

Business and Personal.

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Peck's Patent Drop Press. For circulars, address Milo, Peck & Co., New Haven, Conn.

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Automatic Wire Rope R. R. conveys Coal Ore, &c., without Treatise Work. No. 61 Broadway, N.Y.

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Best Philadelphia Oak Belting and Monitor stitched. C. W. Army, Manufacturer, 301 & 303 Cherry St., Philadelphia, Pa. Send for circular.

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Dean's Steam Pumps, for all purposes; Engines, Boilers, Iron and Wood Working Machinery of all descriptions. W. L. Chase & Co., 93, 95, 97 Liberty Street, New York.

Steam Fire Engines—Philadelphia Hydraulic Works, Philadelphia, Pa.

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Waterproof Enamelled Papers—all colors—for packing Lard and other oily substances, Chloride of Lime, Soda and similar Chemicals, Cartridges, Shoe Linings, Wrapping Soaps, Smoked or Dried Meats, and Dehydrated Vegetables, Shelf Papers, and all applications where absorption is to be resisted. Samples on application. Crump's Label Press, 75 Fulton St., New York.

For descriptive circulars, and terms to Agents of new and saleable mechanical novelties, address James H. White, Newark, N. J., Manufacturer of Sheet and Cast Metal Small Wares.

Emerson's Patent Inserted Toothed Saws, and Saw Swage. See occasional advertisement on outside page. Send Postal Card for Circular and Price List. Emerson, Ford & Co., Beaver Falls, Pa.

Answers to Correspondents

B. W. F. is informed that an American gallon contains 231 cubic inches; an English imperial gallon, 277 7/8.—F. D. L. will find a description of a process for black enamel on iron on p. 208, vol. 26.—P. S., who asks questions as to roofing, etc., should send his name and address.—H. E. J. should consult our advertising columns for books on carpentry.—J. F. F.'s reply to V. C. is incomprehensible.—W. H. S. will find directions for making vinegar on p. 58, vol. 30. Solid opodeldoc can be made by using more soap in the mixture.—G. O. D. will find recipes for gliding on glass on p. 243, vol. 30. Asphaltum varnish is described on p. 283, vol. 26. For painting on glass, see p. 123, vol. 30.—T. F. will find directions for a cement for mending china on p. 241, vol. 27. Tempering springs is described on p. 251, vol. 29. Black asphaltum varnish for cast iron is described on p. 237, vol. 26.—J. T. B. will find a recipe for jet black ink on p. 303, vol. 29.—S. A. M. will find directions for making marking ink on p. 251, vol. 29.—For whitewash, see p. 230, vol. 29. For paper boats, see p. 168, vol. 27.

W. F. H. asks: 1. How can I find the velocity of water in any sized tube? A. By experiment. 2. What percentage of power do overshoot wheels usually yield? A. From fifty to seventy-five per cent. 3. Can you give me a rule for laying out bevel gears? A. You will find it in any treatise on mill work.

A. M. B. says: 1. In vol. 30, No. 12, you speak of an ice boat going nearly three times as fast as the wind. B. says that this is against common sense. Can you explain it? A. You will find the matter clearly explained on p. 176, vol. 28. 2. What would be the real lifting power of an engine of 4 horse power? A. It would be able to lift 132,000 lbs. one foot high in a minute.

In our answer to L. E. I., in the SCIENTIFIC AMERICAN for April 4, 1874, the sentence that "port a ea one half that of the piston" should read: "port area from one twentieth to one fifteenth the area of the piston."

G. A. B. says: We use two kinds of brake shoes on our cars, one of wood, the other of iron. My friend says that the iron ones are the best, for the reason that he can screw down brakes as hard as he pleases with the iron shoes, and the wheel will scarcely ever slide on the rail; but with the wooden one, half the force expended will cause the wheel to slide. I, on the contrary, say that the wooden one is the best, for it is the one which retards the revolving of the wheel most with the least expenditure of "elbow grease;" we do not question which is the best material for shoes for general usage, but which will stop a train in a given time with the least power expended by the brakeman. Who is right? A. The friction between the wheel and the wooden shoe would ordinarily be greater for the same pressure, than when the iron shoe was used. 2. What gum can I get which will dissolve in alcohol and after drying be again soluble in water? A. We do not know of any.

G. W. M. asks: About how deep will cast or wrought iron rust, if exposed to all weathers? A. Experiments have not been very extended, but it is supposed that, if the metal is not subjected to strain, it will rust about 1-16 of an inch deep in 25 years.

S. H. D. asks: Why is it that a common portable pump, used on a portable steam engine to feed the boiler, will not take hot water but will take cold water? A. The vapor formed by the hot water creates such a pressure that the valves cannot open.]

G. R. B. asks: Is the weight or pressure upon the valves of a steam engine the area of the ports or openings which are covered by the valves multiplied by the pressure persquare inch, and are the valves balanced when the ports or openings are not covered by them? It short, is the theory of no port, no pressure, correct, and do the rules which apply to the figuring of the weight or pressure on the valves of an engine also apply to the pressure upon the piston packing? In other words, can the rings of the so-called steam piston packings be set out by steam? A. The pressure of the valve is that due to its own weight and the unbalanced pressure of the steam on it. Thus, if an equal area is pressed on top and bottom of the valve, all the pressure will be taken off. There are several styles of piston in which the packing rings are set out by steam pressure.

W. C. M. asks: 1. Is tallow the best thing for lubricating an engine cylinder? Is there anything that will improve it for the purpose? A. Some prefer oil. 2. How can I bleach tallow without injuring it? A. Melt and strain it before using.

H. W. says: 1. We attribute to Newton the discovery of the law of gravitation. Is there an opposite law of repulsion? A. Yes, but it acts at very small distances. Molecules repel each other according to the amount of heat they contain; the temperature of space, supposed to be 300° Fah. below zero, is sufficient for ether vibrations. 2. Newton dignified his discovery by declaring the law of gravitation to be a principle inherent in matter. In the same sense, is there not also an opposite law of repulsion which is a principle inherent in matter? A. No. 3. I suppose it may be said that gravitation is not now considered to be a principle, but an effect of force. In this view of the case, is there not repulsion which is in the same sense an effect of force? A. No. 4. Do or can astronomers explain the movements of comets satisfactorily upon the theory that they are balanced between the centripetal and the centrifugal forces, or do they offer any satisfactory explanation of such movements on any basis which ignores the existence of a law, a principle or an effect, of repulsion which is independent of the above named forces? A. The moon falls toward the earth one twentieth of an inch every second, instead of going off at a tangent. See Loomis' "Treatise on Astronomy." 5. If the earth swings around the sun in an orbit predetermined only by its momentum, its centrifugal, and its centripetal force, why is it that, when its orbit is once disturbed or varied, as it has been thousand of times by the planet Mars, for example, that the variation does not remain a permanency? [A. Where two bodies have exactly commensurate orbits, the orbit of the smaller body is entirely changed. Hence the gap in Saturn's ring has been caused by one of its satellites. In the formation of a solar system, only those orbits survive which are incommensurate with each other. 6. Comets which come to the center of our system are hurled back into the depths of measureless space. What is the power which operates with such irresistible certainty? Can their eccentric orbits possibly be referred to the equal and unvarying centrifugal force? Is not every known mechanical supposition opposed to such a theory? A. All bodies move with their greatest velocities at the perihelion passages. Hence their ability to get away again. 7. But all orbits of all comets are like those of comets, namely, they have an ellipsoidal form of revolution. Does not this indicate the idea that the laws which compel them to retain their orbits are in all cases the same as those affecting cometary revolutions? Here end the questions I desired to ask. The theory of a principle of repulsion has already been announced. It remains to ascertain how this law or principle or effect comes into existence. Take two balls of some light substance, dried pith is as good as any. Let one of these be surcharged with electricity, and it will attract the other. Let the two balls remain in contact with each other a short time, long enough for their electrical condition to become equalized, and they will repel each other. Now suppose the sun to be a highly charged electrical body, and a comet to be relatively an uncharged body, it follows that the comet will be drawn toward the sun by electrical attraction. It is true that the comet will be drawn by the force of the attraction of gravitation also, and will be governed by its centrifugal force, but the electrical attraction will supplement these forces. Arriving near the sun, the electrical condition of the comet becomes changed by reason of its proximity, and hence is repelled just as one pith ball is repelled by the other when the condition of the two has become equalized. It is proper to say here that while many various phenomena of electrical action are recognized, yet the whole subject of electricity, its connection with heat motion, the contraction or expansion of bodies by heat or from other causes, its development by motion or from contiguity of bodies, in short, the whole theory of the correlation of forces, can hardly be said to be understood, and in many respects is halting and unsatisfactory. Whether the sun is surrounded by what may be called an atmosphere of electricity, which reaches beyond the boundaries of the outermost planet, or whether the electrical condition of comets is excited by their expansion by heat when they arrive at their points of closest proximity to the sun (which appears improbable), one thing is certain, which is that there is a law or principle or effect of repulsion which is a necessary law, and which defines those circular boundaries in space which the worlds may not overpass. A. Electrical forces appear to play a very subordinate part in Nature. Stars are seen to drift about in currents and vortices with an occasional collision. The resulting combinations are in exact accordance with the law of gravitation. The notes in a sunbeam, the shining *noctiluca miliaris* in the sea, or Brownian movements of minute particles under the microscope, may serve to illustrate these currents of circulating stars.

E. B. W. asks: 1. What is the rule for finding the area of a segment of a circle? A. It is equal to the area of the circular sector, bounded by the same arc, diminished by the triangular portion of the sector. 2. Also of an ellipse? A. The area of an ellipse is equal to 0.7854 times the long diameter multiplied by the short diameter. 3. What causes a liquid to circulate when running downwards through a hole, as, for instance, through an opening in the bottom of a vessel? A. The motion is given to it by the spiral form of the hole, or the position of the hole in reference to the center of the vessel. 4. What is the best recent work on surveying? A. Trautwine's works are among the latest and best.

T. G. asks: 1. How can I solder or braze two pieces of brass together steam tight? A. See p. 251, vol. 28. 2. What is the best thing to remove scale from a boiler? A. Try putting about two ounces of muriate of ammonia in the boiler twice a week. 3. Ought a person who wishes to be an engineer to study any books, or is practice alone sufficient? If not, what books are the best? A. By all means study good books. Begin with Bourne's "Catechism of the Steam Engine." 4. What is the best paint for a smoke stack? A. See p. 295, vol. 28.

C. R. asks: 1. How can I make a good cement for filling air holes in cast iron? I want some thing that will stand heat. A. You can tap the hole, and screw in a piece of metal. 2. Which drags the most water, a side wheel steamer or a propeller, both hulls being of the same size and shape? A. Generally there is no drag in either case.

D. B. S. says: 1. In a lecture on electricity, a piece of money was placed in a saucer of liquid that looked like water, and a person could have it if he could pick it out. In one hand was to be placed a ball connected with the wire of a battery, which did not have any effect on the person until the other hand touched the liquid, when that hand would immediately fly upward the length of the arm. What was the liquid? A. Probably water. 2. Why did the effect take place? A. The water in the basin was connected with the other pole of the battery, so that, on touching it, a violent shock was given to the system, with the result you describe. 3. Are caoutchouc and gutta percha the same? A. No. 4. Will a bell give the same volume of sound if struck on the outside that it will when struck on the inside, the blow being equal in both cases? A. Depends upon the size and form of bell. Small bells, we believe, give better sound when struck upon the outside.

M. asks: 1. Do you think I can master mechanical drafting without the aid of a teacher, other than books? Whose work would be the best on drafting? A. You can learn a great deal from a book, but there are many things that a draftsman should know that can only be acquired by experience. We can recommend Professor Warren's works. 2. Why will a screw propeller make more turns, other things being the same, in running against the tide than in going with it? A. We would like some good evidence that this is a fact before seeking for a reason.

M. W. H. asks: 1. Will vegetable or any freezable bodies freeze in alcohol? Will they freeze as soon as the alcohol gets below 32° Fah.? A. When the temperature of the substances contained in it, they will freeze. 2. Why does a telescope magnify if we look through from the big end at anything close to the little end, while, when looking at anything a few feet off, it makes it smaller? A. In the former case the rays proceeding from the object glass enter the eye as a diverging beam. 3. Is there such a thing as a single glass telescope, or thing that can be used as a telescope? A. A single glass telescope is not possible. 4. Will nitro-glycerin explode as soon as the acids and glycerin are poured together, or does it have to be stirred together and left to stand for a while? What are the proportions of chemically pure nitric acid, sulphuric acid, and glycerin, by weight, to make nitro-glycerin? A. See p. 283, vol. 30.

M. M. asks: 1. Where gas from the city works can be bought for \$3 per thousand feet, would it be economy to generate hydrogen by the action of sulphuric acid at 3 cents per lb. upon iron turnings at 1 cent per lb., and give it luminously by passing through a filter saturated with coal oil at 20 cents per gallon? A. If these figures represented the entire expense of the manufacture, it would be. 2. What is the cheapest method of procuring oxygen upon a large scale without expensive apparatus? A. The oxygen companies use chlorate of potash heated in iron pots. The simplicity of the plant employed and the purity of the gas compensate them for the cost of an expensive material. 3. Is the calcium light made by a jet of common air through a flame of illuminating gas upon a piece of chalk of sufficient intensity to use as an illuminating agent? A. No.

J. H. says: I have two coal shafts, both sunk to the same vein, one for downcast and the other for upcast. I am using for a ventilating power, at the bottom of the upcast, a large furnace; and in addition to the furnace I have the upcast elevated 45 feet above the level of the down cast; both shafts are of the same size, 7x14 feet. If I make the mouth of the downcast 18 feet square in place of 7x14 and bring it down to the regular size at 18 feet down the shaft, which I think would make a kind of receiver, would it add to the weight or pressure of air in that shaft, and be any help to the furnace? A. No. 2. Is coal tar injurious to wire rope? A. No.

G. E. D. asks: How can I make sensitized paper? A. Take albumen paper, and float (prepared side downwards) on a bath of 1 oz. nitrate of silver in 18 oz. distilled water; add a few drops of citric acid to dissolve the first precipitate. Float for half a minute and dry in a dark room.

E. D. B. asks: 1. Are the grounds of cameos colored artificially after being cut, especially the beautiful green ones? If so, by what means? A. No. The different colors belong to the various strata of the stone. 2. What work on geometry has a full description of the curves of the fourth order? I have heard that, by the use of the cisoid, an angle could be trisected; is this so? A. In treatises on the calculus. The cisoid is a curve of the third order. It is described in Newton's "Universal Arithmetic." 3. Has there ever been a supposed metallic base of hydrogen discovered, or is any such supposition entertained by Science? A. It is considered a reasonable hypothesis by some scientists; but so far as we know, no such metallic base has been discovered. 4. Is the ultramarine water color made from the stone lapis lazuli? If not, what is the reason of its great cost? 4. Yes. Artificial ultramarine is also made, and sold much cheaper.

D. B. asks: 1. Where is the proper place to bolt a portable engine to a boiler, on the side or on top? A. Either place will do, if the boiler is properly braced. 2. Is a portable engine, placed on the top of the boiler and using a double crank, as strong as one bolted to the side of the boiler, using a single crank? A. Yes, if well proportioned. 3. I have a portable engine, cylinder 5 x 10 inches and speed 120 revolutions per minute; the firebox is 20x19x3 inches, with 32 flues (1 1/2 inches) of copper, 32 inches in length. I use the exhaust blast, contracted to 1/2 an inch, in a stack 8 inches in diameter and 17 feet high. The pressure is 30 or 40 lbs. Would it be more economical to lengthen the boiler to 4 feet, using the same number of flues? A. We would not recommend this change.

C. O. asks: 1. What is the difference between the actual and nominal power of a steam engine? A. Actual power depends upon actual conditions under which the engine works. Nominal horse power is obtained from assumed conditions. 2. What would be the power of an engine that has 36 inches stroke, 16 inches diameter of cylinder, and 45 revolutions a minute worked with 70 lbs. of steam? A. You do not send sufficient data. See article on "Indicating Steam Engines," p. 64, vol. 30. 3. How much is to be deducted for friction? A. From 20 to 50 per cent. The precise amount can only be determined by experiment. 4. Is half the power lost by the crank in converting rectilinear into circular motion? A. No.

S. A. R. asks: In making steam connections using the globe valve, which end of the valve should be placed next the steam pressure? A. It is generally placed so that the pressure is on top of the valve. Some engines, however, prefer to arrange it in the other way, so as to be able to pack the stem under pressure.

J. H. H. asks: 1. What causes zinc to bubble and leave blow holes when poured into a plaster of Paris mold? A. It may be caused by impurities, or by insufficient vent in the mold. 2. What kind of anti-mony is used to harden zinc? I bought some, but it turned black and would not melt. A. You probably have a compound or an impure article. 3. I took a bottle and filled it with water, and then put in a cork with just enough lead on it to make it sink very slowly. I then connected a force pump to the bottle, supposing that when the pressure became great enough the cork would rise to the surface. I put 35 lbs. pressure on the bottle, but the cork stayed down. I then took off enough lead so that it would just float; then when the pressure was put on, the cork went down and would come up when I lessened the pressure. A. When the pressure was increased, the air in the cork was compressed, and sufficient water entered to make it sink. When the pressure was taken off, the air expanded and forced out the water.

H. S. H. asks: If a quantity of air be compressed to half its bulk, what pressure will it exert against the sides of a vessel? By what rule of proportion is the pressure governed? A. If the temperature is constantly during the compression, the pressure varies inversely as the 1/408th power of the volume.

T. W. M. asks: Can you tell me of a cheap and simple method of reproducing manuscript music? A. Write it of lithographic transfer paper, have it transferred to stone, and printed by a lithographer.

R. U. asks: How is phosphor bronze made, and what percentage of phosphorus does it contain? A. Phosphor bronze is made by adding a small portion of phosphorus to common bronze or gun metal. The latter is composed of 90 parts of copper, and 10 parts or less of tin. To this, from 6 to 10 per cent of phosphorus is added, to make phosphor bronze.

C. R. asks: How can I make French polish, and how should it be applied? A. Dissolve 1 1/2 ozs. shellac and 1/2 oz. sandarac in 1/2 pint naphtha. Wet a piece of flannel with polish, stretch a clean linen rag over the flannel, apply one drop of linseed oil to the linen, and rub in a circular direction.

P. H. B. asks: What kind of roof will a composition, said to be composed of French asphaltum, hydraulic cement, salt, coal, tar, and sand (of such consistence as to be easily spread with a plasterer's trowel upon paper felting) make? What is the difference between French and American asphaltum? What is and what are the uses of an oil called dead oil, said to be mixed with carbolic acid for disinfecting purposes? A. There is no asphalt called French asphaltum as distinguished in any peculiar quality from any other asphalt. The combination of ingredients specified by you is useless for the purpose indicated, as the salt would destroy its efficiency by continually attracting moisture from the atmosphere. Dead oil is the last that comes over in distillation, and is a fatty oil that is not likely to dry well in such a composition. A great deal of the material complained of is sold to be put on by the purchaser, and unless properly laid is not likely to give satisfaction; cases have occurred, we are informed, where the material has been sent out with the plainest directions, and where, nevertheless, the preparation of felting, etc., has been laid with the upper side down, thus exposing to the weather a surface never intended and not prepared for it.

A. D. B. asks: Will copper wire, which is covered with cotton and then with beeswax, do for a primary coil? A. Two thicknesses of it may be used. 2. I have a coil which is too small, the covering of the wire of the primary of which is worn off in some places, and the secondary coil has been cut in several places. Can I mend the fine wire, and, with more added to it, use it for the one I wish to make? A. There is no reason why the wire should not answer when properly joined. 3. Is it necessary to put layers of oiled silk or other insulator between the layers, it being covered with cotton? A. The oiled silk will perfect the insulation.

A. A. W. asks: What kind of wood are gutters made of? A. Well seasoned pine is frequently used.

C. G. asks for a recipe for making furniture polish. A. Take pale raw linseed oil 10 ozs., lac varnish and wood spirit each 5 ozs. Mix well, and it is ready for use. This is a reviver for French polished wood.

C. R., and Mrs. G. W. P. ask: 1. How can I make a light gray color to color a brown wall so that it will stand the weather? A. Put a very little blue black in ordinary whitewash. 2. How can I make a dark brown color for the same purpose? Use amber or ocher in whitewash, to the shade required.

A. H. W. G. asks for a recipe for turner's cement, for holding small articles in the lathe. A. Take Burgundy pitch 2 lbs., resin 2 lbs., yellow wax 2 ozs., dried whiting 2 lbs.; melt and mix.

D. E. R. asks: How can I put a fine polish on walnut in a very short time, say 3 hours? A. Melt 3 or 4 pieces of sandarac, each the size of a walnut, add 1 pint boiled oil, and boil together for 1 hour. While cooling, add 1 dram Venice turpentine, and if too thick, a little oil of turpentine also. Apply all over; and after a few hours, rub it off.

G. F. F. asks: What is the best thing to use in cleaning silver plated goods? A. Prepared chalk in cold water: apply with a plate brush, chamoise leather, or soft woolen rag.

Mr. E. Kireersky, of Penza, Russia, and many other correspondents ask for further particulars as to burning brick with petroleum, described on p. 53 of our current volume. Will our "Old Subscriber" send us the details?

J. S. G. asks: 1. Has the exhaust steam of a high pressure engine ever been used as a source of power? A. Yes. In the compound engine, its expansive power is utilized. In other inventions, it is used to run a second cylinder with vapor of a liquid of a low boiling point. 2. How is a compound engine constructed? A. See pp. 116, 391, vol. 25.

C. R. McC. asks: I. Can water be raised and thrown with hydraulics to 200 feet elevation and 1,500 feet distance through 1/2 pipe with a strong spring and 21 feet of fall from springhead to ram? Would such a situation afford a reasonable supply of water for a dwelling and barn, by using the most improved ram? A. You can make a good ram answer the purpose, if you have plenty of water in the spring. A manufacturer will give you instructions as to the proper size of pipes.

C. F. B. says: I have a room 14 x 15, heated by a stove, which I wish to ventilate by leading a register into an air passage between the boarding and plastering. Where should the register be put, at the top or bottom of the room? A. You should have two registers, one at the top and one at the bottom.

R. A. M. asks: Would it be practicable to plate steel pens with zinc, tin, or other metals, either by dipping them in the molten metal or by electricity? Would it prevent them corroding without injuring the temper? I have succeeded in tinning a few without injuring their writing qualities, with a common soldering iron, with the aid of muriate of zinc. A. Steel pens plated with different incorrodible metals are largely manufactured.

P. H. W. asks: 1. What is tin foil, such as is used for wrapping tobacco, composed of? A. An analysis of a piece of tobacco tin foil in our possession showed that it contained mostly tin with some lead. Seven other samples obtained from different sources had the same composition. 2. What are storm glasses, indicating changes in the atmosphere in advance of storm, wind, etc., filled with? A. See p. 123, vol. 29.

J. W. B. says: I wish to make a Ruhmkorff induction coil. I have 10,000 feet of No. 32 silk covered wire for the secondary coil. Of what size and length of wire should the primary coil be? A. Forty feet No. 12 copper wire, silk-covered and varnished with shellac in alcohol. 2. What should be the diameter of the iron core? What should be the length of the coil? A. A bundle, 1 inch in diameter and 1 foot long, of No. 16 soft iron wire. 3. What amount of surface should the condenser have? Are tin foil and paper the best to make it of? A. 50 square feet of tin foil and 50 square feet of paper soaked in melted paraffin is the best known. 4. What is the best material for the ends of the coil? A. Glass or hard rubber. 5. About what length of spark will I be able to get from a coil of that size? A. If carefully drawn, pure copper wire is used, well insulated with paraffin or shellac, you will get a spark 1 inch through air, with two cells of Grove's battery. 6. What is used for polishing black rubber with? A. French polish. 7. Do you think I could make a Ruhmkorff on this plan, without loss of power or other defects? A. Yes; it is better to have less metal around the secondary coil. 8. What book on electricity and magnetism do you think the best? A. Noad's is a good work.

W. H. B. asks: Is there any quick way of finding the number of diameters which a small compound microscope will magnify? A. For scientific purposes, it is generally determined experimentally by means of a micrometer. If you can find the focal distance of the objective and the eyepiece, the magnifying power of each can be determined approximately by dividing 10 by the focal distance. The magnifying power of the microscope is equal to the product of the two magnifying powers so found.

M. M. S. asks: 1. What load will a thimble skinned wagon bear, with 4 inch spindles, the wheels being three feet and one half in height? A. We are not familiar with wagons of that kind. 2. What is the largest sized cube that can be cut from a globe whose diameter is 12 inches? A. One having a face about 6.93 inches square. The rule is to multiply the radius of the sphere by 1.516, to find an edge of the cube. It is given in nearly every work on mensuration.

M. & S. ask: What is best to use on chills to prevent blowing? A. You do not send sufficient details to enable us to give you any information. Matters of this kind are best learned by experience. They may be considered secrets, akin to the secret of Ogle, who was asked how he mixed his colors, and replied "with brains." We have seen it stated, however, that it is a good plan to cover the mold with a mixture of red lead and oil.

L. T. W. asks: 1. Will you give me the formula for ascertaining the number of square inches of heating surface in cylinder and flue boilers? A. Heating surface of cylinder boiler in square feet = 8.1416 x radius in feet x length. Heating surface of flue boiler in square feet = 8.1416 x radius of shell in feet x length in feet + 8.1416 x twice the number of flues x radius of flues in feet x length of flues in feet. 2. How do you estimate the horse power of a boiler, either cylinder or flue? A. We can give you no definite rule. 3. How can I compute the area in square inches of a square fire box? A. The area is equal to the product of the length and breadth, supposing the surface to be flattened out. 4. How many horse power would vacuum add to an engine, or, in other words, if a high pressure be converted into a low pressure engine, how would you estimate the added horse power? A. It would increase the mean pressure in a certain ratio, and the horse power in the same ratio, other conditions being the same.

J. B. asks: Can a concavo-convex lens, 1 1/2 inches in diameter, be made to throw a focus 1/2 inch in diameter at a distance of 48 inches? A. The focal image of a star is a bright point. The diameter of the image compared with that of the object is proportional to their respective distances from the lens, if aplanatic.

A. S. says: 1. We put steam from a small engine into a tank for supplying the boilers, likewise the steam from pump at boilers; we use olive oil for lubricating. Will it hurt our boilers or cause them to scale? We use terra japonica as a boiler purge, and find it very effective in removing scale. A. The oil will not injure the boilers, unless you use a very large quantity. 2. When you speak of heating surface (in calculating horse power), do you mean all the parts exposed to the action of the fire or heat, such as the tubes, back end of boiler, and all below the brick work? A. All this surface is ordinarily counted. Some persons, however, do not estimate all. 3. Is there any means of finding where there is water for a well without digging for it? A. If the soil is not rocky, you can make borings with very little trouble. 4. Does a broad belt on a pulley cause more friction if only the same weight be applied, as a narrow one? A. No. 5. What is the best material for preserving belts and keeping them in working condition? A. Castor oil is often recommended.

E. S. W. asks: What is the amount of resistance per foot of cross section to a body moving in the air at given rate, say 100 feet per second? When the velocity is equal to that at which air will flow into a vacuum, is the resistance equal to our atmosphere? Does much depend upon the shape of the body? What reliable experiments have been made, and where can the results be found? A. Experiments on this subject are far from complete. A resume of the most important is given in the Encyclopaedia Britannica, and the rule is deduced that the resistance of the air to the motion of a plane surface, in grains per square foot, is equal to 16 times the square of the velocity in feet per second. A sphere does not encounter more than one fourth the resistance that would be opposed to the motion of a plane surface with the same cross section.

P. O. T. asks: How can I estimate the amount of tannic acid in bark, leaves, and roots of different kinds? A. By precipitating the tannin with protochloride of tin mixed with chloride of ammonia, and measuring the precipitate.

L. W. E. asks: How many gallons of water are required, per horse power, to run a small engine for a day? A. From 50 to 75 gallons per day of 10 hours.

G. C. C. says: I am running an eight horse engine with coal. The furnace has a poor draft; would the pipe referred to in a recent issue of your paper, to throw steam direct from boiler to stack, be of any use? We run the engine all the time, and exhaust into the stack. Would it be of any use to reduce the size of the exhaust nozzle? It is large, I think 1 1/2 inches in diameter. How small shall we make it? A. Generally, the exhaust can be arranged to make enough draft.

G. E. S. asks: Will a tin boiler, 2 feet long and 18 inches in diameter, be large enough and strong enough to run an engine cylinder 5 inches stroke and 3 inches diameter, at 80 revolutions per minute? A. Yes.

J. T. and others: Foaming in boilers is especially caused by impurities in the water, insufficient steam room, and too heavy firing.

W. S. W. says: 1. In your issue of March 14, the statement is made that the combustion of 1 lb. of coal in one minute is productive of a force equal to the work of 300 horse power during the same time. A. The work represented by 300 horse power is the same as that required to raise 9,900,000 lbs. 1 foot high in a minute. Now every unit of heat produced by the combustion of coal, if it could be converted into work, would be capable of raising 772 lbs. 1 foot high, so that the number of units of heat required for the production of 300 horse power would be about 13,000 a minute; and the total heat of combustion of ordinary coal exceeds this. 2. Have not theory and practice shown us that 2 1/2 lbs. consumption of coal to the horse power per hour is a very favorable result? A. The large ocean steamers at present consume about 2 1/2 lbs. of coal per hour per horse power. Better results are obtained in some cases.

W. W. B. asks: 1. Will a gun with a long barrel shoot straighter than one with a short one? A. Other things being equal, probably one will shoot with as much precision as the other. 2. What was the name of the first newspaper printed in the world, and where was it published? A. The first periodical newspaper whose existence is not disputed; was published at London, May 22, 1622, by Nicholas Bourne and Thomas Archer. It was called The Weekly News. 3. Where was the first balloon voyage made, and who made it? A. At Paris, November 21, 1783, by Pilatre de Rozier, and the Marquis d'Arlandes. 4. How much does the atmosphere surrounding the earth weigh? A. About 11,000,000,000,000,000 lbs.

COMMUNICATIONS RECEIVED.

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

- On a Theory of the Sense of Smell. By D. E. G.
Onlaying out Teeth of Gears. By H. I. C.
On a Museum of Natural History. By J. G. L.
On the Cause of the Tides. By W. M. D.
On Steam on the Southern Rivers. By G. W. S.
On Drying Lumber. By H. R. T.
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On Using Old Tin Cans. By J. P.
On Hydrogen. By V. P.
On Modern Telegraphy. By G. L.
On the Keely Motor. By D. D. P.

Also enquiries and answers from the following:

- C. W. Y.—D. E. G.—J. T. B.—C. W. B.—H. G. H.—W. W. H.—R. H.
Correspondents whose inquiries fall 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.
Correspondents in different parts of the country ask: Who makes ax helves and similar wooden articles? Who sells electric gas-lighting apparatus? Who makes cotton seed hullers and linters? Who makes a wood engraver's ruling machine? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

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.

[OFFICIAL.]

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