heater for that purpose. 2. What is the chemical reaction that causes the pulp of an apple to become reddish when cut open and exposed to the air? A. All fruit and vegetables, when cut, expose the juice and pulp to the oxidizing effect of the air. In some kinds of fruit (sweet apples for instance) the saccharine matter commences to combine with the oxygen of the air at the instant of cutting. 3. What is "setting one's teeth on edge"? A. This is a nervous condition caused by the contact of bitter or sour substances with the nerve tracks of the tongue and gums.

(2) B. G. W. asks: What substance would be best to nse to fill in the decayed part of a large tree to prevent rain from soaking in? A. Use any hydraulic cement and sand, equal parts, with a coat of tar on the surface.

(3) J. F. B. asks: A good receipt for polishing iron in tumbling barrels. A. Much care is required in assorting iron for tumble polish, to avoid wearing away corners and edges of small pieces by contact with heavy work. For smoothing and clearing of scale, use sharp sand in the tumbler, enough to cover the castings or pieces, and coarse or fine to suit the work. A second tumbler should be used for polishing if the work warrants it. Use in this scraps of leather or skivings, coarse sawdust, chips from a planing machine, etc., with charcoal, pulverized pumice, rouge or plumbago for various styles of polish or for different kinds of goods. It requires a few trials to find the right material for your requirement.

(4) G. G. G.—There is not enough difference in the cost of high or low pressure steam heating, where you require high pressure for power, to be worth the attention necessary for arranging and managing two steam systems in the same house. Calling 12 square [feet heating] surface in your boiler equal to one horse power, you will need 120 square feet radiating surface in ordinary rooms, which will heat 12,000 cubic feet of space, or in this proportion for various sized rooms.

(5) J. M.—There is no material for springs as good or durable as steel. Hard brass is the next best that is reasonably cheap. You can buy the hard rolled brass in sheets or strips through the brass trade. German silver hard-rolled makes a fair spring, but expensive. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 20, "How to Make Spiral Springs."

(6) H. J. K. asks: What power would an eight foot overshot water wheel afford, supplied from a spring that runs one gallon per minute? A. $\frac{1}{555}$ of a horse power.

(7) W. E. C. asks the proper temperature for the withdrawal of engraving tools from an oil tempering bath. The tools are intended for cutting silver, gold, German silver, etc. They come hard and have to be drawn. A. Such tools should be hardened by immersion in water or oil from a cherry red heat. The drawing of the temper in an oil bath is not reliable unless you insert a thermometer that has a scale running up to 500° Fah. You will require a temperature of about 450° for gravers. A far better way is to brighten the end of the graver on a water stone and heat in a spirit lamp until it turns a light brown color. Even this is not always an indication of hardness or toughness, as there is a great difference in the hardening process, due to quality of the steel, its hardening heat, and the kind of cooling bath.

(8) G. J. D. asks the best formula or process for coppering iron. A. Try 3 oz. sulphate copper and 1 oz. sulphuric acid to 1½ gallons clear water. The articles must be made perfectly clean by pickling in muriatic acid 1 part, water 3 parts, scrubbing bright or tumbling in sand. Dip in the copper bath for few seconds only, moving the articles about, and rinse in hot water with a little sal soda and dry quickly in sawdust. The cleaner the articles are made, the brighter the copper coating will be. Too long immersion makes the copper dull.

(9) C. C. J.—Native hematites, limonite, and magnetite iron ores are used in Pennsylvania in the manufacture of iron and steel. Other ores, the magnetites of New Jersey and Northern New York, the specular ore of Wisconsin, and the Spanish hematites are also largely used as mixtures for special grades of iron and steel. We cannot say from your description what the value of your ore would be. An analysis from fair average samples would indicate its use and value, but partially. We advise you to make fair sample lots, and submit to the steel works of Eastern Pennsylvania for trial.

(10) S. R. T. asks the approximate heating value, and the relative bulk, of a ton each of good soft bituminous coal, anthracite coal, and coke, for use in cook stoves, hot air furnaces, and grates. A. Both anthracite and bituminous coal vary in heating value, owing to varying amount of ash, so that a special comparison can only be made with coals of similar amounts of combustible to the pound. The best coals of either kind are nearly alike for given weights. The bituminous coals from different mines vary so much, and the method of firing is so variable, that the results of experimental tests do not agree, as for instance trials on the Baltimore & Ohio Railroad determined the evaporative effect of one ton Cumberland as equal to 1·25 tons anthracite. Other experiments make bituminous coal 13 per cent more effective than coke for equal weights. The average of a long series of experiments on U. S. naval vessels makes anthracite 41 per cent more effective than bituminous. For domestic purposes, as cooking and heating, the cleanliness, durability, and convenience of an anthracite fire set it far ahead of any other coals or coke.

(11) J. T.—The steam engine receives steam at 212° up to 400°, and discharges it from the exhaust or through the condenser at 100° to 180° F. This difference is the loss of heat you speak of. A pound of steam at 100 lb. pressure will expand to about seven times its volume in doing work. Its volume is 691 cubic inches. A pound of water always gives a pound of steam.

(12) T. D. McC. asks: 1. Why is it that a main line telegraph current, strong enough to give a very severe shock when broken, or to make a spark visible in broad daylight, will only just move the lever of a 20 ohm sounder which can be worked satisfactorily on one cell gravity battery? A. The shock is due to extra current developed on breaking a circuit which contains coils of wire. It is much more intense than the original current on the line. 2. What cement is unaffected by solution of blue vitriol? A. The majority of cements, such as sealing wax, are unaffected.

(13) J. L. P. asks: Would the slack from a coal mine be good as a fertilizer? A. It might be of use on a clay soil, but would act mechanically, and afford little or no real nutriment to plants.

(14) A. L. R. asks: Is there any rule for estimating the expansion of coal gas for each additional five or ten degrees of temperature? A. For each degree Fahrenheit rise in temperature, the gas expands $\frac{1}{491}$ part of its volume at 32°; as an approximation allow $\frac{1}{5}$ of one per cent for a degree.

(15) J. C. M. asks: 1. Is there any metal known to science that has more affinity for gold and silver than quicksilver? A. At ordinary temperatures, mercury is the only available metal for gold extraction. 2. Is there any way of increasing its affinity for the precious metals, more than it is when bought out of the stores? If so, what are they, and how are they prepared? A. A little sodium is often added to cause it to amalgamate better with "rusty" gold.

(16) H. D. Q. writes: 1. Am just completing the 8 light dynamo described in your paper and would be obliged to you if you will kindly give me advice on the following questions: 1. Are lamps to be a low or high resistance, and of what resistance? A. The resistance of the lamps is 50 ohms. 2. What size wire should be used to conduct the current from dynamo to lights 500 feet distant and return? A. No. 10 copper wire. 3. The manner in which the machine is wound and connected is called what? Series, parallel, or what? A. Series. 4. How are lamps to be connected? Is the inclosed sketch correct? A. In parallel, not in series, as you have shown them.

(17) J. M. E. asks how to construct a wigwam. A. The height and size should correspond with your want of accommodation. A rustic framework, using small trees and hoop poles for framing would be appropriate for a large or small wigwam. The rough side of the bark should be outside, all over. To make a knockdown wigwam, the framing should be lashed together with ropes or twine, and the bark tied to the rafters with twine. This can be done by boring holes through the bark and lapping the courses to cover the tying.

(18) R. H. S. asks a method of etching on steel that will leave the etching a gold bronze. A. The gilt inscriptions on cutlery are put on after the biting in, and before the etching wax is removed, by battery attachment in a gold solution. A superficial gilt lettering may be produced by printing the background of the design with gums that resist ether, and then dipping the article in an ether solution of gold, or dropping a small quantity of ether solution on the bright part with a camel's hair brush.

(19) E. A. G. asks if there is anything with which leather can be treated or soaked so it will not absorb or allow kerosene to pass through or penetrate it, as he desires to treat leather so as to use it as a valve against leakage from kerosene or gasoline. A. Use any soft leather that is entirely free from grease or oil. Saturate at a heat of about 150° with a mixture of 1 part by weight of good glue to 10 parts glycerine, the glue to be soaked in warm water until it swells and is soft like jelly, when the excess of water is poured off and the glycerine added, bringing the whole to a boil. Then cool it to 150°, and soak the leather thoroughly. Hang up until cold and cut the valves.

(20) C. M. D. asks if there is anything with which he can treat the inside of a new wood cistern, that will penetrate the wood and act as a preservative and at the same time not affect the water. A. Apply melted paraffine with a paint brush to the dry wood; moisture will prevent penetration.

(21) E. A. H. writes: The basement walls of my house have a coating of tar on the inside. What mixture of paint can I use that will dry thoroughly on the tar? Can I mix anything with cement that will cause it to adhere to the tar? A. A solution of shellac in alcohol may be used, and applied like paint over tar that is to be painted. Its high expense prevents the application of this on a large scale. Cement cannot be made to adhere.

(22) J. B. asks (1) whether it be possible to make a complete or partial magnetic screen. A. No. 2. Whether a soft iron sphere around the magnet, or a soft iron plate or hemisphere between the magnet and its armature, will answer? A. You merely replace the armature by the sphere. The armature will be less attracted, and the sphere will be strongly held in place.

(23) D. E. F. M. asks: What would be the chemical reaction, in burning of the solidified petroleum referred to in SCIENTIFIC AMERICAN September 1, page 131, col. 2? In what sort of apparatus could the heated mixture be safely prepared in a small way? A. The reactions would involve ordinary combustion of the hydrogen and carbon of the petroleum, and would be retarded by the solidified condition of the mixture. A glue pot would answer for experimenting with it. It should be heated with great care, best in the open air. If over a flame, a large pan of water should be kept directly under the flame. If over a range, it should be heated in a large pan of water.

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