W. R. A. asks: Would a boiler 5 feet long by 14 inches diameter be large enough to drive an engine inches bore x 4 inches stroke? If not, what size would it require? Would such an engine drive a boat 16 feet long, 3 feet wide and 2 feet deep, and at what rate? Answer: You will find general directions as to boiler proportions in answers to previous correspondents. It is impossible to answer questions of this kind, unless more data are sent.

S. A. T. says: 1. What will make a soft waterproof varnish for muslin, one that will not crack? I have constructed an umbrella with 7½ feet ribs, making a diameter of 15 feet; it is covered with muslin, and I wish to varnish it. 2. Can you give me the recipe for Worcestershire sauce? Answers: For a waterproof varnish, take of india rubber 1½ ozs., bisulphuret of carbon 1 pint; digest in the cold until the solution is complete. Or take linseed oil 1 gallon, dried white copperas and sugar of lead, each 3 ozs., litharge, 8 ozs.; boil with constant agitation until it strings well, then cool slowly and decant the clear portion. If too thick, thin down with quick drying linseed oil. 2. We have never made any chemical examination of this article to determine its composition. Recipes will be found on pp. 249 and 281, vol. 26.

A. J. C. asks: Can water be carried over a hill 50 feet high with a siphon, or can it be raised any higher with a siphon than it can be raised by suction? If a siphon were laid over a hill 50 feet high and filled with a force pump, and the pump removed, would the water run out, or would 33 feet perpendicular hight of water remain in the tube with a vacuum in the tube above, provided the tube was perfectly airtight? Answer: The difference of level between the highest point of the siphon and the level of the water that supplies it must never be more than the hight to which the water will rise, by the pressure of the atmosphere, in a vacuum.

S. M. L. asks: 1. Of what material should I make a pair of rollers for drawing stalks between? The drawing will make considerable friction. Should they be of iron or wood? Would wooden rollers, with a covering of belting or rubber, be preferable to either? 2. The stalks being of unequal size, it is desirable to have the rollers fitted in rubber sockets, so that they will open for large stalks and close on small ones. This would prevent me from having the rollers connected by gear wheels. Would the friction of one roller upon the other be sufficient to draw the stalks through? It is not my object to have the stalks crushed. 3. These rollers being about four feet from the driving power, can I derive the same desirable effects from the rollers by having them driven by a small belt or endless chain as I would by having them driven by gear wheels? 4. Would I derive any benefit by using a fly wheel on the rollers? 5. In preparing a model for the Patent Office, is it necessary that the model be made of the same material that it is designed to construct it of in manufacturing for general use? Or may brass or other soft metals be used instead of iron? Answer: 1. A very common way of effecting this object is by means of cast iron rollers having projecting teeth, which catch the stalks. 2. Rollers which open, driven by gearing, are in use on many clothes wringers. 3. A belt would probably give the best results. 4. We think not, but could not answer certainly without knowing more about the proposed machine. 5. A model for the Patent Office may be made of any convenient material.

N. S. A. asks: Does frost or hoar frost ever form if the mercury stands at any point above 32° Fah.? Answer: Hoar frost is frozen dew, and is never formed at a higher temperature than 32° Fahrenheit. It is true, however, that a thermometer placed in the vicinity might mark a higher temperature, because frost is sometimes formed by rapid evaporation of moisture from the surface of the ground, so that the temperature is lower than that of the surrounding atmosphere. But if some of the frost were collected and placed on the bulb of the thermometer, it would cause the mercury to fall to 32°.

W. W. McC. asks: How are iron, copper, and brass pipes bent for use on locomotive engines, such as for pumps, injectors, sand, heater and blower pipes? Are they bent hot or cold; and if cold, are they filled with anything, such as resin, solder, or lead? Answer: Small copper pipes are generally filled with resin, and bent without being heated. Curves in large copper pipes are formed by hammering the separate pieces before they are brazed together. Small wrought iron pipes can be bent by heating them and applying pressure carefully. They are not generally filled with anything. Large iron pipes of special form are generally made of cast iron, from patterns.

T. W. H. asks for a correct rule for figuring the amount of power from a given number of cubic feet of water, the fall being also given. Answer: Let Q=number of cubic feet of water discharged per minute. h=hight of fall, measured vertically, in feet. P=horse power of the water. $P=(Q\times h\times 62{\cdot}5)\div 33{,}000$, or the horse power of the water is equal to the product of the quantity of water discharged per minute, the hight of the fall, and 62·5, divided by 33,000. Example: What is the power of a water fall, 10 feet high, discharging 50 cubic feet of water per minute? $P=(50\times 10\times 62{\cdot}5)\div 33{,}000=0{\cdot}947$ horse power. All this power cannot be realized by the application of a hydraulic machine, but an amount, varying from 15 to 80 per cent of the whole, will be lost.

C. D. asks: How is iron, such as porcelain kettles, etc., enameled? What are good books on the process? Answer: Iron vessels are enameled by first cleaning with dilute sulphuric acid; the porcelain mixture is then applied in the form of a paste consisting of calcined ground flints, borax and potter's clay; and when this coating has set or become firm, the enamel is sifted over the surface, and then fused in a furnace. For details, consult Tomlinson's "Cyclopædia" and the article on enameling in Brewster's "Edinburgh Cyclopædia."

D. G. H. asks: 1. Is there an easy and thorough method of curing membrane, such as bladder, so that it will be dry, soft, tough, inodorous and durable? 2. I have read in your journal of a new substance, harder than asphaltum, for covering roads. Can you refer me to it? Has any trial been made of it in your city, and with what result? How will it do for cellar floors? 3. What is fuchsin? Answer: 1. There is no easy process. The best method, probably, is that for preparing goldbeater's skin, which is tedious and difficult. 2. "The Coming Pavement" was published on page 16 of our present volume. 3. Fuchsin is a brilliant red color made from coal tar. See page 73 of our volume XXIV.

J. M. asks: 1. Can a wire rope be employed as a belt to run over two pulleys of 16 and 40 inches diameter, respectively, making the 40 inch revolve 50 or 60 times a minute, so as to be trustworthy? 2. How should the pulleys be made? Answers: 1. Yes. 2. Consult a manufacturer.

W. C. A. asks: What gives to Russia leather its peculiar finish and smell, and what kind of skin is used? Does the odor proceed from some article used in the process of tanning or dressing? Why is it not manufactured in other countries as well as in Russia? Answer: Russia leather, known as *jucten*, has long been esteemed for its valuable qualities of resisting moisture and the attacks of insects. Russia was long the only country that produced it, but it has lately been made in Paris. Its odor and peculiar qualities are attributed to the oil of birch bark with which it is impregnated after tanning. In Russia this leather is manufactured from all kinds of skins; but in Paris only sheep and goat skins are used. The method of preparing this article is not very generally known out of the seats of manufacture, but the following details will give an insight into the process: The dried skins are softened by soaking in water for five or six days in summer, ten or twelve in winter, and then well cleansed and deprived of their hair, by steeping in milk of lime. During the steeping the skins are frequently examined; and when the hair and epidermis are detached, they are worked upon the beam with knives. The hair is removed from ox and cow hides by piling them upon one another and thus inducing fermentation. For more delicate skins, bran water baths are sometimes used. The usual steeping and heating, etc., are afterwards given, and then the clean skins are introduced into a vat, holding a fermented menstruum of rye, oatmeal, salt and leaven. These are left here for 48 hours or longer, until raised. The tanning process is then begun by first steeping the skins in an infusion of oak or willow bark, and afterwards they are interstratified in a tan pit with layers of coarse willow bark, and charged with the liquor of the last steep. Fresh bark and solution are substituted for the exhausted material, every fifteen to twenty days, and from three to six such changes are required, according to the thickness of the skins. Very thin skins get but two. After this tanning process, the leather is immersed for a day or two longer in a thin paste of oatmeal, salt and water to remove its rigidity, and then cleaned and allowed to drain. The currying then begins. The moist leather is placed, grain side downwards on a table and treated with a mixture of oil from sea calves and that distilled from birch bark. One part of birch oil and two parts of the other is the standard composition. About 9 ozs. of the mixture are used to each medium sized skin, and it is laid on carefully in a uniform and entire coat. The skins are then stretched upon cords in an open shed and left so till dry.

B. F. W. asks: Is there any way of dissolving gum benzoin so that it will mix with linseed oil? 2. Is there any way to harden the surface of common window glass? If so, how is it done? Answer: Gum benzoin will only dissolve sparingly in linseed oil. Digest the gum in the oil with frequent stirring. 2. There is no method, that we are aware of, of making the surface of window glass any harder than it ordinarily is, yet preserving its transparency.

P. O'B. asks for a formula for preparing adhesive mucilage. Answer: The ordinary mucilage sold at the stationers is far inferior to the old fashioned solution of gum arabic. This mucilage seems to be a solution of dextrin or British gum. Dextrin is formed by the action of dilute boiling acids, or by an infusion of malt at about 160° Fah., on starch. It is also formed when potato starch is exposed to a heat of about 400° Fah. You can make gum dextrin, on the large scale, by observing the following process and proportions: Malt (crushed small) 1 lb., warm water 2 gal., mix, heat the whole to 145° Fah., add potato starch 5 lbs., raise the heat to 160° or 165° Fah., mash for 25 minutes, or until liquid becomes thin and clear. Then instantly run off and raise to boiling point to prevent formation of sugar. After boiling 3 or 4 minutes, filter and evaporate to dryness by steam heat. There are various other processes, but we cannot determine whether you could make a reasonable profit by manufacturing.

J. F. asks: Can a man give power enough to saw cord wood by a cog wheel with 120 cogs on which is a crank, a pinion wheel with 18 cogs, and a balance wheel 60 lbs. in weight, with a wooden wheel 4 feet in diameter for a drive wheel, with a belt attached driving the saw, the pulley on the saw shaft being 7 inches diameter? Answer: Yes; but as there is always a loss from friction, etc., with every connection, he can probably do better with the old fashioned buck saw and horse, if he is sound in the back.

M. L. L. says: When we see a chain of lightning pass from the clouds to the ground, say at a distance of four miles, we feel no jar until we hear the report. What is it that causes the jar and makes the windows rattle? Is it caused by the sound passing through the air, or is it caused by the electricity coming in contact with the earth? Answer: The jar that you speak of is probably due to the disturbance of the air.

E. P. M. asks: What are the inside dimensions of a square box flume, one mile in length, to be placed under ground and capable of carrying from 1,000 to 1,200 or 1,500 inches of water, it being fed from a reservoir giving eight feet head? Will the pressure of water in the reservoir overcome the friction in the pipe so as to give an outlet to the water on a level with the bottom of the reservoir? Answer: You do not furnish enough data to enable us to determine the size of the box. In our article on "Friction of Water in Pipes," on page 48 of our current volume, you will find information as to loss of head. The box should be set so as to preserve the level or fall.

A. L. R. asks: 1. Does not an inside cylinder locomotive draw a passenger train more steadily than an outside cylinder engine of the same size? If so, is not an inside cylinder engine better as a passenger locomotive? 2. What good book would you recommend on locomotives? Answer: 1. We think not. 2. Weissenborn's work, now in course of publication.

A. M. asks: 1. Can I braze or solder brass to brass? If so, what kind must I use? 2. Is there any book published that will give me an idea about breech-loading rifled cannon and small arms? Answer: 1. Use spelter solder and sal ammoniac. 2. The specifications and drawings issued at the Patent Office are divided into classes, and those of any class are sent for ten cents each. Breech loaders are in class 18. We cannot advise you as to a trade in your locality.

E. T. L. asks: Where a book of recipes is compiled from various sources, and few if any of the recipes, processes, etc., are original, does the copyright of such a book protect it from being published in part by others, or prevent others from copying from it? In other words, what does the copyright cover in such a case, the whole book, the arrangement, or only the title? Answer: Matter which has already been published cannot be protected by copyright. The copyright of such a book as you mention would cover the title and the original matter only.

W. A. B. cannot remove the scale from his boiler. Answer: Send us a specimen of the scale.

W. S. P. asks: 1. If an engine of sixteen horse power be applied to pump atmospheric air into another engine of same dimensions, will the engine No. 2 which is worked by air have the same number of horse power as engine No. 1? 2. If so, what temperature will the air be heated to while undergoing such pressure between the two engines? 3. If the air be exhausted in a large pipe or tunnel, 4 feet in diameter and 100 yards long, open at the end furthest from the exhaust, what would be the temperature in any part of the pipe or tunnel? 4. Will compressed atmospheric air work a concentric rotary engine? Answers: 1. No. 2. You will find a table of temperatures due to pressure on page 155 current volume. 3. This question could not be answered without knowing the size of the compressing cylinder. 4. Yes.

P. J. T. says: What are the proper dimensions of a boat to run with an engine 3½ x 4 inches? Please state diameter and pitch of screw wheel. 2. What sized boiler is best suited for the same? Answer: 1. Boat from 25 to 30 feet long. Screw from 1½ to 2 feet in diameter, 3 feet pitch. 2. Boiler with about 100 square feet of heating surface.

H. A. F. asks: How can I cure a dog that is troubled with a humor or vermin, I hardly know which? Answer: Your animal is probably suffering from mange. Administer flowers of sulphur internally, and wash externally with carbolic soap.

T. R. F. asks: Can any of the readers of the SCIENTIFIC AMERICAN inform me where anhydrous sulphuric acid (SO_3) and nitric acid (NO_5) can be seen? Answer: We have no doubt that Professor Chandler of the School of Mines, Columbia College, would give our young correspondent an opportunity to see what he wants in the fine laboratory of that institution.

C. E. asks for a description of the vulcanizing process. Answer: A full description of the vulcanizing process would be too lengthy for this place. It consists in combining sulphur or the mineral sulphurets with india rubber. The discovery of the singular action of sulphur on caoutchouc was made by Charles Goodyear, of New York, in 1842. See specifications of patents of Charles Goodyear, 1842, and of Thomas Hancock, England, 1843.

W. F. H. asks: Is cider boiled in an iron kettle injurious to the health? If sweet cider be brought to the boiling point, then skimmed and strained and barreled up tight, will it keep sweet during the summer? Answer: We would not risk boiling cider in an iron kettle, either as regards health or for the purpose of preserving it. Boiling would cause its change to vinegar more quickly than anything else. We will give you a process which has proved successful, but which the trade may consider trade secrets. To 1 barrel of new cider, add ½ part sugar and 2 handfuls of fish sounds to clarify. Let stand 2 weeks in cool place, then rack off into a well washed cask or barrel, and add from 1 to 2 dozen whites of eggs; let stand another two weeks, and then rack off into another barrel. Add finally 2 gallons of whisky, stirring well, then bottle. This cider will keep sweet through the summer.

J. S. asks: Is a safety valve 3 inches in diameter large enough for two boilers 16 feet long, 44 inches in diameter, with four 12 inch flues in each? How do you obtain the proper diameter for a safety valve for any sized boiler? This is my rule; is it correct? From six tenths to eight tenths of a square inch area of valve for each square foot of grate surface. Answer: We expect soon to publish some remarks on the proper proportions of safety valves, giving most of the rules in common use. You will find some rules in back numbers of our paper. Your allowance agrees well with the practice of many engineers.

H. asks: Can you suggest a cheap and quick method of restoring a badly smoked ceiling other than scraping it? Answer: Wash the ceiling with a brush and abundance of clean water, and then whitewash.

J. W. asks: What are the principal surface indications of a lead or silver vein, and does said vein always keep in one direction? If so, will it not terminate at some point? Answer: The ores of silver belong chiefly to primitive rocks, and occur in veins which traverse granite, gneiss, micaceous and argillaceous slates, greenstone, sienite, hornblende and porphyry. They have also been observed in veins which traverse graywacke, compact limestone, etc., but seldom or never in more recent secondary rocks. Galena, or sulphuret of lead, usually contains more or less silver, and occurs most frequently in secondary rocks, especially in compact limestone. In Silesia, galena occurs in a bed of brown ferruginous marl, in the famous mines of Missouri in red clay, often marly, containing masses of quartz and resting on limestone; in Pennsylvania in limestone; in New York traversing a slaty rock; in Massachusetts at Southampton the bulk of the vein is quartz; in Maine in granite. Veins are often divided into several branches which sometimes terminate in the contiguous rocks and sometimes wind and return into the principal vein.

W. asks: What is the difference in the weights of a ball that weighs 10 pounds in air and the same ball 100 feet under water? Answer: Under water, its weight would be diminished by the weight of an equal volume of water.

C. F. H. asks: How can I guard against the deleterious effects of the dust arising from emery wheels and belts used in grinding and polishing iron and steel? Is there any kind of shield, that can be worn by a workman, that will prevent the fine metallic particles from finding access to the lungs? Answer: Put a hood over the wheel and run a small pipe to an exhaust air blower. The suction will take off all dust. This plan is used in many establishments, one blower serving to take the dust from several wheels.

A. F. G. says: I accidentally found that I can temper gun or other springs under the hammer by using the following recipe: 1 oz. corrosive sublimate and 1 oz. sal ammoniac, a few handfuls salt, dissolved in water, putting fine salt in the smithy fire while at work. Dip your hammer in the solution and keep the anvil wet all the time. Work the steel till nearly cold. This will give the required temper without any other process. Answer: We do not think that your chemicals have much to do with your success in tempering steel, but the welding, hammering and gradual cooling have a great deal.

D. R. K. states that the lamp black in his ink for marking packages floats at the top of the fluid. Answer: There is no method of preventing the lamp black from rising to the top, unless you make the fluid thick enough or of sufficient consistency to hold it, as it will not dissolve. We offer you a recipe for a marking ink, which we hope will prove better and cheaper than the other: Lampblack (previously heated to dull redness in a covered vessel), ¼ oz., triturate with good black ink, gradually added, 1 pint. Observe similar proportions.

S. W. G. asks: I wish to elevate water 115 feet in half a mile, from the spring to a reservoir, from which I have 23 feet fall to the ground; what is the best means for the purpose? Is not the hydraulic ram the best for a stream only large enough to fill a two inch pipe? What per cent of volume could be elevated to that hight, and what size of pipe would be the best? Answer: We would not like to give a decided opinion on such a matter without knowing more about it. A good engineer should be consulted in a case like this.

B. P. asks: Is there any method by which I can utilize the domestic supply of water for motive power? Would a small turbine wheel attached to the water pipe furnish sufficient power to run three printing presses? Answer; A small turbine would do the business. Some years ago we witnessed the operation of the large presses of the *Traveller* newspaper in Boston by means of a turbine, and probably you can get the information you wish at that establishment.

H. asks: Can I warm a room 15x20 by the aid of a gas stove in order to make it sufficiently comfortable for a sitting and sleeping room? Answer: Unless your room is exposed, or has a large glass window surface, you could probably make it comfortable by means of a gas stove. But unless you can provide a small pipe to carry off the products of combustion, we would not advise you to use it.

G. A. W. asks: 1. What are the uses of collodion, and (2) of what is it made? 3. What are the best solvents for the same? Answers: 1. Collodion is extensively used in the art of photography, in combination with chemical agents that are sensitive to light. It is also used in surgery, both in the natural state and combined with medicinal substances. As a dressing for wounds, it unites the cut or torn surfaces closely, and prevents the action of the air; and it being transparent, the wound can be inspected when necessary. 2. Collodion is gun cotton or pyroxylin dissolved in a mixture of alcohol and common ether. Pyroxylm is made by immersing clean carded cotton for 4 or 5 minutes in a mixture of equal parts of concentrated nitric and sulphuric acids. The cotton is then squeezed free of acid, afterwards washed thoroughly and finally carefully dried by hot water or steam at a heat not higher than 180° Fah. 3 Collodion will dissolve Venice turpentine, castor oil iodine, etc.

A. B. asks: How is fire communicated to the gas in a kerosene lamp, thereby causing an explosion? Is it through the wick, or does it take fire from the heating of the lamp? Answer: Generally there is a leak; and when the oil gets low, the space above it is filled with gas, which is thus readily inflamed. In the case of very poor oil, the heat is sufficient.

R. W. asks: How can I make blue and green glazing for common earthenware? Can I make a glazing without melting the ingredients into glass before it can be applied to the work? Answer: A glaze for common earthenware is made as follows: White lead (pure) 53 parts, quartz or ground flints 36 parts, Cornish stone or felspar 16 parts, white flint glass 5 parts; reduce to an impalpable powder, grind with water to a very thin paste, dip and fuse. This may be colored blue by oxide of copper, added in quantities according to the shade desired. Earthenware may be glazed by throwing common salt into the heated furnace containing the ware.

T. W. D. asks: What substance is there, the vapor or fumes of which, expelled or liberated by heat, will bleach vegetable substances on a large scale? Sulphur will not do. Answer: Chlorine is probably the most effective bleaching agent known; and in the form of chloride of lime is very extensively employed. You can use gaseous chlorine instead of the usual solution of chloride of lime, and in the same way as sulphurous acid gas. The vegetable substances must first be boiled in a weak solution of soda or potash to remove resinous matters, grease, dirt, etc., and then hung up after washing, in a capacious room, into which chlorine gas is admitted. You can make chlorine as follows: In a leaden retort, capable of being heated by steam underneath, mix cautiously oil of vitriol and water each 7 parts, and allow to cool. Add, when cool, common salt 4 parts mixed intimately with peroxide of manganese 3 parts. The gas comes off slowly at first, but a gentle heat causes it to rush forth in large quantities.

J. W. H. says, in reply to H. M., who asked how to make good ice cream: Take 1 gallon of good milk or cream, the yolks of 18 eggs, 1½ lbs. of sugar, and 2 vanilla beans; and you will have the ingredients for 1 gallon of vanilla ice cream. Any other flavor may be used. Take the yolks and the sugar (well pulverized) and beat them well together. Mash the beans well and add them. Put the milk over the fire, boil it, take it off, add the eggs, etc., and again boil it, being very careful not to burn it; in a few minutes take it off. Let it get cool, after which you may freeze it in the ordinary way, and you will have nice ice cream.

J. D. replies to a querist, who asked if a 12 horse power separator will run harder with tumbling rods than with a belt; "If you drive with an engine, it will take 20 horse power to stand with rods what 10 will do with a belt. I know this by experience."

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

I. O.—Your pebbles are quartz. The largest one is colored by oxide of iron. They are of no value.

COMMUNICATIONS RECEIVED.

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

On Patent Systems. By T. W.
On the Marsupialia. By N. B. H.
On Flying Spiders. By T. C. E.
On the Witch Hazel. By S. F. C.
On a Proposed Balloon. By J. C. W.
On Cooking Stoves. By D. R. W.
On Poisonous Undershirts. By J. N.
On Patent Rights. By H. A. W.

Also enquiries from the following:

A. T. H.—A. G. G.—W. E. W.—A. B. C.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.