. What number of wire shall I use (22, 32, 44, etc.) and how many lbs. of that number shall I use? Will the machine exert more power if I wind my wire into a long thin coil, or vice versa? A. 15 lbs. of No. 44 silk-covered; wind in three short coils, whose aggregate length shall be 8 inches. 2. How much battery power shall I have to use, and what kind of battery is best for my purpose? A. Three cups of Grove.

(47) I. R. B. asks: Is eating thirty quail in thirty days, one bird each day, a difficult task to accomplish, and why? A. The eater becomes greatly nauseated, the flesh probably having some medicinal action. It has been accomplished, and accounts can be found in our back numbers.

(48) J. M. asks for a recipe for syrup for popcorn balls, that will stay sticky when cool? A. Use molasses, or boil the syrup but slightly.

(49) W. T. asks in regard to the telephone: 1. How much copper wire is needed for a pair? A. About 4 ozs. 2. Is it necessary the copper wire should come in direct contact with permanent magnet? A. No, it must not. 3. Is it necessary permanent magnet should move endways to be adjusted, as in a relay? A. No. 4. What are the collars made of that hold the copper wire in position? A. Either wood or hard rubber. 5. Is copper wire wound on haphazard or in layers? A. The same as a spool of cotton is wound. 6. How can I make the iron rod become a permanent magnet? A. You cannot; it is a rod of hardened steel, and

can be magnetized by drawing it in one direction over one pole of a permanent horseshoe magnet; or by placing it in a helix and then connecting the helix with a battery and breaking the connection before removing the steel from the helix.

(50) W. S. H. asks how the bluish white color is given to gun locks and mounting? They have a grayish white frosted appearance. A. The colors appear from the casehardening process, which consists of heating the articles sealed in a box containing bone dust and charcoal to a red heat, maintained for two or three hours, and then dipping them in water.

(51) R. W. S. asks: 1. What kind of a stove or heater, and how should I arrange the pipe and heater, to warm a poultry house 100 feet long, 10 feet high, and 10 feet wide? A. Use a hot water apparatus, such as are provided for greenhouses. There are some that are very simple, consisting of a stove and large cast iron circulating pipe, that give a continuous but low degree of temperature. 2. Also, what can be used instead of blacking? A. An application of asphalt might answer the purpose. Pipe of galvanized iron does not rust so easily as the common pipe.

(52) L. E. asks how blue vitriol can be dissolved for electrical purposes? A. In either hot or cold water.

1. It is said that if kerosene oil be allowed to run through a hot tube it will turn into gas. Is it true? A. Yes. 2. If so, what is the name of it? A. It is one form of carburetted hydrogen. 3. Will it burn? A. Yes, in the presence of air or oxygen. 4. Is it explosive? A. Yes, when it is mixed with certain proportions of either air or oxygen.

(53) A. S. says that his plow castings were recently rusted by the flood in Richmond, Va., and asks how to clean them? A. Retumble them in broken glass.

(54) P. S. asks: 1. Is the hissing sound made by steam escaping from a boiler through say a 4 inch valve that is one turn open, a certainty that the steam is perfectly dry? Will not any steam, wet or dry, escaping through a small opening into so large a pipe and being constantly consumed before it has time to fill the said pipe, will it not make the same hissing sound? A. Either wet or dry steam, escaping through a small orifice, will produce sound; but the sound produced by dry steam will be of a higher tone than when it is produced by wet steam. 2. Are the Harrison boilers, which are made of cast iron and are put together in globe-shaped sections, a first class boiler as regards economy, safety from explosion, and for making the best, that is the driest, steam for running machinery? A. They are a very good boiler, as far as safety is concerned, but we believe they will not furnish as dry steam as the ordinary tubular boiler.

(55) W. A. B. asks how to make a wire of a gradual taper? A. You might try passing the wire under tension through a bath of heated lead or through some gas or other flame, reducing the speed gradually to increase the taper.

(56) W. S. asks how to harden a piece of steel 9 inches long by 3/4 inch square, so that it will not warp in hardening? A. Heat it in red hot lead, dip it endwise and vertically, and hold it quite still in the water.

(57) C. M. F. H. asks: What would prevent a steel plate from corroding, and cause it to retain its high polish? A. A thin coat of Canada balsam varnish, or possibly warming the plate and applying a little paraffin, rubbing the wax well in, would answer.

Is it possible to make asbestos, mixed or saturated with silicate of soda, pliable, when pressed or rolled out, it being thoroughly dry? A. This can best be determined by experimenting.

(58) W. J. G. asks for the composition of the white lead mixture applied to bright metal work to keep it from rusting? A. Mix white lead, tallow, and linseed oil to a thick paint.

(59) Mack asks for the degrees of expansion and contraction by heat of the different metals? A. The length of a bar at 32° Fah. being 1, its length at 212° would be as follows: Bismuth, 1.00139; brass, 1.00190; cast iron, 1.00111; wrought iron, 1.00125; steel, 1.00118; platinum, 1.00095; silver, 1.00201; tin, 1.002; zinc, 1.00294; copper, 1.00174; gold, 1.00149; lead, 1.00284.

(60) Dr. T. D. offers the following suggestion for opinion: To so attach the water spouts to side walls as to insure always complete isolation by glass rings or other device of non-conductor, as in the manner of lightning rods proper. As now arranged our water spouts attract toward the interior of the houses the electricity, whereas they might act as protectors (by extending upper and lower ends) always quite as well and at less outlay than by the rods. A. The interposition of glass or other non-conductor, to insulate lightning conductors, is not only useless, but undesirable—the discharge from a large induction coil easily pierces blocks of glass several inches in thickness, and the tension of atmospheric electricity during a thunderstorm is vastly greater than that from the coil. Metal leaders seldom have adequate connection with the earth, and are therefore not only incapable of properly diverting the charge, but are in many cases sources of danger in the absence of a good rod. If the leader is used as a lightning conductor, it must terminate in moist earth, with an exposure of surface not less than 100 square feet, and must be joined, by means of stout copper wire, with the gas and water pipes, and other metal work of the building. This arrangement may afford protection, but it would be safer to provide the rod also.

(61) O. F. asks for rules for making a cone pulley (or pair of pulleys) so that a belt will be equally tight on the different sides of the cone? A. First assume the radii of one driving pulley and the corresponding driven pulley, measure the distance between their centers, and find the length of belt required. Then assume values for the radii of the successive pulleys on the driving cone, and calculate the values of the

corresponding radii on the driven cone by the following rules: I. Having assumed the value of one radius, it is first necessary to ascertain whether the one to be calculated is greater or smaller: (1) Multiply the assumed radius by 3.1416 and increase the product by the distance between the centers of the pulleys. (2) If the quantity obtained by (1) is greater than half the length of the belt, the assumed radius is greater than the one to be determined. (3) If the quantity obtained by (1) is less than half the length of the belt, the assumed radius is less than the one determined. II. When the assumed radius is greater of the two, to find the other one. The distance between the centers, and the length of the belt are supposed to be given. (1). Multiply the assumed radius by 6.2832; subtract this product from the length of the belt, and divide the remainder by the distance between centers. (2). Add the quantity obtained by (1) to the number 0.4674 and extract the square root of the sum. (3). Subtract the quantity obtained by (2) from the number 1.5708, and multiply the difference by the distance between centers. (4). Subtract the quantity obtained by (3) from the assumed radius and the remainder will be the required radius. III. When the assumed radius is the smaller of the two, to find the other one. (1). Same as (1) of preceding rule. (2). Same as (2) of preceding rule. (3). Subtract the number 1.5708 from the quantity obtained by (2) and multiply the difference by the distance between centers. (4). Add the quantity obtained by (3) to the assumed radius; the sum will be the required radius. These rules apply to an open belt passing over any two stepped cones.

(62) S. S. B. asks: What is the so-called "madstone," supposed to be a cure for hydrophobia, and what are its virtues? A. The madstone of the Southern States is an aluminous mineral, and its charm lies in its power of absorption. The Ceylon madstone or "pombokalo" is a black highly polished substance which, when applied to an open wound, rapidly imbibes the blood, and with it the poison. Faraday analyzed it and found it to be a bit of charred bone. The Mexican madstone is charred deer horn. The efficacy of the remedy resides simply in the stone being porous and withdrawing the blood. Sucking the wound would accomplish the same result.

(63) C. H. M. says: In your "Notes and Queries" you frequently refer to back numbers or to the SUPPLEMENT. Can you furnish these, and at what price? A. In most cases we can. By referring to our advertising columns you will see that an unusual opportunity now exists for purchasing a large number of bound back volumes of the SCIENTIFIC AMERICAN at about the cost of the binding. We can supply all the back numbers of the SUPPLEMENT, bound or unbound.

What is the chemical called "colgate"? A. We know of no such substance. Send us a specimen for examination.

(64) A. W. asks if there is any way of making autograph letters other than by lithography? A. The electric pen furnishes a simple means of obtaining any number of copies. The letter is written with the pen which forms the characters by minute perforations, so that the sheet serves as a stencil plate over which an inked roller is passed, the ink marking through the holes upon a sheet of paper placed beneath.

(65) A. G. C. asks how to cut stencil plates otherwise than by chisels. I have coated my brass with wax, scratched through to the metal, covered the letters with sulphuric, nitric, and muriatic acid, but neither of the acids named will cut through the plate. A. There must be something wrong with your acid. Generally nitric acid diluted with 3/4 water is used. The best plan is to etch the plate as much as possible with the acid, and then clear the cutting with the graver. To obtain clean cuts the back of the plate should be smeared with oil.

(66) H. L. C. writes: 1. I am making a new electric engine in which I have three pairs of electro-magnets wound with 1/4 lb. of No. 16 cotton insulated copper wire to each pair; it will be necessary to have all three pairs in the same circuit at one time. Now if they are all set in a brass plate that makes connection with the cores of all the magnets—but not with the wire direct—will such connection carry the current across from one to the other of the outside magnets, so as to affect the strength of the middle magnet? A. No. 2. Would iron be better than brass? Wood is not strong enough. A. Brass is the best metal to use in this case.

(67) W. T. K. asks if there is a locality on the globe where the sun jumps a day; where at high twelve Sunday, noon ceases, and instantly Monday meridian begins, or where Sunday comes into a man's house on the eastern side, and becomes Monday by the time it passes his western door? A. The sun does not jump a day anywhere. Navigators in sailing around the world, provided they use the time of any given locality, gain or lose a day in their reckoning, and by common custom it is usual when not already done to adjust time pieces for this error on passing the meridian of Manilla. But as a rule clocks are adjusted aboard ship daily, the local time being determined by observation.

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

T. A. A.—It is lignite in a gangue of ferric sulphide—marcasite—and sandstone. The mineral is of no practical value, but if obtainable in larger samples might be of some interest to the mineralogist.—B. B.—They are fine specimens of what are known as claystones—concretions formed by the tendency of matter to collect about a center. They are usually flattened, and at the center there is most commonly some foreign object, a fossil, shell, twig, or the like, which was the nucleus of the crystallization.—E. A. J.—It is a banded agate. It is composed of silicic acid. The colors are caused by traces of organic matter, oxides of iron and manganese, and by the difference of density of the siliceous rings. As regards your other question, there must exist some outlet for surplus water, if the measurements were properly made.—A. W.—It is not brown coal, but a slaty shale.—The color is due to oxide of iron.—W. P. McC.—The siliceous clay does not contain coloring matter other than a little oxide and silicate of iron—

it is not valuable.—We have received an unlabeled sample of ore rich in zinc and lead—probably from Connecticut.—Will M. S. send other samples of his ore?

COMMUNICATIONS RECEIVED.

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

On the Theory of Universal Gravitation. By J. McC. On Algebraic Equations. By J. T.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

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

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

WANTS AND BUSINESS INQUIRIES.

Almost any desired information, and that of a business nature especially, can be expeditiously obtained by advertising in the column of "Business and Personal," which is set apart for that purpose subject to the charge mentioned at its head.

We have received this week the following inquiries, particulars, etc., regarding which can probably be elicited from the writers by the insertion of a small advertisement in the column specified, by parties able to supply the wants:

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