## Business and Personal.

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C. H. B. is informed that liquid glass is silicate of soda, the preparation of which is described on p. 225, vol. 23.—J. L. H. will find directions for polishing black walnut on p. 315, vol. 30.—J. A. F. will find directions for cleansing cotton waste in No. 7, p. 202, vol. 31.—E. F. C. will find full particulars of induction coils on pp. 215, 218, 363, 378, 379, vol. 30.—D. C. R. will find instructions for destroying trunks of trees in answer No. 72, of this issue.—S. W. C. does not send sufficient data as to the cut-off of his engine.—J. C. D. can make a phosphorescent lamp by following the instructions on p. 203, vol. 31.—B. F. G. should consult an engineer who can inspect the engine which he desires to alter.—J. M. will find a recipe for dissolving rubber on p. 363, vol. 30.—E. B. S. will find directions for making malleable castings on p. 138, vol. 29.—W. T. H. will find directions for repairing rubber garments on p. 203, vol. 30, and for gilding picture frames on p. 90, vol. 30. Bookbinders use glue, sometimes tempered with a little molasses.—H. R. R.'s query as to the proportions of all the parts of a steam engine is to comprehensive to be answered in these columns. Working drawings of engines and boilers can be purchased.—A. will find information as to the use of the square in any work on stair building.—J. D. H. can polish his wooden handles by following the method described on p. 315, vol. 30.—A. P. W.'s difficulty can only be settled by experiment. The device he speaks of is patented.—W. A. should apply to the publishers who advertise in our columns, for catalogues.—C. W. will find directions for marbling in Spon's "Workshop Receipts." M. J. H. will find that bronzing is described in the same work.—An anonymous correspondent can produce a black finish on brass by following the methods described on p. 266, vol. 30.—W. M. B. will find directions for making pickles on p. 181, vol. 27.—P. C. H. can prevent paint from blistering by following the directions on p. 123, vol. 31.

(1) W. T. W. says: The water for use in my engine has failed to supply the boiler. There is a branch 800 yards off, which is 50 feet below the boiler. How can I get the water to the boiler more economically than by hauling it? A. You must use a pump, which might, perhaps, be worked by a windmill. You can obtain the tools you speak of at a ship chandler's store.

(2) J. H. E. says: I want to run a wire along the rails of a railroad, and make a connection between this wire and each rail. I propose to drill a hole in the flange of each rail and make the connection between wire and rail by fastening the wire to a brass plug and driving this plug through the hole drilled in the rail. Would the rail, where it is in contact with the plug, always keep bright, so as to make a good electric connection? If not, do you know of any metal that would answer better for this plug? A. You can easily make an airtight joint between the plug and the rail by brazing this connection.

(3) S. E. J. asks: Is it a common practice for machinists to put bits of tin, small pieces of iron, etc., under their turning tools when the tool post is not adjustable, or only partially so? A. It is a common practice, generally approved by good workmen.

Is it common for foremen and other superintendents of machine shops to determine first what kind of a tool a man shall use on a lathe or planer, provided it performs the work it was intended to do in a good and proper manner? A. It is not usual for a superintendent to give such orders when the men use tools that do good work. The right of the matter seems to be as follows: If the men are engaged on piecework, they can use such tools as they think proper, provided that their jobs are properly finished. If, on the other hand, the men are paid by the time they make, the superintendent can direct the manner in which work is to be performed, and the tools to be used. The propriety of exercising this arbitrary right over skilled workmen is, however, very doubtful.

(4) F. H. W. says: Suppose a red rubber balloon, such as we see children playing with, to be of equal texture and elasticity throughout; and the balloon to be inflated with the gas commonly used for balloon inflation, and the balloon set free. Would the balloon rise to a position where it would remain suspended, on account of the approximate densities of the gas and the extreme atmosphere, or would the gas expand until the internal pressure would cause the balloon to burst? Or would the balloon rise until the low temperature would cause moisture to condense upon the balloon and the balloon to fall, until it reached a point where it would begin to re-ascend? Please inform me, which, if any, of these results, would follow, and which, if any, of them is usual with the ordinary balloons, which are of unequal texture. A. If the gas in the balloon does not become heated, the tendency to burst by expansion will not be great. The balloon will rise until the external air becomes too light to carry it up further. If the gas is cooled, the balloon will sink again. Meanwhile, some of the gas will constantly be escaping, so that after a time the balloon will fall to the ground.

(5) H. W. S. says: As to the speed of the teeth of a large and a small saw, both being firmly fastened to the same shaft, I claim that the teeth of the large one go very much faster than those on the small saw, because they move in a larger circle and both saws must make a revolution in the same time. I believe this is a fair statement of the case, and I have but one comment to make: To deny this principle is to deny the principle of multiplying speed by large and small pulleys. D. E. W.'s version is this: If I have a saw arbor that turns 400 times in a minute, and I put on a saw that is 24 inches on one end of it, and a saw that is 12 inches on the other end, will the teeth in the 24 inch saw go any quicker than the teeth in the 12 inch saw? A. H. W. S. is right. A matter of this kind is easily settled by experiment. Secure a pencil to a tooth of each saw. Hold two boards so that one will bear against the pencil, and revolve the saw arbor once. Then measure the path described by each tooth, as traced on the boards, multiply each distance by 400, and the result will be the velocities of the teeth of the two saws.

When a wagon wheel rolls on the ground the top goes faster than the bottom, and the reason why is that the ground is the fulcrum, not of the wheel but of the wheel's motion. Is this so? A. Yes.

(6) C. F. says: I am somewhat at a loss to reconcile two statements, which appear on your p. 138, current volume, in answer to B.'s question concerning the asymptote. You say: "The straight line is continually dividing the distance between itself and the curve so that, between two successive equal lengths of the straight line, the distance between the curve and the straight line is only a fraction as great as it was before; but as there will always be some distance to divide, the two lines will never meet." And on p. 133, in an article on "Specific Heat:" "Experience teaches that every known substance is divisible, but it seems reasonable to suppose that, if the division be carried far enough, the ultimate particles will at last be reached, which cannot be subdivided without losing their properties as parts of the given substance." Now, as substance and distance are terms which denote actual and concrete quantities, I fail to comprehend why in the one case we may reach an ultimate division, and in the other we must fail so to do. A. There is no contradiction in the two statements. It is not difficult to conceive of the infinite subdivision of a quantity. The researches of chemists, however, lead them to believe that, in making this division in practice, a particle or molecule will at last be reached which, if again divided, will cause the substance to be resolved into its constituent elements. Thus, if the ultimate particle of water were reached, the drop, when again divided, would be resolved into hydrogen and oxygen, and the last division would give products which did not possess the properties of water.

(7) C. F. T. says: A saw file or three cornered file is sometimes called three square. I say that nothing with only three corners can be square. A. You are right.

What preparation is there that I can put on an opera glass to make it stronger and clearer? A. Good lenses.

How can I prevent ants from getting into cellars, etc.? A. By stopping up all cracks.

(8) F. A. McG. asks: What is the cause of a mill burr getting out of a true face? It was in true face and in true balance when last put down. What is the cause of a burr getting in wind? A. A mill burr will get out of true from various causes, the most common being that the hub is not a close fit to the shaft, or that the key does not bed properly, in which case driving up the key will throw the stone out of true. It will also wear out of true if there are unusually soft places in the stone. If the burr is properly fastened to the shaft and still gets out of wind, the cause probably arises from a defect in the bearings.

(9) J. H. says: In reply to S. F. you say that one of the earliest flying machines had four sheet copper balloons attached to the corners. 1. Was the air pumped out of them, or were they inflated with gas in the usual way? A. We believe that they were filled with hydrogen. 2. Which would produce the greatest degree of rarity, pumping out the air or inflation with gas? A. The former method. 3. Would it be possible to construct a balloon of any considerable size of thin sheet metal (corrugated or otherwise) that would not collapse when the air was exhausted? A. It would be too heavy to ascend.

(10) W. C. asks: Can an ice boat go faster than the wind that drives it? A. Yes. See explanations heretofore published by us.

(11) J. W. P.—There are several feed water heaters in the market that are said to remedy trouble from sedimentary deposits.

(12) T. G. asks: What are the principles involved in an injector on a steam boiler, and how does it overcome the pressure in the boiler? A. The steam enters the injector at a high velocity, and, being condensed on mingling with the water, imparts its momentum to the latter, so that it is forced into the boiler.

(13) W. C. A. asks: If a machine at 50 revolutions per minute requires 50 horse power, what power is required to run it 100 revolutions? A. It is impossible to answer a question expressed in such general terms; and in most cases the answer would have to be determined by experiment.

(14) L. H. P. asks: How can zinc be precipitated from its solution, or what is the simplest way of obtaining zinc flour? I know that evaporation is one way, but that takes too long. A. Metallic zinc has never been thrown down from its solution, because of its highly electro-positive character, for which property it heads the list. Its value as the positive element in galvanic batteries is due to this property.

(15) D. H. P. Jr. asks: What is the weight of cast iron? A. One cubic inch of cast iron weighs at 60° Fah. about 1767 2 grains.

How are magnets made? A. You do not state what kind of magnet is required. A simple way of magnetizing a bar consists in placing the bar on its side and bringing down, on one of its extremities, either of the ends of a bar magnet. If the north end be brought down on the steel bar, it must be drawn slowly along towards the extremity of the bar which it is intended shall possess south magnetic force; this operation must be repeated three or four times in the same direction.

(16) N. J. R. says: I propose making an electric machine, using a cylinder of wood covered with tin foil for a prime conductor, and a ball covered with same for the negative conductor, insulating the same by the use of common bottles. 1. How can I bore holes through the bottoms of bottles so as to use bolts for fastening them to the stand? A. Wet an ordinary drill with petroleum or benzine; turpentine will answer, but not so well; it will then bore common glass nearly as rapidly as steel. The sand blast is now used for this purpose. 2. What can I use to stick the tin foil to the cylinder and ball, which are made of wood? I intend driving plugs into the necks of the bottles by which to fasten on the conductors and journals for glass wheel; what kind of glue can be made to fasten these wooden plugs to the glass bottles so that they will hold? A. Try ordinary glue. 3. Can you tell me how to make a Leyden jar? How is the baked wood, used as a lid, obtained? A. The ordinary form of the Leyden jar consists of a bottle of thin glass, with a wide neck. A coating of tin foil is pasted upon both the inner and outer surfaces, to within 3 or 4 inches of the neck. A wire surmounted by a brass knob, and supported by a smooth plug of dry wood, serves to convey the charge to the inner coating, with which it is in contact. Any ordinary light wood will answer; but it must be perfectly dry.

(17) A. V. K.—The London Underground Railway tunnels are about 26 feet wide and 18 feet high. They run under the streets in all directions. Total length, 13 miles. The cars are operated by the heaviest class of steam locomotives. We have not the back numbers.

(18) J. W. D. E. asks: What is the cause of heat in a compressed atmosphere? Is it not owing to the heat contained in several atmospheres being condensed into the space of one, together with the heat generated by the piston of the air pump? A. It is due to the work of compression. 2. Is the amount of heat present in any given number of compressed atmospheres the same at all seasons? A. The temperature of compression varies with the initial temperature of the air. 3. How many compressed atmospheres would be required to boil water? A. Air at 60° Fah., compressed to 21 lbs. above atmospheric pressure without loss of heat, has a temperature of about 215°.

(19) B. C. & C. ask: What is there that can be put on polished iron that will not change the color, will dry quickly, and not be too expensive, to prevent rust? A. Use a transparent shellac varnish.

(20) A. M. C.—You cannot gain power by the use of a machine: but you may gain force or pressure at the expenditure of distance passed through by the force in a given time. If we understand your sketch rightly, you should have the same pressure at the rack as you apply to the lever, less the friction of the parts.

(21) M. & F. ask: What is the fastest time ever attained by any steamer in the United States? Has 25 miles per hour been made? A. We have seen it stated that the speed mentioned has been attained by steamers on the Hudson River.

(22) H. M. L. asks: I have a boiler, 26 feet long by 40 inches diameter, with two 12 inch flues. I take steam from a drum 18 inches from back end, and it is very wet and the power poor. What should I gain if I take steam from front end? The feed water goes in at back end. A. We could not answer this question without knowing further particulars. Possibly the steam drum is not large enough. We advise you to consult an engineer.

(23) A. B. C. asks: 1. Is not water raised in a siphon by means of atmospheric pressure? A. Yes. 2. Can water be raised in a siphon above 34 feet? A. No.

(24) J. E. P. says: I have a barn 100 feet long and about 40 feet high. In the rear, within 100 feet, rises a hill, the top of which is half the hight of the building. Can I protect the building from lightning by erecting an upright pole (on the top of the hill, higher than the building) and attaching thereto a lightning rod, having the rod terminate well in the ground at the base, in connection with a tun or two of iron buried beneath the surface, and thereby draw the effect rather from than to the building? A. The method you propose would not be likely to give you protection. The safer way will be to place conductors on the building, and connect them with the deposite of iron.

(25) J. McI. asks: What is the proper way of replacing a level glass on an old stock, so that it shall be correct? A. Place the new glass in adjustment as nearly as possible by the eye, put the level on a plane surface, and bring the bubble to the center of the tube, by raising or lowering one end of the surface. Then turn the level end for end, and if the bubble runs away from the center, bring it halfway back by moving the glass and the other half by raising or lowering one end of the surface. Continue this operation, turning the level end for end and adjusting, until the bubble will remain in the center of the tube.

(26) T. & D. ask: Please tell us the necessary thickness for boilers of 30 inches diameter, of steel and of best iron, drilled and double riveted, to stand with safety 600 lbs. hydraulic pressure. A. The thickness of plate should be about ¼ of an inch, to have the boiler just strong enough to withstand the pressure. Using a factor of safety of 4, the thickness should be 1 inch, of 6, 1½ inches, and so on.

Can you give me any account of the trial of steam boilers at Pittsburgh last year? A. See p. 97, vol. 30.

(27) H. W. J. asks: What is a lathe dog? A. A clamp, to make the work turn with the face plate.

What book shows how to use a lathe? A. "The Lathe and its Uses."

What kind of wood is used in making models for small castings? A. Mahogany is the best.

Would a small kitchen boiler, about 3 feet high, answer the purpose of boiler for a small engine with a cylinder 4 inches diameter by 6 inches stroke? A. It would not be large enough.

What are students in the German colleges examined in, for admittance and graduation in chemistry? A. You should write for catalogues.

(28) E. B. Jr. asks: Can the degree of "Master Mechanic" or "Mechanical Engineer" be acquired at any school or university, or is it necessary to have practical experience in the workshop, or both? A. There are several technical schools in the United States that confer the degree of "Mechanical Engineer" upon their graduates.

(29) T. F. says: A friend of mine recently contended that there is a gun in the United States which weighs 100 tuns, manufactured at the Fort Pitt works, Pittsburgh; while I contend that the 81 tun gun now in course of construction at Woolwich will be the largest in the world. We agree to abide by your decision. A. We think that T. F. is right.