Chief Engineer's Office, U. S. Navy Yard,
WASHINGTON, November 18, 1874.
Commodore Thos. H. Patterson, U.S N., Commandant:

SIR:—In obedience to your order of October 5th, 1874, to carefully test the EMPIRE PORTABLE FORGE, manufactured at Troy, N. Y., I have the honor to submit the following report:

* * * * * * This is a very excellent and convenient forge. It works easy and with but little noise, and the power being applied with a lever, it can be worked without interfering with the manipulation of the fire.

I can recommend it as a very useful tool for work on ship board or shop use.

Very respectfully, your obedient servant,
[Signed] EDWIN FITHIAN,
Chief Engineer, U.S.N.

Business and Personal.

The Charge for Insertion under this head is $1 a Line.

Notes & Queries

J.P.S. can utilize old rubber as described on p. 349, vol. 26. Galvanizing castings is described on p. 346, vol. 31.—A. L. and others will find a recipe for a blackboard composition on p. 91, vol. 30.—S. A. H. will find a formula for proportioning cone pulleys on p. 100, vol. 25.—F. P. can keep moths out of clothing by the process given on p. 225, vol. 27. Inkstains can be removed by the method given on p. 139, vol. 29.—T. & L. will find directions for purifying rancid butter on p. 119, vol. 30.—J. D. V. Jr. will find a recipe for bronzing brass and copper on p. 331, vol. 29.—S. M. can bleach cane juice for sugar by the method given on p. 378, vol. 30.—O. K. will find directions for making rubber stamps on p. 156, vol. 31.—S. A. T. can fasten paper to brass by painting the brass with oil paint, letting it dry, and using common glue. (This answers H. H. R.) Lead is readily run into plaster molds. A recipe for a soldering liquid is given on p. 43, vol. 31.—W.S. will find directions for galvanizing iron on p. 12, vol. 346. Rubber can be fastened to wood with glue.—T. R. B. will find a recipe for transparent varnish on p. 11, vol. 31, which will do for making cloth airproof.—S. M. E. will find a formula for the dimensions of a safety valve on p. 107, vol. 31.—A. E. A. can bleach skeletonized leaves by the process given on p. 155, vol. 31.—P. B. will find directions for bending wood by steaming on p. 26, vol. 31.—A. M. J. and others are informed that no preventive for boiler scale can be recommended unless the nature of the mineral deposit is known.—W. M. ought not to try and remove canceling ink from postage stamps, as it may lead to fraud.—J. F. H. will find a recipe for Babbitt metal on p. 364, vol. 29.—E. T. D. will find a description of artificial pearls on p. 250, vol. 30.—J. H. R. should consult a dictionary as to the meaning of words in common use.—A. A. will find a rule for calculating gears on p. 187, vol. 29.—L. K. Y. will find full descriptions of solder of all kinds in our last three issues.—P. S. can join his water spouts with waterproof glue; see p. 91, vol. 31.

(1) S. A. T. asks: How can I cement a porcelain mortar? A. Use a mixture of black japan varnish and white lead.

(2) W. B. B. asks: Having a good violin, to improve it I removed all polish and paint with alcohol, which spoilt the tone. How can I restore it? A. Take coarsely powdered copal and glass, each 4 ozs., alcohol (64 over proof) 1 pint, camphor ½ oz; heat in a water bath, stirring frequently until the solution is complete. When cold, decant the clear portion. This is an excellent varnish for any musical instrument of the violin species.

(3) J. J. D. asks: What is meant by slack coal? A. Coal dust. The term is commonly applied to the dust formed in cutting out coal in the mine, which is frequently piled in heaps at the pit's mouth.

(4) F. O. asks: What metal is best for making candy molds? I want to find one that cools quickly. A. Tin molds are commonly used. Dust them with powdered sugar to prevent the adherence of the candy.

(5) C. F. F. asks: Which is the front side of a mill dam? A. The side which the water runs to.

(6) D. G. K. asks: How can I prepare coach varnish? A. Fuse 8 lbs. fine African gum copal, add 2 gallons clarified oil, boil for 5 hours until quite stringy. Mix with 3½ gallons turpentine, and strain.

(7) P. H. K. asks: Can you give me a rule to measure corn in a crib? A. Multiply the depth of the corn in inches by the length and width of the crib in inches, and divide by 2150·42. The quotient will be the number of bushels.

(8) M. A. B. says: The best thing for taking dirt and grease off the hands without injury is bicarbonate of soda, used in place of soap.

(9) I. R. M. asks: How can I calculate the speed of a train of pulleys? A. Proceed as in vulgar fractions, placing the number of the revolutions of the prime mover as the numerator of a compound fraction, and the diameter of each of the driving wheels in inches also as numerators, and the diameters of each of the pulleys in inches as denominators, and proceed by cancelation.

(10) A. E. S. asks: How can I paste newspaper clippings into a scrap book without the leaves curling up and warping? A. Use a gum arabic mucilage with some refined sugar dissolved in it.

(11) A. B. L. asks: How can I make a washing crystal? A. The soda ash and soda crystals of commerce are used for this purpose, and you could not make them on a small scale to advantage.

(12) C. asks: Is there an animal generally known as the sea otter? A. Yes. It is found in the Northern Pacific.

(13) S. says: I read an article on the beneficial effects of glycerin in boilers. I tried the experiment, and the result was the reverse of beneficial. We got rid of most of the earthy matter by using a surface blower, but the glycerin had the effect of depositing the earthy matter in a hard crust, and the surface blower showed clear water in the boiler. A. The use of glycerin, as a solvent for the salts in impure matters, has been recommended for cleaning woolen fabrics, but your experiment of its use in steam boilers is the first of which we have heard. It is possible that, by blowing off from the bottom, you might get rid of the deposit. We shall be glad to hear further on this matter from any of our readers who can communicate any information.

(14) J. K. asks: What constitutes a yard of plastering? A. Nine square feet of surface.

(15) J. B. S. asks: What is the best way of polishing holly wood? A. Use a white shellac varnish.

(16) J. H. asks: Is the Pacific Ocean higher than the Atlantic at the point where it is proposed to connect them by a canal? A. No.

(17) W. R. B. says: In Dick's "Practical Astronomer" is a description of Rogers' achromatic telescope on a new plan. It consists of placing a small compound lens of flint and crown glass in a small part of the cone of rays of a large crown glass objective, and thus correcting the rays, enabling a person to use a large crown glass objective and making it achromatic by the small compound one. 1. I have a good crown glass double convex lens, of 5 inches diameter and about 100 inches focus. What should be the size, shape, and focus of each of the lenses forming the compound one, to produce the proper correction for the above mentioned lens? A. Plano concave of double dense flint, of 2¼ inches diameter, 3½ inches radius, and plano-convex of plate glass same dimensions. 2. At what distance should the given compound lens be placed from the object glass? A. About 60 inches. 3. With the compound lens adjusted, what would be the entire focus of the instrument? A. Twelve feet six inches. 4. Are you acquainted with any telescope on the above plan, and is it satisfactory? A. An inch dialyte, by Plossl, of Vienna, divided *y Caronce*, distance 0·6″.

(18) S. G. S. asks: If the daily motion of the earth were to cease, would all the loose bodies on the surface fall into space? A. No.

(19) J. C. C. asks: Where is the best place to hang a thermometer to ascertain the heat of the atmosphere? A. If it is desired to know the temperature of the surrounding atmosphere, the instrument should be placed in some shady spot, protected alike from the direct rays of the sun and cooling drafts of air. If exposed to the direct radiation of the sun, the instrument itself will become overheated (the materials of which it is composed being better absorbers than the surrounding air), and the consequence will be that the thermometer will indicate the temperature of the materials composing it and not that of the air. The indications of cheap thermometers are never absolutely correct.

(20) P. E. R. asks: How can I cement glass together, to withstand the action of electro-plating solutions? A. Try a solution of shellac in alcohol, evaporated to the consistence of a thick paste.

(21) G. A. N. says: I want a small engine, to run a sewing machine or small lathe. Would a ¾x1½ inches cylinder, 20 or 30 lbs. pressure, and 300 or 400 revolutions per minute, be large enough for the purpose? A. Yes.

(22) H. S. P. asks: 1. What would be the horse power of an engine, with a cylinder of 5 inches bore by 6 inches stroke, running at 300 strokes per minute, with 70 lbs. of steam? A. It would develope from 4 or 5 horsepower. 2. Would it do to run a circular saw 15 inches in diameter through two inch oak plank? A. Yes. 3. How large a boiler would this engine require? A. Make a boiler with 60 or 70 square feet of heating surface. 4. Will an upright boiler last as long as a horizontal one? A. Upright boilers, when well made, are quite serviceable.

(23) P. B. asks: 1. What is the average weight of freight locomotives? A. There is a very great variety, an average example being somewhat as follows: Weight, 60,000 lbs. 2. What is the diameter of the drive wheels? A. Five feet. 3. What is the length of the stroke? A. Two feet. 4. What is the diameter of the cylinder? A. Sixteen inches. 5. What is the weight of an average freight car? A. Eight tuns.

(24) W. P. asks: 1. What size of engine would it take to run a boat 15 feet long at the rate of 8 miles per hour? A. Make the cylinder 2½ x 4. 2. I have a boiler 36 inches high x 15 inches diameter, carrying from 40 lbs. to 50 lbs. pressure per square inch. Would it be large enough? A. The boiler is too small for the speed.

(25) H. J. asks: 1. Will an engine having a cylinder 3x6 inches, steam pressure of 60 lbs., running at 300 revolutions per minute, with a cut-off at ¾ stroke, do to run a circular saw 6 inches in diameter with? The fly wheel of the engine is 24 inches, and the mandrel pulley 6 inches, in diameter. A. The engine is quite large enough. 2. My boiler is 13 inches in diameter by 5 feet in length, a plain cylinder in form. Is it big enough? A. No.

What will take the stains of varnish or paint off marble? A. Try a paste composed of soda, pumicestone, and chalk.

Where is the best place to put exhaust steam in a smoke stack, at top or bottom? A. The top.

(26) S. E. P. asks: How can I remove rust from joiner's tools? A. Use emery and oil, with a piece of wood. This also answers S. A. T.

(27) W. W. says: I have a small upright engine, cylinder 4 inches diameter by 6 inches stroke. Would it do to run an ordinary row boat? How fast would she go, and what would be the best kind of propeller wheel to use? What kind of boiler would be best? Would it be necessary to have a counterbalance on the crank? A. Your engine is large enough for a boat 25 feet long, with a propeller 30 inches in diameter and a boiler from 30 to 36 inches in diameter. Some slight counterbalance may be put on, but it is not a matter of any great importance.

(28) G. asks: What amount of sulphuric acid will it require to entirely dissolve 1 lb. zinc? A. For its complete conversion into sulphate of zinc, 1 lb. of pure zinc requires 1½ lbs. of sulphuric acid of specific gravity 1·84=66° Baumé at 60° Fah. 2. What volume of hydrogen gas will the mixture give off? A. One pound of pure zinc, by its reaction with hydrated sulphuric acid, will liberate about 40 gallons of hydrogen.

(29) C. S. R. asks: What is the cause of the bursting of water backs? Two such accidents occurred lately. A. There was probably ice in the circulating pipes, so that the steam which was formed could not escape. Under such circumstances, fire should never be permitted in a range.

(30) K. K. asks: What would be the difference between the pressure necessary to explode a steam boiler from the inside, and that necessary to crush or flatten it from the outside? A. In the case of a wrought iron boiler, perfectly cylindrical, the internal pressure that would rupture it is thickness in inches×tensile strength in lbs. per square inch÷the diameter in inches. The external crushing force is: 111,000×(thickness in inches)²÷diameter in inches×length in feet.

(31) B. R. asks: Can ice be torn off a dam by powder? The ice is 18 inches thick and the water 12 or 13 feet deep. A. We advise you not to attempt this kind of blasting, unless you have had some previous experience.

(32) J. H. asks: 1. How are red mortar and black mortar made, for laying face bricks in? A. Mortar is made red by mixing therewith a certain proportion of Spanish brown, and black by lamp black, but neither is sufficiently permanent to be satisfactory. 2. Is fresh water better than salt for making mortar in winter? A. Pure water is better than salt water in any weather.

(33) H. says: The atmosphere in a certain building is raised from 0° to 75° by water at 212°, passing through coils of iron pipe. Suppose this operation should be reversed, and an attempt made to cool the atmosphere at 90° by cold water at a temperature of 35°, provided the circulation were kept up, to what degree of temperature could the atmosphere be reduced? A. This question cannot be answered except by experiment.

(34) J. S. asks: How much water can be boiled away in 10 hours in a vat, 5 by 12 feet, with 1¼ inch pipes laid close together over the bottom of the vat, with steam at 60 or 70 lbs. per inch? A. It will depend upon the arrangement whether you boil away 25 or 75 per cent as much water as you have steam. With a good apparatus, you may calculate to evaporate ⅔ of a gallon of water in the vat for every gallon of water evaporated in the boiler.

(35) S. G. says: Suppose a water tank, 8x10 x5 feet deep, is placed on top of a house, 1,000 feet from an engine house, what kind of an indicator would be best to show how much water there is in the tank? A. Put up a stand pipe, say one inch in diameter, in the engine house, and connect it at bottom with the pipe running from the pump to the tank. Enlarge the upper part, which must be on a level with the tank, so as to introduce a float; connect this float by a cord over a pulley, with an indicator in the engine room below. As the water in this pipe will stand higher, when pumping, than in the tank, it will be necessary to stop the pump to find the true hight.

(36) F. S. says: 1. Please give me a rule for finding the strength of a boiler when diameter of shell and thickness of iron are given. A. For a single riveted iron boiler, the safe working strain, in pounds per square inch, may be found by multiplying the thickness in inches by 7,600, and dividing the product by the diameter of the boiler in inches. 2. Would it make any difference in the working of an engine which end of the boiler I took the steam from, or at which end I let in the feed water? A. Ordinarily, no.

Are large mill saws tempered after they are made? A. Yes.

(37) S. D. K. says: We have a large hall, built of brick, 50 feet square and 20 feet high. The reverberation is so great as to make it very disagreeable to speak in, causing confusion of sound. What is the best remedy? Will wires do, and how

are they applied? A. The use of wire to improve the acoustics of halls, etc., is of comparatively recent date, and is not sufficiently extended in the number of reported experiments to warrant a very great degree of certainty in assigning either the sizes of the wire, their distance apart, or their exact location. It is generally thought best to place them in front of the vertical wall opposite the speaker, about 5 inches from the wall and 6 inches apart, extending vertically from the floor to ceiling. The object being simply to break the wave of sound, as small a wire will answer as is consistent with strength.

(38) J. G. R. asks: 1. Would it be practicable to have the telegraph wire within ½ inch of the wood at every pole? A. Yes. 2. What is the smallest distance that will work well? A. Any distance if they do not touch. Air is an insulator, and galvanic electricity will not pass through it unless some other substance is present. It is better to keep the wire at some distance from the pole on account of snow or ice forming a connection between the wire and pole.

(39) G. W M. asks: Is cement pipe much used for aqueducts for water supply? When laid entirely below the action of the frost, and bedded in clay, would it be durable and not likely to become leaky from cracking or otherwise? What thickness should three-inch cement pipe be to conduct water under a head of 30 feet? Would such a pressure be likely to produce leakage by filtration through the pores? Which would be most economical in the beginning, and less liable to further expense for repairs, to make the pipe in short joints before laying it, or to lay the cement in its final bed in a plastic state, forming the hole as fast as the work progresses? What is the process of the latter mentioned mode of laying pipe? What are the ingredients required, and their proportions? A. Cement pipe is principally used for drainage and very seldom for supply, except when the current runs to a grade without filling the pipe, and so not under pressure. A notable instance of a cement concrete pipe is that of the Vanne aqueduct, thirty-seven miles in length, for supplying water to the city of Paris. This aqueduct has two and a half to three miles of arches, some of them fifty feet in hight, and eleven miles of tunnels, which, with the aqueduct pipe, are all constructed of béton Coignet. The pipe is circular, 6½ feet in interior diameter, with a thickness of 9 inches at the top, and 12 inches at the sides, at the water-surface. It has proved to be impermeable to water. But cement pipe of small size, bedded in the earth is much too liable to be broken by unequal pressure, caused by the washing away of its support, to be safe under ordinary circumstances.

(40) J. D. M. asks: What is the capacity of a cylinder 6x8 inches, carrying a pressure of 50 lbs. to the inch, and making 200 revolutions?

A. Area of piston in square inches	28·27
Multiply by steam pressure	50
	1413·5
Multiply by twice the length of stroke in feet	1·33
	1,818
Multiply by revolutions per minute	200
Divide by 33,000	363,600
Horse power	11+

(41) W. W. F. says: 1. In a church are two furnaces for heating, which can be made to draw only when the atmosphere is in strong motion. Two large coal stoves have been substituted, with 8 inch pipes running the whole length of the church. These also operate the same way. What is the reason? A. The draft is checked by the great length of horizontal pipe, and most probably by the small size of the vertical flues likewise. The best conditions for draft in such cases are the location of the former at the bottom of the vertical flue, with little or no horizontal pipe, and the size of the flue being sufficient for the work it has to do. One of the worst conditions is that of a horizontal pipe running in a direction contrary to that of the strongest and most prevalent winds; and the same difficulty occurs in carrying heated air in pipes from a furnace. The furnace therefore should be placed at the windward end or side of the church, and have large flues ascending directly from them. 2. In building chimneys, is there any prescribed rule for the size or shape of flue? A. No graduated scale for the size of flue has been indicated, but 12 by 16 inches or 12 by 12 inches ought to be sufficient in a case like this.

(42) A. B. A. asks: Is there any process by which freckles can be removed from the face without injury to the skin? A. A good lotion is made of: Bichloride of mercury 6 grains, pure hydrochloric acid (specific gravity) 1 fluid drachm, water (distilled) ¼ pint, mix, and add of rectified spirits and rose water, each 2 fluid ozs., and glycerin 1 oz.

(43) J. M. says: I have a boiler 1 foot in diameter and 21 inches long, with 14 flues. The firebox and flues get choked. What is the cause of it? A. The flues are probably too small for ordinary fuel. Try charcoal. The power of your steam engine depends upon the steam pressure and speed, which you do not mention.

(44) O. A. asks: Would a room, partitioned off in a cellar, do to store ice for summer use? If so, how must I arrange it? A. You can make an ice room in your cellar that will most likely preserve ice, if the space you can devote to that object be large enough. Ice will keep best when compacted in a solid mass, and a cube of 12 feet will be found to be best for family storage, even where perhaps not more than one half of this amount will be required for use in one season. Place 2x12 inch uprights, 2 feet apart, around the room, with the edge to the wall, and line them with stout inch boards. Then fill in the spaces between the uprights with dry sawdust, and construct a similar protection on the ceiling of the room. Cover the ground with shavings 6 inches deep, and lay sleepers and a tight floor thereupon, arranged to drain to one side, and provide a drain to carry off the water. Also provide ventilation from the top of the ice room. Put in a double door at the entrance, and provide a sawdust mattress to fill the space between them, making the inside door in sections to take down from the top. A space partitioned off outside of the ice room can be used as a cold closet.

(45) G. asks: Are there any ingredients that can be molded into artificial stone for building purposes, that will stand the action of the weather? A. Artificial stone, made in the manner you refer to, is manufactured by three or four companies in this city and elsewhere; but their combination of ingredients is in each case protected by a patent. The peculiarity of each consists in its use of some choice and noted cements as a basis for its composition, and upon this their success mainly depends. One of these companies uses the hydraulic lime of Teil, and another Portland cement, and great care is taken to wash the sand perfectly clean and to cause the combination of the sand and cement to take place under the best conditions. This is sometimes done under pressure. The operations of these companies are now very extensive, but their processes are mainly concealed from the public, especially the points wherein their peculiarities consist.

(46) P. M. J. M. and many others.—We do not know of any rule for determining the horse power of a boiler.

(47) O. D. B. says, in reply to G. M. B. (who asks: How can I construct a receptacle in a garret for water from the roof of a house? It must not let the water be frozen in winter, or spoiled in summer): My garret being sufficiently tight, frost does no harm. For my tank I used a poor grade of 1½ inch pine, sawn into strips 2½ inches wide, all pieces of equal length. I took one thickness of matched 1¼ stuff for the bottom, and then laid on the strips around next the edge of the bottom, and nailed each layer, breaking joints at the ends, until the requisite hight was reached, thus making a a tank needing no tongues or grooves. If it is to be over five feet high, saw the strips 2¾ or 3 inches wide. Having lined the tank with sheet lead, the water was taken from the roof, and (through an elbow and conductor pipe of galvanized iron) was discharged into the bottom of the tank (the conductor being in the tank and reaching to the bottom); thus each successive shower moved all the water in the tank, stirring it up and causing the surplus or overflow to pass on to the main house cistern. The more roof water that can be conveniently turned into the tank the better, for the supply is thus kept constant and the changes are more frequent. A. We understand our correspondent's plan of building a tank to be something like that of erecting a log house, with the strips he refers to overlapping each other at the corners, and the whole wall nailed down into each other as the walls rise. We do not see the necessity of multiplying the number of joints to so great an extent as this plan involves, and think there is less labor required to be expended on the ordinary style of tank. When the tank is high, a cradling of slight scantlings will be necessary to bind it together and sustain the pressure of the water, in either case.

(48) J. B. B. asks: Please explain the construction and mode of working the automatic telegraph instruments in use in many brokers' offices of New York and Philadelphia. A. There are many kinds. In one of them a type wheel containing letters is propelled, step by step, by electro-magnetism, and another wheel containing figures is propelled in a similar manner. The printing is done by a third magnet, which attracts an armature attached to a lever, the distant end of which brings the paper against the type wheel. The paper is moved along by the movement of the lever.

(49) W. & Co. ask: What are the *modus operandi* and ingredients used in making electric carbons? A. The fine dust of coke and coking coal is put into a close iron mold of the shape required for the carbon, and exposed to the heat of a furnace. When taken out, the burned mass is porous and unfit for use; but by repeatedly soaking it in thick sirup or gas tar, and reheating it, it at length acquires the necessary solidity and conducting power. The carbon that forms on the roof of gas retorts is harder and better than the carbon thus made, but it is difficult to work, and the supply of it is limited.

(50) A. T. O. says: I am building an engine of 3 inches stroke by 1½ inches bore. What sized boiler ought it to have to run a foot lathe? A. Make the boiler of ⅛ inch iron or copper, 15 inches in diameter, and 30 to 36 inches high.

(51) A. W. P. asks: Is there any spot in the depth of the ocean where the density of the water is such as to prevent a 50 lbs. weight from sinking any farther? A. Possibly.

(52) A. K asks: What causes a conical shot fired from a smooth bored gun to fly end over end? A. It is on account of the resistance of the air, since the axis of the shot is not permanent, as it has not been made to rotate on its axis while being forced from the gun.

(53) J M. W. asks: Is there any means of finding gold and silver that is buried in the ground? A. Digging till it is found is the only solution of the difficulty.

(54) G. B. asks: What is the best polish for handles, such as chisel handles, etc.? A. Ordinary polishing paper answers very well.

What power have I on my foot lathe, the driving wheel being 26 inches in diameter and the driven wheel 3½ inches? The belt is 2½ inches in width. A. You must measure with a spring balance, or otherwise, how much pressure you produce on the treadle, multiply it by the distance the pressure is exerted in feet for each revolution, multiply also by the number of revolutions per minute, and divide by 33,000.

Why is wood seasoned under water heavier than that seasoned by boiling or steaming? A. Generally because as much of the sap has not been expelled in the former case as in the latter.

(55) R. U. asks: What is Chatterton's compound, for insulating electric cables, composed of? A. Stockholm tar 1 part, resin 1 part, gutta percha 3 parts, by weight.

(56) A. L. C. asks: Does the perihelion of the earth's orbit to the sun always lead the sun in its course among the stars, or does it occupy a fixed position? A. It retrogrades slowly, moving in a direction contrary to the order of the signs.

How do you account for the ocean waters being salt? A. Streams carry down minerals, especially soluble chlorides, the water returning by evaporation and rain.

Will iron weigh the most when hot or cold, and why? A. A cast iron ball at first sinks in melted cast iron, then floats, and finally melts.

How much will a ball drop in the first mile, when shot from a cannon? A. A falling body describes in 1 second 16½ feet, in 2 seconds 64⅛, in 3 seconds 144¾, in 4 seconds 257⅛, in 5 seconds 402 1/16. The United States 0·45 caliber bullet (charge 7 grains), at 1,050 yards range, elevation 3° 34′ 15″, has a dangerous space of 75 feet, and rises 35 feet above the line of sight at 500 yards. Initial velocity 1,300 feet per second. Pressure 16,300 lbs. per square inch.

I always notice that men, horses, and other animals, when running in a circle, always prefer to run with their left side toward the pole. How do you account for this? A. Because the left half of the brain and the right side of the body (which it governs) are best developed.

(57) F. E. R. asks: How many cells of a Callaud or of a Daniell battery would be required to silver plate small articles, such as buttons, coins, etc.? A. Two cells of either will do.

(58) M. D. H. and others.—It is self-evident that the earth and moon must gyrate about their common center of gravity. The pseudo science of metaphysics consists of an insensible change in the meaning of words during a course of reasoning. We may thus prove mathematically that one equals two, that a straight line is always perpendicular to itself, that a straight line may cut a circle in 4 points, etc.

(59) W. J. asks: How can I make a cheap apparatus to govern electricity, so that it can be taken in light or heavy shocks? A. Take 50 feet of No. 16 copper wire covered with cotton, and make a helix, and then take 1,000 feet of No. 30 copper wire insulated with copper and make another helix around the first. Connect a battery to the two ends of the first helix; and by rapidly breaking and making connection with the battery, a current will be developed in the second coil which can be felt by taking hold of the two ends of the second wire. By inserting a bundle of iron wires in the center of the first helix, the shocks will be greatly increased, and the amount of the shocks can be varied by the distance to which the iron wires are inserted in the helix. 2. What is an electric circuit? A. A circuit is made by connecting the two poles of a battery together.

(60) J. T. M. asks: 1. How many men's work is equal to one horse power? A. From 6 to 7. 2. Is an engine with its cylinder 3 inches long by 1 inch diameter large enough to run a half medium Gordon printing press? A. It is rather too small.

(61) G. C. P. Jr. asks: How can I make an electric battery for a telegraph apparatus? A. Get some cheap glass tumblers and place in the bottom of each an ounce of blue vitriol. Place over the blue vitriol a small coil of copper wire. Attach to the copper wire coil an insulated copper wire extending out of the top of the tumbler (gutta percha covered wire is the best for this purpose). Get some thick sheet zinc and cut out disks of it which will fit into the top of the tumblers, and to the zinc attach a short piece of copper wire. Fill the glass with water. Connect the wire leading from the copper coil of one tumbler to the wire leading to the zinc in the next tumbler. The strength of one cell will be one volt. Use as many tumblers as are necessary to get what power is required.

(62) S. asks: Why does the sun appear larger at the horizon? A. It is an illusion, caused by comparing the size of the sun with terrestrial objects.

When an author gives the strength of wood as 100 lbs., in what direction does he mean that the strain shall be applied? A. It is impossible to tell, unless there is something immediately preceding the information to explain it.

Why does a heated razor cut better than a cold one? A. We are not sure that this is a fact.

(63) S. H. B. asks: Is it enough to test kerosene oils to heat in an open vessel to 110°, and then apply a lighted match? A. Yes, it is a very good test.

(64) J. says: I have made a small steam engine (of one inch bore and three inches stroke) entirely of lead, and so far it runs well. Will it be comparatively durable, and can there be sufficient power got from it to run a sewing machine? A. If it is run light, with low steam, it will probably continue in order for a considerable time. It is probably quite powerful enough to drive a sewing machine, but it is doubtful whether it would stand the work for any long period.

(65) S. P. H. asks: In tempering sickles for cutting grass, to what color should they be drawn? A. A light purple, or a temperature of about 530° Fah.

Claret wine poured into a tumbler of water will penetrate the water and mix; but if a piece of bread is put into the water and the wine poured in, the wine will float on top of the water, part being absorbed by the bread. Why is this? A. We think this experiment can be performed without the bread, if carefully managed.

(66) F. asks: How many barrels of water per foot in depth will cisterns 7 feet, 8 feet, 9 feet, and 10 feet in diameter contain respectively? A. Multiply the square of the diameter by the decimal 0·186. Thus the cistern 7 feet in diameter contains for each foot in depth 49 times 0·186 or 9·114 barrels.

(67) W. S. P. asks: 1. Is a 400 barrel water tank, 16 feet square by 10 feet high, made of 3 inch plank properly braced and bolted, as strong and useful as a round tank of 16 feet diameter by 12 feet high, made of staves 2½ inches thick and properly banded? A. Yes. 2. If the square tank were cased inside with the lightest make of sheet zinc, or galvanized iron, would it be better? A. Yes. 3. How long would it last as a watertight vessel with more or less chalybeate or iron water in it and exposed to the air? A. From a few months to several years, according to the condition of the wood. 4. Would an iron varnish (distilled coal tar) be a protection to the iron or zinc? A. Yes.

(68) J. H. M. says: A friend states that, if it were possible for a man standing in a car 100 feet high, moving at the rate of 60 miles per minute, to throw an iron ball straight up 100 feet, it would drop exactly in his hands. I contend that, while the ball would descend in a straight line, yet, in the time required for the ascent and descent of the ball, the car would have moved a mile for every second from the place where the ball started, so that by the time the ball reached its starting point the man would be too far away for it to drop into his hands. He also says that, if he was standing on the roof at the rear end of the rear car, and I should be standing on the platform of the same car exactly underneath him, the car going at the same rate of speed as before, and he should drop this iron ball, it would strike me. I contend that by the time it reaches my level I would be as many miles from it as it occupied seconds in falling. Which is right? A. Your friend is right, if the resistance of the air can be disregarded.

(69) W. L. D. asks: When it is noon on Friday, at Greenwich Observatory, London (longitude 0), is it Friday or Thursday midnight, at opposite (longitude 180°)? A. Looking at the south pole of a globe, the day of the month is one later at all places between meridian 180° and midnight, counting toward the left, than between 180° and midnight, counting toward the right; that is, it is always later at the first meridian than at any place in west longitude, and earlier than at any place in east longitude.

(70) M. says, in reply to M. B., who asks for a a rule for cutting a tree so that its top shall fall at a certain distance from its root: Let A B represent the tree, and C the point on the ground. Draw B C and calculate its length. From D, the center of B C, draw D E perpendicular to B C, and E will be where the tree should break. B A C and B D E are similar triangles, hence B A : B C :: B D : B E.

(71) C. W. says: You mention, as good for steps for turbines, rock or swamp maple. I have known the knots of light wood or pitch pine to last for years in this service.

(72) R. E. B. says, in reply to a question how to remove clinkers from firebrick: Pour vinegar where the clinker collects, and the latter can be peeled off after being well saturated.

(73) C. T. S. says, as to corrosion of engine bolts by using tallow as a lubricant: I think that D. K. has given the real reason for the cutting out of screws and other parts of pistons. After a practical experience of nearly twenty-five years, I am convinced that the use of oil of any kind in the steam chests and cylinders of steam engines is a positive damage and an inexcusable waste, except in the case of locomotives, when running down grades without steam. Nearly all oils contain salts and acids which are destructive to iron under the conditions above described. Oil thrown into a steam chest (where the temperature is high) almost instantly vanishes, leaving a residuum between the wearing surfaces, which is anything but a lubricant, causing more friction and wear than the oil ever compensates for. Oil pumps are sometimes resorted to where it is thought necessary to waste a gallon or two of oil weekly through an engine. Having occasion to make some slight repairs upon an engine a few days ago, I took off the cylinder head, and examined a piston which I put in new five years ago. I found the follower screws, and the screws and nuts under the packing springs, as perfect as when put in; and the cylinder was as bright and smooth as a mirror, also the valves and valve seats. Yet this engine had run 5 years without oil inside the cylinder, and made a saving to the proprietor of not less than $100 in the item of oil alone. Piston and valve rods can be oiled from the outside if necessary; but if the packing in the stuffing boxes is renewed before it becomes hard and charred, very little oil will be needed. A. You do not state what kind of oil you found to leave a residue creating friction.

(74) J. H. S. says: D. K., in his reply to D. S. T. (No. 17, issue of Jan. 30), says that he had trouble with bolts, etc., being eaten away by the acid in the tallow he used, and that he now used lard oil. After a great deal of trouble from the same source, I got a large earthen crock and set on top of my arch, keeping it filled with crude tallow obtained at a meat market. It tried out very nicely, and is of course pure. I have used it on an an engine for 18 months, and everything is all right, although I am using the same water as I did when the trouble was in the cylinder. I have always found that, where lard oil was used in steam, everything ran very dry It is not heavy enough.

(75) J. & J. T. say, in reply to J. C. & Co., as to the inclination of a bolting reel: At the Millers' National Convention in St. Louis, Mo., June, 1874, we learned that a fall of 1 in 48 always gave the best results.

S. A. T. asks: How can I make a fugitive ink that will disappear in two days after being written?—T. C. H. asks: How can I make an easily flowing ink for drawing on zinc plates, so as afterwards to etch the drawings with muriatic acid?—E. P. M. asks: How can I tan and color beaver skins?—L. M. asks: 1. Can you give me a good rule for getting the length of a carriage axle from shoulder to shoulder before welding, supposing the hub of the wheels to be 6½ inches long, and the track of the wheels 4 feet 7 inches? 2. Please give me a rule for setting axles.—J. F. E. asks: What is put in soap to keep it from shrinking in drying?

COMMUNICATIONS RECEIVED.

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

On the Generation of the Wicked. By T. W. C., and by A. S.
On the Sagacity of the Partridge. By J. K.
On Glue as a Healing Remedy. By J. J. B.
On Honey. By A. L. F.
On Amalgamating the Precious Metals. By J.T.
On a Mammoth Skeleton. By A. R.
On a Lunar Phenomenon. By H. M. S.
On the New Rule at the Patent Office. By J.McC.
On the Slide Valve. By J. T. H.
On Squaring Numbers. By E. T.
On Spiritualism. By F. H. R.
On Small Steam Engines. By W. C. D.
On a Mathematical Fact. By E. H. W.
On the Human Will. By W. L. S.

Also enquiries and answers from the following:

M. G. L.—E. W.—T., F & Co.—J. K.—J.G. T.—T. R.—A. E. O.—J. T. H.—S. T. J.—J. E. B.—F. H. W.—A. A. F.—C. C. C.—D. B.—G. W. H.—C. E. M.—J.K.—J. C. R.—G. C.—C. F. B.—J. C.—R. W. J.—J. B.—T. K. B.

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 enquiries analogous to the following are sent: "Who publishes books on dressing and coloring furs, and on bleaching wool? Who sells magnesia and chloride of magnesium? Who makes machines for cutting thin stuff off round logs while the latter revolve? Who sells the best steamer for laundry purposes? Who makes steel castings? Who sells the best gage cocks, etc.? Are there glass-lined iron pipes in the market? Who makes engines suitable for boats 4 feet long?" 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.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week ending

February 16, 1875,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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DESIGNS PATENTED.

8,057.—BRACKET.—N. L. Bradley, West Meriden, Conn.
8,058 to 8,061.—AQUARIUMS.—J. W. Fiske, New York city.
8,062.—CARPET.—A. Redfern, Philadelphia, Pa.
8,063.—SPICE CAN.—Z. R. Traver, Detroit, Mich.
8,064.—BOTTLES.—F. S. Upton, Rochester, N. Y.
8,065.—GAS FIRE LOG.—T. N. Dixon, Philadelphia, Pa.
8,066.—ALTO RELIEVO.—W. B. Gleason, Boston, Mass.
8,067.—HANDLE SOCKET.—J.R. Mackay, W. Meriden, Ct.
8,068.—CIGAR BOX.—M. Moll, New York city.
8,069.—FORK HANDLE.—C. Osborne, N. Attleboro, Mass.

TRADE MARKS REGISTERED.

2,228.—CIGARS.—F. De Bary & Co., New York city.
2,229.—SALVES.—C Heinrich, Plainfield, N. J.
2,230.—MUSTARDS.—Jewett & Co., Milwaukee, Wis.
2,231.—MEDICINE.—J. Kaiser, Pittsburgh, Pa.
2,232 to 2,236.—CLOCKS.—F. Kroeber, Hoboken, N. J.
2,237.—CIGARS.—Lichtenstein & Co., New York city.
2,238.—MEDICINE.—E. G. Lewis, Pittsylvania county, Va
2,239.—PACKING.—W. H. Miller, Philadelphia, Pa.
2,240.—CIGARS, ETC.—G. Solomon, New York city.
2,241.—CIGARS.—J. M. Seip, Allentown, Pa.
2,242.—FERTILIZERS.—Walton & Co., Wilmington, Del.
2,243.—RAT POISON, ETC.—E. S. Wells, Jersey City, N. J.
2,244.—SUGARS.—Woods & Co., Baltimore, Md.
2,245.—SEWING SILK.—Brainerd & Co., New York city.
2,246.—BATHING POWDERS.—F. Rauchfuss, New York city.

SCHEDULE OF PATENT FEES.

On each Caveat $10
On each Trade mark $25
On filing each application for a Patent (17 years) $15
On issuing each original Patent $20
On appeal to Examiners-in-Chief $10
On appeal to Commissioner of Patents $20
On application for Reissue $30
On filing a Disclaimer $10
On an application for Design (3½ years) $10
On application for Design (7 years) $15
On application for Design (14 years) $30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,

FEBRUARY 12 to 24, 1875.

4,389.—A. Willson and E. M. Law, Bell Ewart, Ont. Car coupling. Feb. 12, 1875.
4,390.—Jas. Laing, Dundee, Scotland. Overhead sewing machine. Feb. 15, 1875.
4,391.—F. C. Porter, Buffalo, N. Y., U. S. Folding table. Feb. 15, 1875.
4,392.—C. W. Selinas *et al.*, Montpelier, Vt. Door spring. Feb. 16, 1875.
4,393.—J. T. B. Bennett, Birmingham, England. Making cokeand gas. Feb. 16, 1875.
4,394.—J. C. Tilton, Pittsburgh, Pa., U. S. Wash boiler. Feb. 16, 1875.
4,395.—J. Carpenter, Mariners' Harbor, Northfield, N. Y., U. S. Wagon spring. Feb. 16, 1875.
4,396.—T. Shaw, Philadelphia, Pa., U. S. Steam, air, and hydraulic seated valve. Feb. 16, 1875.
4,397.—H. Harris, Seaforth, Ont. Stove pipe damper, Feb. 16, 1875.
4,398.—B. Arnold, East Greenwich, R. I., U. S. Netting machine. Feb. 16, 1875.
4,399.—Wm. Adamson *et al.*, Philadelphia, Pa., U. S Making starch and fermented liquors. Feb. 17, 1875.
4,400.—L. H. Young, St. John, N. B. Punching machine. Feb. 18, 1875.
4,401.—S. Dobbs *et al.*, Rochester, N. Y., U. S. Picture frame hanger. Feb. 18, 1875.
4,402.—I. F. Williams, Bristol, R. I., U. S. Rubber boot. Feb. 20, 1875.
4,403.—F. Kent, Hamilton, Ont. Tyre tightener. Feb 20, 1875.
4,404.—J. B. Larkin, Pittsburgh, Pa., U. S. Grate and grate bar. Feb. 20, 1875.
4,405.—E. R. Whitney, Magog, P. Q. Hay loader. Feb. 20, 1875.
4,406.—N. Dubrul, Cincinnati, Ohio, U. S. Cigar mold. Feb. 20, 1875.
4,407.—T. DeCodejo, New York city, N. Y., U. S. Smoke and spark conveyer. Feb. 20, 1875.
4,408.—I. F. Williams, Bristol, R. I., U. S. Lasts for boots. Feb, 20, 1875.
4,409.—S. L. Wiegand, Philadelphia, Pa., U. S. Grate bar, etc. Feb. 20, 1875.
4,410.—T. Irwin, Hamilton, Ont. Hot air furnace. Feb. 20, 1875.
4,411.—Wm. Stephenson, Acton, Ont. Tempering oven. Feb. 20, 1875.
4,412.—E. Hambujer, Detroit, Mich., U. S. Rocking chairand cradle. Feb. 22, 1875.
4,413.—J. Grist, Jr., Ottawa, Ont. Mirror plate andmirror. Feb. 22, 1875.
4,414.—J. M. Bruce, West Townsend, Mass., U. S., *et al.*, Street lantern. Feb. 22, 1875.
4,415.—J. M. Brosius *et al.*, Richmond, Va., U. S. Car axle box. Feb. 22, 1875.
4,416.—J. L. Fralick, Picton, Ont., *et al.* Tyre upsetting machine. Feb. 22, 1875.
4,417.—D. S. Cornell, Warwick, Ont., *et al.* Hand straw cutter. Feb. 23, 1875.
4,418.—A. Rodgers, Muskegon, Mich., U. S. Circular saw carriage. Feb. 23, 1875.
4,419.—T. Penton, Sarnia, Ont. Combined cooking stove heater, and engine. Feb. 23, 1875.
4,420.—L. M. Becker, Peckham, England. Sewing machine. Feb. 23, 1875.
4,421.—B. Waggoner, Reach, Ont. Gang plow. Feb. 23, 1875.
4,422.—B. Waggoner, Reach, Ont. Iron neck yoke. Feb. 23, 1875.
4,423.—J. F. Williams, Niagara, Ont. Boot latchet loop. Feb. 23, 1875.
4,424.—J. H. Osgood, Boston, Mass., U. S. Inking roller composition. Feb. 24, 1875.
4,425.—F. L. Bates, Carrolton, Miss., U. S. Nut lock. Feb. 24, 1875.
4,426.—E. R. Powell, Winooski, Vt., U. S., *etal.* Wheel harrow and grain coverer. Feb. 24, 1875.
4,427.—Wm. J. Garton, Toronto, Ont. Wax thread heating machine. Feb. 24, 1875.
4,428.—M. Hutchinson, Norfolk, N. Y., U. S. Heating drum. Feb. 24, 1875.
4,429.—A. Rodgers, Muskegon, Mich., U. S. Gang saw mill. Feb. 24, 1875.