(4) J. D. G. asks: 1. What size steam pipe is required to take away the steam from 1,000 horse power boilers, pressure in boilers 90 pounds? A. 12 inch pipe. 2. A simple rule to calculate the condensation in steam pipes under different temperatures per square foot of pipe surface. A. The condensation in steam pipes is so variable, from the conditions of its surrounding medium, that no simple rule will give a satisfactory answer. The amount of heat escaping from the surface is the true index, but varying very much with the moisture and circulation in the air in contact with the outside of the pipe. The velocity of the steam in the pipe also has a controlling influence upon the amount of water condensed. Measuring of the water obtained from the drip pipes is the most satisfactory solution of the question. As a general rule, for a temperature of 60° one square foot of boiler or steam generating surface is required for 10 square feet of exposed pipe surface.

(5) G. R. A. asks (1) how to obtain the standard of an inch, and from where derived. A. You may obtain the standard measure of inch, foot, etc., by addressing Bureau of Weights and Measures, Washing, D. C. 2. What is the rule for finding proportion of diameter to circumference? Can an arc or a circle be squared? If not, why? A. Multiply the diameter by 3·14159265358+ for the circumference. The circle can be squared for all practical purposes.

(6) T. F. B. asks for some material for protecting steam pipes from rust. The pipes are used for greenhouse heating, and are partly exposed to frequent wetting. Am told that ordinary mineral paints interfere considerably with the radiation of heat. The material used shou d not prevent radiation, nor set free any noxious gases under heat. Would ultramarine blue be available? A. We know of no greenhouses in the vicinity of New York that protect their pipes for heating. Probably this arises more from neglect than a fear of defective service. In all other kinds of heating apparatus the pipes are protected from rust and for appearance. Plumbago paint, *i. e.*, ground plumbago and linseed oil (boiled) mixed thick enough to be rubbed upon the pipes with a woolen pad or wiper, so as to leave the coat thinner than with a brush, will no doubt be the best for durability, and give out the most heat. 2. Also, how to estimate the pound pressure of a water connection, supplied by an elevated cistern or reservoir; will the distance a stream of water thrown by ordinary ¾ inch hose serve to indicate the amount of pound pressure? A. The pressure from your cistern maybe ascertained by dividing the height of the surface of water in cistern above the nozzle in feet by 2·239, which will give the pressure in pounds per square inch. The jet height is uncertain, from the friction in the pipe.

(7) M. M. writes: Is a condenser now of any benefit to an engine? With our present improvements with a cut-off at one-quarter stroke, with four expansions, does not that supersede the condenser? If not, why not? Can a vacuum be made by the use of the air pump that will be of any benefit to the engine? A small power will make a vacuum of fifteen pounds to the inch; a large one will do no more. Is it worth what it costs to make it? If so, how? Can exhaust steam from an improved engine be transferred into a receiver and then into a low pressure cylinder, the area of which is four times the area of the high pressure piston? Does size of the piston add anything to the power? A. With all the modern improvements of automatic cut-off and valve gear, the condenser has lost none of its benefit, but rather gained in requiring less water for condensation than in the old forms; for any economy in steam saved is economy in the work of the air pump. A fair vacuum is equal to 13 pounds per square inch on your piston. This is a large percentage on the mean pressure upon the piston, which may be as low as half the boiler pressure; as with a boiler pressure of 60 pounds and a mean piston pressure of 30 pounds your gain would be over 40 per cent, less the friction and area of the air pump. A compound engine illustrates the economy of the condenser in a remarkable manner. You will find an interesting article and illustration of the theory of the compound engine in SCIENTIFIC AMERICAN SUPPLEMENT, No. 204, and also illustrated compound engines in Nos. 138, 366, 388, 305.

(8) W. S C. asks: 1. How many inches would have to be added to the stroke of an engine to increase it five horse power? A. This depends upon the size of the cylinder. 2. Is an engine 10x16 rated as powerful as 12x12? A. 12x12 is the more powerful. 3. Can there be anything done for a cylinder that is cut, without reboring? A. We know of nothing but reboring for a cut cylinder. 4. What are blind tubes eight inches long put into boilers for? A. Short blind tubes are parts of leaky tubes headed up and reinserted, and should not be used when new tubes can be obtained.

(9) O. S. B. asks how to obtain the skeletons of animals, large and small, also of birds. A. Use a barrel of water with two or three pounds of caustic soda in solution for disintegrating the flesh from skeletons; two or three pounds of quicklime added to the above helps the process, and bleaches. 2. Will a common hot water boiler (galvanized iron) be strong enough to generate steam for a 1½ horse power engine? A. Could not trust a hot water boiler. Not enough surface for 1½ horse engine. You require 22 square feet heating surface, and also steam room.

(10) F. A. P.—The area of the main building of the New Orleans Exhibition is 1,378 by 905 feet, covering 33 acres, or 11 acres more than the main building at Philadelphia. There will be some extensions, but just how much space will thus be included is not yet certain. The exhibition opens December 1. The five principal bu ldings of the Philadelphia Exhibition covered an area of fifty acres.

(11) W. B. P. asks: What is the steadier pressure of water—taking from a pumping main or from a main from a reservoir? A. From the main from reservoir.

(12) A. R. asks if there is any way that articles of soft brass can be made hard of an iron nature. A. Brass cannot be hardened except by hammering or rolling. A composition resembling brass may be made which is hard when cast. We know of nothing but steel that can be hardened.

(13) Injectors for high lifts and long distance suction.—Referring to the inquiry of J. O. G. (32, in SCIENTIFIC AMERICAN of October 25, where the lift was 12 feet and the longitudinal suction 290 feet, we learn from Mr. A. Aller, 109 Liberty Street, this city, that the Korting injector, of which he is agent, has been applied with great success for longer suction and higher lifts than that mentioned. The Korting is one of the most effective of all the injectors, and the manufacturers make a special point of guaranteeing high lifts and heavy duties where other injectors have failed to work.

(14) J. N. asks how many feet of No. 36 silk insulated wire it would take for the secondary coil of an induction coil which will be strong as the majority of people can stand by taking the ends of the secondary coil in their hands, provided the rest of the machine is perfect and the insulation perfect. A. 200 feet of No. 36 wire will make a strong coil.

(15) F. H. asks for the process of making whiting, and also the process of making or manufacturing plaster of Paris. A. Whiting consists of chalk carefully ground, then thoroughly washed, after which it is formed into balls and dried. Plaster of Paris is ordinary gypsum (calcium sulphate) calcined so as to expel the water of crystallization, and then finely powdered. It contains 20 percent of water.

(16) H. C. H. asks for a receipt for a finish for rubber tubing; something that is a liquid and very thin and will dry quick, glossy, and elastic, and so when stretched it will not come off, but be glossy when it comes back; something that will not be sticky after drying. A. The following is used on rubber balloons, and may prove satisfactory: Digest cold 1½ ounces India rubber cut small in 1 pint of either chloroform, sulphuric ether (washed), or carbon disulphide. This will dry as soon as laid on. Silicate of soda, or soluble glass, may be applied as a coating for rubber. It prevents the gas from coming through. The ordinary varieties of varnish will crack, and therefore cannot be used.

(17) C. McD. writes: Please inform me as to the present and probable future demand for professional chemists. In what kinds of establishments does the chemist find steady employment, and what is the nature of his work? What inducements does the profession offer as to compensation, manner of living, independence, etc.? Do you think that a young man with fair ability would probably attain reasonable success, or in other words would you advise him to adopt the profession? A. The demand for professional chemists is on the increase, but the supply is greater than the demand. In all kinds of technical establishments the services of a chemist are desirable. In iron mills and furnaces, in mines, in soap factories, mills where cloth is made and dyed, in fact everywhere that anything is produced from raw materials, the services of a chemist are needed. A chemist is generally a salaried clerk, and cannot rise, as a rule, above the figure once given him, unless by his knowledge he is successful in introducing improvements into the methods used. Then he is likely to receive an interest in the increased receipts. The average pay of an established and competent chemist is probably from $1,000 to $2,000 per annum. Success depends more upon the individual than upon the pursuit of any special branch of learning. A mechanic receiving $3.00 a day is surer of his income than any chemist can ever be, still there are chemists whose annual income exceeds $20,000, and there are millionaires to-day who were newsboys in their younger days.

(18) E. F. R. writes: 1. Suppose two bar magnets are placed one across the center of other, will the poles of either be affected or changed? If so, why? A. We think the magnets placed in the position described would not affect each other more than if placed in any other position with their poles the same distance apart. 2. Of what diameter should an electro magnet be, of straight form, being two inches in length? A. There is no fixed rule for the proportion of diameter to the length of a straight electro magnet. The core and the coil are generally adapted to the work to be done by the magnet.

(19) J. B. M. writes: I have a battery, the cups made of hard rubber: some of them have small leaks, and waste the fluid. How can the leaks be stopped? A. You can stop the leaks in your battery cells by using a cement composed of gutta percha, pitch, and shellac, equal parts melted together

(20) A. B. G. asks: When should cod liver oil be taken—midway between meals, just before, just after, or with the meals? A. Take the cod liver oil just after the meal.

(21) J. R. F. asks what muriate of potash is, and what it is composed of. I tried to get some through one of our druggists, but failed, and they sent me something else. A. Muriate of potash is the old name for potassium chloride, or chloride of potassium, and it is composed of chlorine and potassium. It is worth in New York about $1.70 per 100 pounds, or 40 cents to 50 cents per pound pure.

(22) W. L. F. asks the best mode of brazing steel and iron. A. Steel and iron may be easily brazed with ordinary brass or copper, by cleaning the parts to be joined, covering them with borax ground in water to a thin paste, then bind the parts together with iron wire and place a piece of brass upon the joint. Heat until the brass melts, when it will flow through the joint.

(23) N. W. writes: Suppose a car let loose upon rails at the top of an incline 100 feet long, with a rise of 15 feet; and suppose at the foot of the incline it attains a speed of 20 miles an hour. How far will the acquired momentum send it on level rails (supposing the frictional resistance to be 10 pounds to the ton, and the resistance of the atmosphere to be disregarded)? Would the cargo any farther if it weighed 10 tons than if it weighed one ton (resistance of atmosphere being disregarded)? A. Car would run 528 feet. The distance would be the same for a 10 ton or a 1 ton car, with a *pro rata* friction.

(24) R. S. P. asks: Will you have the kindness to give me (1) a recipe for silicate slating for blackboards, or any other good blackboard material? A. Lampblack and flour of emery mixed with spirit varnish. No more lampblack and flour of emery should be used than are sufficient to give the required abrading surface. The thinner the mixture the better. Lampblack should be first ground with a small quantity of spirit varnish or alcohol to free it from lumps. The composition should be applied to the smoothly planed surface of a board with a common paint brush. Let it become thoroughly hard and dry before it is used. Rub it down with pumice if too rough. 2. Also a recipe for the quick drying, glossy ink used with the patent shading pens. A. The following recipe is for a glossy black ink:

Powdered nutgalls	18 parts.
Iron sulphate	8 "
Gum arabic	7 "
Pure water	145 "

The galls are first boiled in 130 parts water, the iron sulphate and gum arabic dissolved in 15 parts water, and this solution then slowly added to the former.

(25) A. L. F. asks how to make a good stove polish. A. Try the following:

Blacklead pulverized	1 lb.
Turpentine	1 gill.
Water	1 gill.
Sugar	1 oz.

(26) R. C. R.—A plane that rounds or puts a bead on the edge of a board is a beading plane; a plane that only rounds the edge without the guide is a rounding plane; for a hollow or round groove, a grooving plane. There are over 80 names in the trades for planes for woodwork.

(27) G. R. writes: Two persons in the shop where I work have a dispute as to the strongest way to place a bar of square wrought iron, supported at each end and the load placed in the center. A says that it will be the strongest placed flat, while B claims that it is the strongest placed on one corner. A. A is right. The bar placed square is as 673 to 568 for a bar placed diagonally.

(28) T. H. C. & Mfg. Co. ask what material or mixture to make to fill up patterns to make them larger and heavier. On plane surfaces we use paper, but on uneven surfaces we want something of a plastic nature that will stand the wear of the sand. A. Shellac varnish and whiting brushed on in several coats will raise the surface of irregular patterns, and will last a time with careful handling. Make the mixture like thick paint, and use quickly.

(29) S. L. W. asks a receipt for a solution that will harden Bessemer steel. A. We do not know that Bessemer steel can be hardened by simply dipping in a solution. A nearly saturated solution of prussiate of potash in water might make a hard surface film. Case hardening with the same treatment as with iron is the best way to obtain a useful surface of steel.

(30) J. P. P.—Delta metal is not on sale. It can be cast, forged, and rolled. Has a tensile strength of 48,000 pounds cast, 75,000 pounds rolled, and 140,000 pounds in drawn wire per square inch. Steel can be cast in links. The inclination of the holes in blasting depends very much upon kind of rock. In crystalline rock a slanting hole is preferred.

(31) N. H. B. asks for a simple method of detecting the presence of iron in water. In paper making it is often very desirable to know whether there is any iron in solution in the water. A. Boil the water with a little nitric acid, and then add a few drops of potassium ferrocyanide; if iron be present, a blue precipitate will immediately show itself. It will be well to concentrate the solution before adding the reagent, as the amount of iron may be slight.

(32) J. F. asks how to melt rubber. A. Rubber may be melted over a water bath. To obtain it in the liquid state, it is commonly the practice to dissolve it in some suitable solvent, and then evaporate that solution to the desired consistency. An elaborate account of the rubber industries is given in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 249, 251, 252.

(33) M. S. G. asks for a solution which will take nickel off of brass or iron. A. Nickel is slowly soluble in not too dilute hydrochloric acid, more readily in hot than in cold. Hot dilute sulphuric acid dissolves it with some difficulty. Much more easily soluble in dilute nitric acid, but with concentrated nitric acid it behaves like iron.

(34) F. B. D. writes: What can I mix with common lard so that it will melt at about 150°? I have a fire alarm that works by the melting of the material, and I am unable to make more of it, so that as it is now the machine is useless. A. Try mixing common resin with your lard.

(35) A. C. writes: 1. Which battery will give the most powerful current? Also, which will maintain that current the greatest length of time—the Grove, Bunsen, Smee, or Grenet? Is it not the Grove? A. The Bunsen bichromate form of battery would probably answer your purpose best. 2. Please tell me how to make an electric motor. I don't mean one like that described in the article on "An Electrical Cabinet," in SUPPLEMENT, No. 191, but a regular motor. One which would have power enough to run a Holtz electrical machine. A. You can make an electric motor by following the directions given in SUPPLEMENT, No. 161, for a small dynamo. There is no difference between the motor and the dynamo except in the adjustment of the commutator, which you can readily arrive at by a little experiment. 3. How many cells of the most powerful of the above batteries would it take to run a Holtz machine? A. It depends on the size of the Holtz machine. Probably 4 cells would run a small machine.

(36) L. H. writes: I am making a dynamo electric machine, with field magnets 6 inches by 4½ inches by ¾ inch, wound with No. 18 silk covered magnet wire. The extreme diameter of armature to be 2 inches. I desire to use it with an incandescent lamp. What size wire should I wind the armature with if I use the original form of Siemens? If I desire to charge a secondary battery, should I wind the armature with a different size? A. Unless you place your field magnets in a shunt, we think that No 18 wire is too fine. You should use No. 16 or 14. No. 18 wire would probably be the right size for your armature. An armature for charging a secondary battery should be wound with coarse wire. 2. Will you give me an explanation of the terms "in series" and "for tension"? A. The term "in series" means connected one after the other, and the term "for tension" means substantially the same thing.

(37) E. L. P. asks how to prepare the pieces of limestone used in producing the calcium light with hydrogen and oxygen gas. What is the best quality of limestone to use, and where can it be obtained? A. The limestone is calcined, producing common lime. Common lime of good quality is generally used for cyliuders of the oxyhydrogen light. Marble is often calcined and used for this purpose.

(38) J. L. G. writes: Please inform me how to recolor ivory billiard balls that have become faded. A. For the red, which is what we presume you desire, any of the following will answer: *a.* Macerate cochineal in vinegar, and boil the balls in the liquid for a few minutes. *b.* Carmine dissolved in ammonia may be used. The tint is more purple red. *c.* Immerse in a very dilute solution of stannous chloride, and afterward in a boiling solution of Brazil wood. A little fustic turns the color to scarlet. *d.* Ivory dyed as last directed is rendered cherry red by immersion in a very dilute solution of potash. *e.* Immerse in an alcoholic solution of alizarine paste. Ivory must not be boiled long in liquids, and when taken out of hot liquid should be rapidly cooled by laying in cold water.

(39) A. H. writes: 1. Have any books been written on electrical engineering, and what are they? A. Sprague's new work on Electricity is very good for a beginner. Gordon's Electric Light, Prescott on Dynamos, Kempe on Testing, and Schellen on Electric Light are all good works. 2. What course should I pursue and what works read to become an electrical engineer? A. Begin with Ganot's Physics; thoroughly post yourself in physics, particularly in electrical physics, and also in mathematics. To become a thoroughly efficient electrical engineer, you should also be a mechanical engineer.

(40) W. M. J. wants a metal or a compound of metals to take a stereotype impression from type, the type being forced into the metal when it is nearly cool with a press. Have tried several compositions, but do not get perfection in every case, without injury to the face of the type. Type metal is too hard and brittle. A. We know of no metal unless it be fusible metal, made of bismuth, tin, and lead, that will answer your purpose. Fusible metal that will melt in boiling water may be made of 8 parts of bismuth, 5 parts of lead, and 3 parts of tin.

(41) F. R. writes: Will you tell me whether I am right or wrong in this: I contend that if a bullet be fired from a rifle perpendicularly in the air, when it returns to the point whence it was fired it will have the same velocity it had when it left the rifle. A. You are wrong; the bullet going up has to overcome the resistance of the air as well as the force of gravity; coming down, it is drawn by a force of gravity equal to that which the explosive at first overcame, but has then also to overcome the friction of the air. If the experiment were made in a perfect vacuum, the bullet would return with the same speed that it left the gun.

(42) J. A. H. asks: Which gets the harder lick—a hammer or a nail—when the nail is struck with a hammer? A. Both alike, except, unfortunately, your finger should happen to share with the nail in its part of the "lick."

(43) J. T. G. asks a cure for chicken cholera, roop, the gaps, etc. A. Our SUPPLEMENT Nos. have valuable papers on chicken raising, treatment of disease, etc., but the best way is to cut off the head of a sick chicken; it is time and money wasted to attempt to doctor it.

(44) A. S. asks: 1. Is there an element with which oxygen does not unite? A. Fluorine is the only element which will not combine with oxygen. 2. What are the advantages and drawbacks of high speed running engines? A. The advantage is speed. The drawbacks are wear, tear, and care, as also waste of oil.

(45) S. W. Y. says: You have stated many times that the sun is the scurce of all heat. Will you inform us of the great source of all cold? A. Cold is but the absence of heat; the terms are only relative, and the lowest temperature we find at the poles is comparative warmth to that which can be produced artificially.

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