(37) G. K. says: 1. A brother engineer and myself are discussing the relative elasticity of steam and compressed air, one maintaining that, when used in an engine expansively, air will not give the same results as steam, as, for want of elasticity, the pressure will fall off much more rapidly after the cut-off than would be the case with steam. The other claims that there is little, if any, difference, in any event too little to be taken into account in practical working. As we have no means of making anything like a respectable test, please enlighten us upon the subject. A. If the temperature is sensibly constant during the expansion, there will be little difference in the two cases. You will find formulæ for the expansion and compression of air without gain or loss of heat in answer No. 14, August 21, 1871.

(38) P & K. ask: 1. Are bored wells from 6 to 16 inches in diameter not a failure, as a rule, on account of having too little reservoir? Does not the cost of boring wells nearly equal that of the ordinary method of digging? Is drilling a six inch hole in hard rock impracticable for wells, inasmuch as it costs too much? A. We think that some of our readers, who have had experience in these matters, can answer our correspondent more fully than we feel able to do. We hope to hear from them.

(39) J. T. W. asks: 1. What strain or pressure will a boiler 7 inches in diameter and 13 inches long, made of copper No. 18 gage stand? A. Fifty lbs. per square inch. 2. How large a safety valve should I use? A. Half an inch in diameter. 3. Would the boiler be large enough to run an engine with a cylinder of 1¼ inches bore and 3 inches stroke? A. It would run the engine, but would not do much work.

(40) L. W. F. asks: 1. Are vernier calipers fastened together before or after being hardened? A. Before. 2. Are they secured by rivets or tapering pins? A. Rivets.

(41) M. H F. asks: What is meant by cushioning as applied to steam in an engine? A. Cushioning takes place when the exhaust port is closed before the piston reaches the end of the stroke, which leaves some steam in the cylinder, which the piston compresses like a cushion.

(42) W. K. B asks: How can I make paste, such as is used by stereotypers? A. Common flour paste is sometimes used for this; but some stereotypers put white lead in the composition.

(43) G. H. M. asks; How can I attach canvas to the leather side of tanned lamb skins? A. Try a mixture of gutta percha and pitch, applied hot.

(44) J. F. asks: 1. Which is the best nonconductor of heat, wood or plaster of Paris? A. Wood. 2. Will heat crumble plaster of Paris after it has been dried? A. No, unless it is great.

(45) McC. T. & Co ask: Is exhaust steam beneficial or injurious if allowed to escape under grate bars? A. Sufficient steam to keep the grate bars from burning is good. It also increases the draft in the furnace.

(46) A. S. asks: Please give me a recipe to prevent cracking of rubber boots. A. The cracking of the rubber is due to the oxidation of the sulphur which it contains. As a preventive, coat the rubber with a thin covering of varnish made by dissolving pure gum rubber in hot naphtha or bisulphide of carbon.

(47) J. R. Y. Jr. asks: Can you give me a recipe for a waterproof mucilage, suitable for pasting labels on wood, something that will stand the weather? In your issue for October 16 I found a recipe for this purpose; but after several trials I have been compelled to abandon it, being unable to combine the glue and alcohol. I tried to combine the two by first dissolving the glue in water, and adding alcohol afterwards; but the glue thickened up and would not combine with the alcohol. A. Melt together equal parts of common pitch and gutta percha. It may be kept liquid under water, and it has been highly recommended both for its superior adhesiveness and waterproof quality after once being applied.

(48) G. W. L. asks: What cement will make the insides of paper barrels tasteless and odorless, and be sufficiently elastic and proof against vinegar, wine, and other liquids? A. Try coating the interior with hot paraffin.

(49) O. S. asks: I stamp embroidery patterns in this way: I lay a sheet of paper under the pattern which I wish to copy, and then trace the outlines on the paper underneath by pricking through the pattern with a fine needle. I then remove the paper, and place it on the cloth which I wish to stamp. I then take rosin and Prussian blue (or any other coloring substance), finely powdered, which I rub through the holes in the paper by means of a small pad, and the pattern shows well on the cloth. This paper is removed and replaced by a clean piece, after which a hot iron is run over to melt the rosin into the cloth. So far I have not been successful, as the pattern rubs off before I can get it worked. Will you tell what to put in the powder to make it stick? A. As a substitute for the Prussian blue and rosin, use first a little very finely ground aniline red, and then rub over this a cloth or sponge moistened with a little dilute alcohol. Dry, as before, with a hot iron. The paper should be removed immediately after applying the alcohol.

(50) N. F. H. asks: Can you inform me of any acid that will operate on ruby or other colored glass, so as to leave it in a rough state, like ground glass? I want to lay out sign work and leave the letters the same color as the glass. I have seen work of this kind done by acids, and it is much cheaper than if done by the sand blast. A. Hydrofluoric acid is used for this purpose. It is made by acting on powdered fluorspar with strong, hot oil of vitriol; and the gas that comes over is passed into water, which absorbs it. The hydrofluoric acid is often used in the gaseous state. A leaden tray is partially filled with the powdered fluorspar, and over this is poured the hot oil of vitriol. The plate of glass, previously prepared, is then secured over the dish tightly, and the gas, as it is liberated, exerts its peculiar corrosive action on the uncovered portions of the plate to its fullest extent.

(51) W. C. J. asks: Do you know of any street car, in this country or in Europe, in which wind is applied as a motor? A. No.

(52) J. V. R. says: I have a quantity of homemade wine, that has fermented in too warm a place, and has consequently become somewhat acid. How can I correct it without injury to its flavor? A. The free acid may be neutralized by addition to the wine of the proper quantity of bicarbonate of soda.

(53) C. A. W. says: 1. I have some bits of gold which I wish to melt up and cast into different shapes. Can I melt it on a common forge or stove fire in a black lead crucible? A. Place the gold in a small black lead crucible with a little borax, and subject it to a very bright red heat for some time, or until complete fusion ensues. 2. Can I pour it best into a charcoal mold? A. No. Molds made of iron slightly waxed or greased are used for this purpose. 3. Do I need a flux? A. Yes. 4. Will silver admit of the same treatment? A. Small beads of both gold and silver may be fused in charcoal, when mixed with a small quantity of borax and heated strongly by means of a blowpipe or blast lamp.

(54) W. D. says: What is the percentage of salt of the water of the Dead Sea? A. The solid matter is 21·722 parts in 100, nearly all of the solids being salts of sodium, magnesium, lime, etc.

(55) J. B. S. asks: Why was it that, in establishing a uniform gage for railroads, 4 feet 8½ inches was chosen instead of 4 feet 8 or some other even number of inches? A. The first railroads were constructed for coal traffic, and were of the same gage as the colliery tramways, 4 feet 8½ inches; and the latter are so old that no one can now tell why this width was chosen.

(56) E. D. P. asks: 1. What are the melting points of gold and silver? A. Gold melts at 2010° Fah., and silver at 1873°.

(57) R. P. G. asks: By what process is cocoa nut oil obtained? A. It is obtained from the cocoa nut, either by expression or decoction. It is of a fine white color, liquid at 80° Fah., and of the consistence of lard below that point, becoming solid at about 40°. It is used for making toilet soaps, and is sometimes employed medicinally in cases of consumption. It must not be confounded with cacao oil or butter, which is obtained from the cacao or chocolate nut.

(58) C. A. K. asks: 1. Am I right in believing that coal is formed by the decomposition of vegetable matter? A. Yes. 2. What proof have you of this? A. The cleavage of blocks of coal frequently shows the forms of the leaves of the vegetable matter from which the coal was made. Fern leaves, especially, are often seen singularly perfect.

(59) W. J. H. says: We have lately put up a large band saw for re-sawing lumber. After running a few days, the saw cracked along the front edge of the blade. What is the cause? A. Either the saw was brittle, or the wheels were of too small a diameter for the thickness, or too great a strain was put upon the saw. A band saw of No. 16 gage should be run on a wheel 6 feet, No. 17 on a wheel 5 feet, and No. 18 on a wheel 4 feet in diameter. This is a good rule to act upon, but an extra tough saw of No. 16 gage may run successfully on a 4 foot wheel, and No. 17 very well on the same size. Parties using band saws should bear in mind that they must not file or sharpen to acute angles, but leave all angles round.—J. E. E., of Pa.

(60) A. S. T. asks: 1. Please tell me the best way to temper tooth chisels for cutting marble. A. Harden at a bright cherry red in a mixture of 1 gallon whale oil (pure), 2 lbs. rosin, and 1 lb. beeswax. Warm the oil, melt the rosin and wax, and stir together while hot; as the mixture loses its hardening properties, add more rosin and beeswax, then draw to the proper color. The above mixture will harden without fire-cracking. 2. Does filing the tooth hurt the steel? A. No.—J. E. E., of Pa.

(61) J. B. J. says, in answer to D. A. R.'s query as to the weight necessary to break an iron bar: If the iron bar is firmly fixed at one end, and the load applied at the other, then $W=\frac{D^2 B}{l}\times k$, in which D=depth of bar in inches, B=horizontal breadth in inches, $l$=length in feet from support to center of weight, $k$=536 for cast iron, 598 for wrought iron (mean of 4 authorities, varying somewhat with quality of metal and manufacture), W=breaking weight in lbs. In the given case $\frac{4^2\times 1\frac{1}{2}}{\frac{7}{8}}\times 536$ or 598=3,752 cast and 4,186 wrought iron, when the flat side is vertical. If the longer side is placed horizontally, then $\frac{(1\frac{1}{2})^2 4}{\frac{7}{8}}\times 536$ or 598=612¾ for cast or 683·4 lbs. for wrought iron. For safety, one fourth of the above should be used.

(62) J. G says, in answer to F. B.'s query as to dropping a ball in a railroad car: Your friend is correct if the motion of the train is uniform, since the directions of the force or gravity, while the ball is falling, are sensibly parallel. If the train had moved (which is an impossible case) such a distance in a straight line during the fall of the ball that the direction of the earth's attraction could no longer be considered parallel during this time, the ball will not strike the same point of the floor as when the train is at rest, neither will it do so if, during the fall, the train changes its motion either in direction or velocity.

## COMMUNICATIONS RECEIVED.

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

On an Air Locomotive. By F. G. W.
On Diphtheria. By J. W. H.
On Imaginative Arithmetic. By S. S.
On Iron. By J. D.
On Specific Gravity, etc. By J. B. M.
On the Mechanical Equivalent of Zinc. By H. M. P.
On Experiments in Geometry. By A. B.

Also inquiries and answers from the following:

J. L.—C. P.—H. S.—M.—J. C. G.—R. H. B.—R. W.—G. W. B.—M. H. S.—J. S. R.

## HINTS TO CORRESPONDENTS.

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.

Enquiries 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.

Hundreds of inquiries analogous to the following are sent: "What is the value of dry extract of oak bark for tanning? What is the price of soluble glass? Who has a steam process for drying lumber, and will furnish particulars? Who makes a picture frame mitering machine, working two knives? Who sells self-rocking cradles? Who makes the best air pump, and what is its capacity? Who makes cotton spinning and weaving machinery? Who sells steam pumps, suitable for irrigation? Whose is the best ice-making machine? Who sells tools for making stencil plates?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

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