## Business and Personal.

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

All Hot Air Furnaces changed to Steam-Same heaters and registers; no boiler; one Furnace, o whole Patent. H. G. Bulkley, Cleveland, Ohio.

Water Front, also Stores or Lots to Rent, Delancy St., E. River. Andrews Bro., 414 Water St., N. Y Nickel Plating; a new and superior mode, not infringing Patents, for sale and references given by A. Scheller, 121 Forsyth Street. New York.

Buy Gear's Improved Variety Moulding Machine. Warerooms, Boston, Mass.

For Sale, Machine Shop and Foundry. Address, Wagoner & Matthews, Westminster, Md.

Sperm Oil-No lubricator like it. See Keladvertisement on another page.

Patent Steel Measuring Tapes, manufactured and sold by W.H.Paine, Greenpoint, N.Y. Send for circular.

For Sale, or Worked on Royalty, the Patent Weighing Scoop, indispensable in all Families. D. H. Priest & Co., 3 Tremont Roy, Boston, Mass.

Iron Roofing. Scott & Co., Cincinnati, Ohio. Manufacturers of Submarine Excavators, Address, with Circular, Geo. W. Parsons, Salisbury, Md.

Wanted—A good Second-hand Portable Engine on Wheels, 6 or 8 H.P. Address, with price and full particulars, T. F. Cramer, Woodsboro, Frederick Co., Md.

Shafting and Pulleys a specialty. Small orers filled on as good terms as large. D. Frisbie & Co., New Haven, Conn.

Steel Castings to Pattern. Can be forged, welded, and tempered. Address Pittsburgh Steel Casting Company, Pittsburgh, Pa. All work warranted.

A Superior Printing Telegraph Instrument (the Selden Patent), for private and short lines—awarded the First Premium (a Silver Medal) at Cincinnati Expo. sition, 1872, for Best Telegraph Instrument for private use—is offered for sale by the Mercht's M'f'g and Construction Co., 50 Broad St., New York, P. O. Box 6865.

Jos. Minchener, Machinist, of Troy, Alabama, offers his services as Agent, to represent any thing that may be of use to Planters, Builders, or Manufacturers.

Wanted, a Machine to make a flat flour har-irel hoop out of black ash timber; also, any Machinery that will decrease the cost of making Flour, Fruit, or Lime Barrels; also, a Machine to shave a flat hoop ready for the barrel. Address P. O. Box 2533, Buffalo, N. Y.

Good Words for the "Gardner"—From Powers & Weightman. Philadelphia, January 6, 1873.

B. B. Waggener, Secretary, No 1806 Chestnut St., Philadelphia. Dear Sir:—At the gas explosion which occurred at our store, No. 56 Maiden Lane, New York, on the 31st of December, the Gardner Fire Extinguishers pro-cured from you were used to great advantage. Powers & Weightman

To Machinists and Manufacturers in want of a prompt, energetic man of long experience to take charge of work, or act as Agent. Address Carrier, 98 P. O., Philadelphia, Pa.

Buy Wood Working Machinery of Gear, Boston, Mass.

To G. G. L.—Having had experience with some patents for chemically preparing and dyeing moss for mattresses, will communicate with you, with your full address directed to H., Box 214, Plainfield, N. J.

Hydraulic Presses and Jacks, new and second hand. E. Lyon, 470 Grand Street, New York.

Foot Lathe for \$22. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Wanted, reliable and responsible parties to Sell Engines, Saw Mills, and other machinery manufac-

tured by the Mansfield Machine Works, Mansfield, Ohio. For the Best Circular Saw Mills and Steam Engines, Stationary and Portable, of all Sizes, apply to the Mansfield Machine Works, Mansfield, Ohio.

For Wait's Improved TurbineWaterWheels, Improved Mulay, Gang, and Circular Saw Mills, Paper Engines, Rope Cutters, &c. &c., address Marthew & Van Wormer, Successors to P. H. Wait, Sandy Hill, N. Y.

All Blacksmith Shops need a Holding Vise to upset bolts by hand. For such, address J. R. Abbe, Manchester, N. H.

Circular Saw Mills, with Lane's Patent Sets; more than 1200 in operation. Send for descriptive pamphlet and price list. Lane, Pitkin & Brock, Montpelier, Vermont.

First Class Bed and Platen Printing Presses to order on short notice by Sullivan Machine Company, Claremont, N. H.

Machinists—Price List of small Tools free Gear Wheels for Models, Price List free; Chucks and Drills, Price List free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Wanted, by T. R. Bailey & Vail, Lockport, N. Y., Planer, new or second hand, to plane 5 to 6 ft. ong, 20 to 26 inches wide.

All Fruit-can Tools, Ferracute, Bridgeton, N.J.

Nickel Salts and Ammonia, especially manufactured for Nickel Plating, also "Anodes," by L. & J. W. Feuchtwanger, 55 Cedar Street, New York.

"Minton & Co.'s Tiles," by appointment, Gilbert Elliott & Co., Sele Agents, No. 11 Clinton Place, 8th St., New York.

For 2, 4, 6 & 8 H. P. Engines, address Twiss Bro., New Haven, Conn.

English Patent—The Proprietors of the "Heald & Clisco Centrifugal Pump" (triumphant at the recent Fairs), having their hands full at home, will sell , for plastering. I am recommended to fill spaces with their Patent for Great Britain, just obtained. A great dry sand or dry ashes sifted fine. If I fill with brick, I

Can Tools, apply to Bliss & Williams, 118 to 120 Plymouth St., Brooklyn.

American Boiler Powder, for certainty, safety, and cheapness, "The Standard anti-incrustant." Am. B. P. Co., Box 797, Pittsburgh, Pa.

Scale in Boilers. I will Remove and prevent Scale in any Steam Boiler, or make no charge. Send for circular. Geo. W. Lord, Philadelphia, Pa.

Gauges, for Locomotives, Steam, Vacuum ir, and Testing purposes—Time and Automatic Record ing Gauges-Engine Counters, Rate Gauges, and Test Pumps. All kinds fine brass work done by The Recording Steam Gauge Company, 91 Liberty Street, New York,

Dobson's Patent Scroll Saws make 1100 strokes per minute. Satisfaction guaranteed. John B. Schenck's Sons, 118 Liberty St., N. Y.

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

Boynton's Lightning Saws. The genuine \$500 challenge. Will cut five times as fast as an ax. A six foot cross cut and buck saw, \$6. E. M. Boynton, 80 Beekman Street, New York, Sole Proprietor.

The Berryman Manuf. Co. make a specialty gyroscope. Consult Peck's "Mechanics for Schools," of the economy and safety in working Steam Boilers. I. etc. We will endeavor to find space and time to trans-B. Davis & Co., Hartford, Conn.

Absolutely the best protection against Fire Babcock Extinguisher. F. W. Farwell, Secretary, 407

Broadway, New York.

Steel Castings "To Pattern," from ten lbs.

upward, can be forged and tempered. Address Collins
& Co., No. 212 Water St., N. Y.

The Berryman Steam Trap excels all others. The best is always the cheapest. Address I. B. Davis & Co., Hartford, Conn.

Williamson's Road Steamer and Steam Plow with rubber Tires. Address D. D. Williamson, 32 Broadvay, N. Y., or Box 1809. For Steam Fire Engines, address R. J. Gould,

Brown's Coalyard Quarry & Contractors' Ap. paratus for hoisting and conveying material by iron cable, W.D. Andrews & Bro.414 Waterst.N. Y.

Millstone Dressing Diamond Machine-Simple, effective, durable. For description of the above, see Scientific American, Nov. 27th, 1869. Also, Glazier's

Diamonds. John Dickinson, 64 Nassau St., New York. Belting as is Belting—Best Philadelphia Oak Tanned. C. W. Arny, 301 and 303 Cherry Street, Philadelphia

adelphia, Pa.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrew's Patent, inside page. For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa.,

for lithograph, etc.

The Berryman Heater and Regulator for Steam Boilers—No one using Steam Boilers can afford to be without them. I.E. Davis & Co.

Always right side up—The Olmsted Oiler, enlarged and improved. Sold everywhere. Gatling guns, that fire 400 shots per minute, with a range of over 1,000 yards, and which weigh only 125 pounds, are now being made at Colt's Armory, Hart-

Electro Gold and Silver Plater on all metals

of 12 years' experience, is open for an engagement. Address S. C., 99 Union Street, Newark, N. J.

Hand Brick Machine—Parties building a machine that will re-compress the brick after moniding and partially dried, will please address the Editor of this paper, Box 773, New York City. Send circular.



1.—V. asks: What is the cause of the scale which is found on malleable iron castings?

2.—C. asks if there is anything better than wax to fill cracks in wood previous to varnishing; if so, what is it?

-H. L. B. asks: How can I remove paint (in pinhead spots) about a year old, from plate glass

4.—H. L. B. asks how to make the carmine stampink used on a ribbon stamp for canceling purposes.

5.—C. asks: How can I case-harden part of an object, such as the face of a hammer head, and leave the rest soft? -J. B. B. asks: What varnish or compo

sition will make cloth waterproof without causing it to be stiff and sticky, or to lose its color?

7.—C. asks: Can corundum be used for grinding on a wheel, like emery, and is it better than emery for grinding steel and iron

 $8.\text{--}A.\ M.\ J.\ says:\ I\ would\ like to know what cement, if any, there is that will stop the leakage$ of crude petroleum from iron tanks which are caulked and riveted.

9.—J. E. F. asks how to preserve and stuff birds, and how to dress their feathers, which get spoiled in killing.

10.-L. H. W. asks: How can I temper small pieces of steel wire, 1-16 of an inch in diameter and lessand 1 inch long? I wish to temper 100at a time.



G. G. S. asks: What is the present variation of the magnetic meridian from the true meridian? What is its variation at different times since 1750? Is it still moving westward, and has it been so through that entire period, or has any change from the west to east taken place? If so, when didit occur? Answer: The information desired can be obtained from the United States Coast Survey Report. The variation is still moving westwardly and has been continuously since the date given. The exact variation at the given locality can be termined at any time by any surveyor who understands his business thoroughly. Apply to the nearest one.

A. H. S. says: I intend to build a residence next spring, and desire to make the house warm and rat proof, if it can be done without too much expense. I the lath be sufficient to sustain the pressure of the sand the studding being 15 or 16 feet high? It is suggested that sand would stifle any fire that might start by closingsroundit, thus rendering building much safer. Answer: There is danger of the outside boarding becoming open by shrinking and warping, in which case the sand will run out through the open joints or laps. Dry sand has been used for deafening between floors to the extent of four inches in thickness, but a special boarding is put in to receive it, so as not to bring the weight upon the plaster: the result in this case as to dry rot has not been determined. But timber encased in plaster and in iron has developed a very dangerous rot in this city. Your safest plan will be to interlath between the studs and plaster one good coat, if you do not wish to incur the expense of brick filling. But you had better filling the end of your floor joists with brick, so as to cut off the connection of the floor spaces with the wall spaces, and so prevent the passage of wind or rats into the floors.

S. J. H. asks: Why does not a top fall when spinning, the same as when it is not spinning? Answer

late it into less purely mathematical language at some future time.

E. O. McC. asks: How far can water be drawn on a perpendicular, with a fire engine? Answer: Probably not 30 feet. 3395 feet is the highest that a column of water can be supported by ordinary atmospheric

J. V. H. N. says: I have a little turbine wheel with which I run my printing presses. It is situated in my second story. The manufacturer stated that I would lose no power by placing it there, provided I made a draft tube of the discharge pipe, by inserting its end in a tub of water and making it air tight. I had the discharge pipe made siphon like at the lower end. The query is: Do I lose power by the siphon arrangement; and, if it is not perfect, would I lose power by the water and tub arrangement, and if so, how much? If I lose power by either arrangement, I should like to know, for in that event I would place the thingin my cellar. Answer Any arrangement by which you make a complete seal of the lower end of the discharge pipe against the ingress of the air, and thus retain the tube full of water, will be effective with a properly constructed wheel, provided that it is not placed at a greater hight above the dis-charge opening than that due the pressure of the atmosphere, and provided that the arrangement does not impede the flow of the water. If the seal is imperfect head is lost and also a proportionate amount of power, by the entrance of the air.

J. F. asks which will be most effective, a circular saw with 43, or one with 26 teeth, in cuttingpine board. Answer: The size of saw or speed of its periph-ery should be given. We cannot give a definite answer as the question is asked. At one speed, the teeth might be set too close if 48 in number, and at other speeds, they would be too far separated if 26 were used.

O. K. asks if it is advisable to drive a 41 feet burrmillstone with a quarter twist belt from the engine shaft to the spindle, and how wide must the belt be. Answer: We do not like quarter turn flat belts, but properly arranged, and with plenty of length, they some times do well. Try a 5 inch belt, if you have good distance between the stone and the line shafting.

J. P. W. says: I have lately put into my shop a ventilator 14 inches square and about 14 feet long, extending from the ceiling overhead, 7 feet out of the roof. I have a hood at the top to cover it, which can be raised any distance, from 2 inches to 3 feet: but it will not draw. A current of air sets downwards most of the time. What is the trouble? Answer: We presume that an equally large volume of air rises through the chimney or elsewhere, where the upward draft is more powerful.

T. I. F. asks: In making the driving or band wheel of a common horse power larger, to inci speed, what proportion in length ought the levers to be, to make any gain in favor of the team, if any, as the larger the circuit the slower is the speed? Answer: Increasing the size of the band wheel in the horse power machine will increase speed of driven pulley at the ex pense of the driving force, which will diminish in similar proportion. No alteration for the purpose of regaining the lost advantage will be successful except by sacrificing the speed gained.

O. N. asks: Which end foremost will a log, thirty feet long and twenty inches in diameter at one end, tapering to a point at the other, tow easiest in water? Answer: The log will move more easily withits sharp end foremost. The principal resistance in propelling properly formed bodies in water comes from the friction between the surface of the body and the water. In the case of a blunt log or a blunt vessel, the resistance is increased by the piling up of the water in front. If the log is moved sharp end first there is no front piling of the water, but the latter is divided and swings sidewise with little or no resistance, like the pendulum of a clock.

T. R. L. says: Last summer I noticed on the grass of mylawn a circle or ring of a bluish or ash color, about 8 inches wide and 10 feet in diameter. Upon examination I found that each blade of grass composing the circle was covered on both sides with a kind of mildew, which, when undisturbed, was of the bluish color but when rubbed between the fingers, it became black The grass was about 4 inches long, and when the mower was run through it, this substance rose in a cloud and was blown away. On another part of the lawn, there was another portion of a circle, about one half. As I never saw one before, can you let us know what caused it, and why it assumed the circular form? Answer: It would be impossible to give a positive answer without some of the substance for microscopical examination But it is very probable that a mushroom would have been found in the center of the circle, and that the "mildew" was caused by a scattering of the myriad spores of the fungus.

E. A. N. says: A discussion has arisen be-tween myself and an old experienced engineer relative to some trouble that I am having with the feed pipe of the engine that I have charge of. The bends in the heat er last but a very short time, and I have had to renev the whole pipe from the pump to the check valve (some parts of it several times) in the last twelve months. The tank is round, and about 8 feet in diameter at bottom and just taper enough to hold hoops; it is between 8 and 9 feethighand is raised 9 feet from the ground. The pipe from the tank to the pump is one inch gas pipe. The pump has a solid plunger 2% inches in diameter and the proposed to fill every space between the studding with brick and mortar, leaving space of 1% inches for room water contains some mineral that injures the iron when heated; I say that the pipe is entirely too small, and I their Patent for Great Britain, just obtained. A great chance for business in England. Address Heald, Sisco & Co., Baldwinsville, N. Y.

For the best Presses and Dies and all Fruit can Tools, apply to Bliss & Williams, 118 to 120 Plymouth pressure in boiler to contend with, would create great friction. In proof of my position, I called his attention to the stand pipe (which is 11/4 inch gas pipe from the check valve to the boiler) and is seemingly as sound now as when put in. Willyou give your views on the subject? Answer: We think the pipe too small altogether, unless the pump runs very slowly indeed. If the trouble arises from oxidation by anything dissolved in the feed water it should be easily detected.

D. M. says: I have a brick building covered ith tin, with a parapet roof; and from some defects in putting on the tin, it leaks badly, especially during very heavy rains. The mechanic blames the tinner, and the tinner the mechanic. I think both are to blame. Please advise me whether I had better tear off the roof or not I had the parapet roofto secure safety from fire from buildings a short distance off. It may be best to change the roof from a parapet. Answer: Do not alter the parapet, but insist upon the tinner's making the roof tight. He should find the openings in it and solder them tight; and if the parapets are of brick, as we presume The principle is, in some respects, similar to that of the they are, he should take paint skins and cement the joint where the tin enters the brick work. Most likely the fault lies here.

O. H. asks: What power for each square inch of water passing through pipesfroman elevation of 400 feet a distance of five miles could be obtained? I am desirous of this information, as my farm is about the above distance from the water works, and the water pipes to supply the city are more than half the distance down in the streets; and if I could convey the water the distance named, it seems to me I should have, with a five or six inch pipe, a power to cost less than to build a steam engine of ten horse power. Answer: Every ten gallons of water, under the head indicated, is capable of developing about a half horse power, if used in an ordinary water wheel of small size. The pressure will be likely to varyimmensely from that due the head with the greater or less amount of water used in the city, and the friction of the pipes will cause considerable loss. The power actually derived from the source referred to will be probably but a small proportion of that due the head, but we can not undertake to say how small that friction may be. We should anticipate that steam power would be cheaper than water power, and also more reliable, under such circumstances.

I. P. H. asks: When was the game of chess nvented, and by whom, and in what country? Who is the standard authority on such games? Are there any reliable books on taxidormy, and whose is bestfor beginners in that art? Can you inform me where Baiern islocated, as I cannot find it on any of the maps? I think it is in the Austrian empire or near it. Answer: The game of chess is said to have been invented in India 5,000 years ago. Staunton and Hoyle are the standard authorities Professor S. F. Baird has published directions for taxidermists in the Report of the Smithsonian Institute for 1856. Baiern is the German name for Bavaria.

J. asks for a simple method of detecting explosive oils, and states that his neighbors use a burning fluid of which the vapor escapes through a burner. He believes a good refined coal oil to be preferable to this fluid, whatever the latter may be. Answer:  $\Lambda$  perfect test for mineral oil was described on page 341 of our last volume, under date November 30, 1872. J.'s letter is one of many asking for instruction on practical matters which come to us every day, answers to which have been already published in our journal. Better evidence of the continued usefulness of the Scientific American could not be adduced.

C. H. says: On December 13, about sunset, there was abluishlight, apparently about the size of a common barrel, at a considerable hight in the air. It traveled westward, and would not have been noticed by many but for the tremendous noise, which jarred the carth and made the windows rattle. It continued roaring all over the sky for several minutes. What was it? Answer: If the blue light had been invested with a tail, it would be easy to account for the phenomenon; but wanting that appendage, science fails to offer a satisfactory solution.

W. H. C. says: I have had an argument with a friend, who takes the position that the sails of a ship, being the first part seen as she approaches, is not a proof of the rotundity of the earth. He argues that the circle of the earth's circumference is too great, and approaches too near a straight line to produce this result within the distance that a ship can be seen with the unaided eye. How is this? What is the rotundity of the earth per mile? Answer: Eight inches.-How far can a large ship be seen on a smooth sea? Answer: About 17 miles, if the masts are 200 feet high.—Suppose a straight line, 50 miles long, to touch the circle of the earth at the center of the line, how far would each end of that line be from the circle? Answer: About 417 feet.

R. H. M. says: We have two flue boilers, each of the following dimensions: 16 feet long, 4 feet di ameter, with 48 three inch tubes; the grate surface is 5 feet by 4 feet. They are said to be of fifty horse power We have also two other boilers, each 16 feet long, 4 feet 6 inches diameter; one has 64 three inch tubes, the other, 62. The grate surface is 5 feet by 4 feet 6 inches; said to be of 70 horse power each. On the last named boilers our working pressure is 80 pounds; we very frequently find great difficulty in keeping up this pressure, with only one hundred horse power of work on our engine. The length of steam pipe is barely 50 feet, consumption of fuel, 6 tuns best soft coal, in twenty hours. What I desire to know is this: Is the estimated power correct according to dimensions given, allowing the usual percentage (which I believe is 15 per cent) for condensation, etc.? Is the consumption of fuel out of proportion to the amount of work obtained? And is the grate or fire surface sufficient? Answer: Good builders of steam boilers usually allow twelve feet of heating surface per horse power, and, with good engines and boilers, it is sufficient. Five hundred and sixty pounds of coal per hour, with a good engine and boilers, should give at least 120 indicated horse power, and with the best engines and boilers in the market, 100 horse power should be obtained with a consumption of one half the amount of coal given by our correspondent. The proportions of the boilers described seem to us good. Examine the engine and the setting of the boilers. There is a serious defect somewhere

C. F. W. says: In estimating the power of antifriction cams, I take it for granted the law is the same as for an inclined plane, namely, as often as the hight is contained in the length the power is doubled; but in my case the length of the plane is 6 inches, the hight3 inches, and when used, both planes work at the same time, but the hight is double, making 6 inches. Is there, or is there not, any power gained besides what is gained by the lever to work the same? Answer: The relation of force exerted to resistance overcome, in the whole combination, can be determined by multiplying the force exerted by the distance over which it moves in its own direction and dividing by the distance traversed by the table of the press. The result gives the resistance which may be overcome, whatever the intermediate mechanism, and provided there is no friction

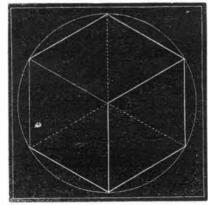
M. D. K. asks: 1. What is the highest speed attained in printing cards, circulars, etc., and what is the name of the press? 2. How can I ascertain the power of a toy steam engine? 3. Is there an illustrated dictionary of mechanical terms published? 4. How are colored lithographs made, and are all the colors printed at one impression? Answers: 1. About 1,000 per hour. by the Gordon press or some one of its modifications. 2. Toy steam engines are generally too small for the ordinary formula to accurately represent. Set your engine to work raising a weight, and remember that force sufificient to raise \$3.000 pounds a foot high in a minute s a horse power. 3. Consult a bookseller. 4. Each color on a lithographic print is produced by a separate impres-

A. A. D. asks whether the power of a hydraulic press is doubled or quadrupled by the use of two or four small pumps, which inject the water into the large cylinder, instead of one; or, if not, whether the effect of two or four of such small pumps would stmp. eequal to the effect of one larger one, the diameter of b

rather the area, of the piston of which is equal to the sum of the others. Answer: To determine the power of the hydraulic press, measure the diameters of the pump plunger and the ram of the press. The square of the diameter of the ram is divided by the quantity obtained by multiplying the square of the diameter of the plunger by the distance from the center of the plunger to the fulcrum of the pump handle and dividing by the whole length of handle. The result will be the number of times that the force exerted by the press exceeds that exerted on the pump handle. Friction is not considered. The action of four small pumps worked by the same handle would be equivalent to that of a single pump of double diameter, that is, of area equal to the four combined.

J. K. asks: Is it safe to use any remedy hen chemicals are used, to remove scales from boilers; Answer: Mechanical means are always to be preferred in the removal of scale once formed, whenever they can be employed. The use of chemicals, in weak solution, where their action can be carefully watched, is proper. If they contain any acid, however, they will injure the exposed metallic surfaces wherever they may come in contact with them. Some apparently harmless remedies roduce acids by their decomposition, and serious injury is thus semetimes caused.

To E. E.—To form a perfect cube in perspective, inscribe a regular hexagon in a circle, then connect each alternate angle with thecenterby a radius. This will give a cube.



To W. G. B.—This communication was received too late to comply with request relating to an earlier note. The desire of our correspondent is, how ever, fully complied with in our last remarks upon the subject of the balance wheel. The only real gain in attempting to balance a reciprocating piece by a rotating one is that derived from changing the direction of the disturbing action of the momentum. For example, the reciprocating parts of a horizontal stationary engine, if running at high speed, produce horizontal strains which its foundation and holding down bolts are less well fitted to resist than to meet the vertical strains which are produced by the momentum of the rotating piece, which may be used to neutralize those horizontal strains.

J. H. D. says: A friend claims that, if a weight of 40) lbs. be put on a wagon axle (which is 200 lbs. on each wheel), the pressure is the same on the top of the wheel as on the bottom; while I assert that, if there are 14 spokes in the wheel, there is just one fourteenth of the weight on the top. Which is right? Answer: The problem proposed involves the higher mathematics. If the rim is absolutely rigid, and if the joints are unyielding, the strains on the several spokes will vary in proportion to the squares of the cosines of the angles which they make with the vertical. In this case, the force resisted by the vertical spoke, either at top or bottom, is about two fourteenths of the total weight on the wheel, where all the spokes take their proportion of the weight, as indicated above.

X. Y. Z. says: Will some one inform me what causes sinks, hollows, or low places in brass castings? Answer: The defects you speak of are due to various causes, such as uneven shrinkage, molds not thor oughly dried, etc.; but principally uneven pouring and too little pressure in the metal from the pot.

J. G. W. sends a mineral specimen and says: The piece Isendyou is broken off from a larger piece weighing % of a pound. It was found while excavating for a cellar and was embedded about three feet below the surface, in a soil composed of sand and clay When found, it was covered with an oxide fully 34 of an inch thick. Many who have examined it think it is of meteoric origin. But I have always supposed that meteors contained a considerable percentage of iron; this does not appear to, for the minutest particles are not in the least affected by a powerful magnet. Answer: It is not of meteoric origin, but is iron pyrites (sulphuret of iron) which is not attracted by the magnet.

S. S. W. C. says: I am using a plain slide valve engine, 10 by 24 inches. The valve cuts off at about two thirds of the stroke. Is it possible to set the eccentric so as to cut off sooner and still give sufficient lead, without changing the length of the valve? Answer: The engine referred to is probably as well arranged as will be foundpossible. To cut off shorter with a single slide valve would probably cause excessive cushioning. To make a change would require, also, a change in the length of valve face.

C. asks how to make a machine to sand paper wood. Answer: Use canvas belts strongly sewed together at the ends. The threads may be so tied togethr as to leave the face on emery side of belt perfectly smooth and level. Size the belt with a coating of thin glue and then let it dry. Hand the belt over two pulleys, so that it can be easily turned. Use the best glue, of about the consistency for glueing wood; put it on hot with a brush, sifting the sand or emery on at once. Go round the belt as quickly as possible, then lay it on a smooth plank, and roll the sand or emery into the glue as hard as possible (an iron pulley, loose on a mandrel, is best); then hang up the belt to dry.

M. H. B. asks: How can I work a blue color into soap? Answer? Ultramarine and smalts or zaffre are the materials used; the pigment ought to be stirred into the soap when the latter is in the mold. The fear that either of these materials will turn green is entirely unfounded.

S. L. A. says that a steel square which he had kept oiled has lost its spring, and asks if oil affects the temper. Answer: The simple covering with oil cannot effect the hardness and elasticity of steel. It is a fact that oil and fats are used to anneal steel, especially thin articles, like springs, but in this case they are dipped into a bath, heated to the point of ignition. Sometimes the tools are covered with the fat or oil, whereupon the

there is a thumping or pounding, like striking with a heavy hammer, from the time we get 5 lbs. of steam till we have 40 lbs., when it ceases. What is the cause of said pounding? The boiler is a large fiue boiler, four feet in diameter and eighteen feet long. The connection pipe from the pump is exposed three feet to the fire, and is a four inch pipe. When in front of boiler the thumping sounds at back, and at back, sounds in front, and is o heavy as to jar the whole mill and to be heard four or five rods outside. Answer: We presume that the action described is due to the presence of cold water in the steam pipe. Open the throttle valve and the pet cocks in the cylinder, or in some other way drain the steam pipe and allow steam to blow through until the pipe is thoroughly warmed.

D. M. O. asks: Is there any process by which grained sugar can be made from sorghum? Answer: The attempts to make granulated sugar out of sorghum have not proved economical. Several pamphlets have been printed by agricultural publishers on this

J. K. M. asks: What is the most powerful bleaching process, and how can I apply it for bleaching an animal substance? Answer: The best bleaching agent for ordinary purposes is chloride of lime. Permanganate of potash is also much employed. For house hold use, what is called Javelle water, to be had of drug gists, can be used to bleach linenand remove wine stains

J. P. C. says: I wish to illuminate a magic lantern with an electric light; what is the best battery to use, and what is the number of cups? Are there any magnetic or other machines that would answer the pur-pose? Answer: It is difficult to manage the electric light without employing Foucault's lamp, and this is ex pensive. Professor Tyndall made use of three of these lamps at his recent lectures in New York, and ran them with a bichromate battery of 50 cells. It is more convenient to illuminate a magic lantern with the calcium

J. F. asks for directions for testing bleaching powder (chloride of lime)? Answer: It is not easy for anyone but a professional chemist to test bleaching powders. The directions for accomplishing an accurate analysis are given in Fresenius' work on quantitative analysis.

VV. E. G., of Ky., sends a mineral specimen asking what it is, and of what use. Answer: It is purgalena, the great lead ore of commerce.

J. M. W. asks for a demonstration of the manner in which a bird rises through the air without exertion on its own part, and states that this will open a new field for perpetual motionists. Answer: If you have read the SCIENTIFIC AMERICAN carefully, you will know that a bird does not rise without exertion on its own part, and you will have a wholesome dread of anything further on the subject of perpetual motion.

F. A. K. says: A lever L has its fulcrum at the angle: the power moves the upper part, and the pres sure is exerted perpendicularly at the right hand extremity of the lower part. Another lever, of similar dimen sions and with its fulcrum similarly placed at the left hand extremity of its lower part, is of shape 1. Which will exert the greatest pressure? Answer: The latter, or 1 form. If the two arms of L are equal in length, there will be merely a transmission of power, less the friction, and no leverage at all. But in the latter form, the leverage and increased power will vary as the point where the power is applied is moved further from the fulcrum: and the leverage will be as this distance is to the length of the horizontal or lower arm of the 1.

E. M. asks: What cheap preparation can I use to make a box water tight against either hot or cold water? Answer: Dip the box in hot parafin.

 $J.\ B.\ W.$  asks for information with reference to the commission for observing the transit of Venus next year. Who has it in charge, and what has been published with reference thereto? He suggests that a table of contents for each number would be a valuable addition to our paper. Answer: Write to Professor Newcome, Washington, D. C., for information relating to the commission for observing the transit of Venus. We publish a table of contents for each number on our edit orial page.

C. M. asks if anthracite coal is injured by exposure to the weather, or by immersion in water? "If have soaked it in water for some days without any in-crease in weight." Is carbon soluble in any liquid without chemical change? Answer: Anthracite coal is con-siderably deteriorated by exposure to the air, a fact that is too much overlooked by dealers. There is no solvent for carbon.

A. G. T. says: I read the article on the use of arsenic in paper hangings, etc., and its effect on the health. I have a large case of stuffed birds in my sitting room, which are, of course, prepared in arsenic. Do you consider them injurious to the health of the occupants of the house; and is the profession of taxidermist an unhealthy one? Is Ure's Dictionary of Arts and Manu-factures an illustrated work? And could I find in it full descriptions of the manufacture of trams and organzine, and weaving of silk? Answers: Stuffed birds should be kept in close cases, and the room be well ventilated as moisture and changes of temperature will liberate some of the poisonous arsenic. Taxidermists are liable to all the symptoms of poisoning unless they are very cautious. The article on silk manufacture, in Ure's Dictionary, is fully illustrated.

D. W. P. says that he and another person have a dispute as to whether the heat of the sun's rays is increased by passing through plain glass of uniform thickness. "I hold that it is not; he says that it is." Aner: The heat of the sun's rays is very m in its passage through glass, but not nearly so much as

W. S. B. asks: Am I right in supposing that a cubic foot of atmospheric air, at a pressure of say one pound to the square inch, would, at a pressure of two pounds to the square inch occupy a space of two cubic feet and so on, and is it the same with all other gases? Whatis the best rule for determining the pressure of water at different hights? Answer: The volume of gases is governed by Mariotte's law, which is that, at e same temperature, the volume occupied by the same bulk of air is in inverse ratio to the pressure which it supports. If the pressure of the column of mercury in a tube is equivalent to one atmosphere, adding this pressure to that which the atmosphere exerts on the mercury we have the air subjected to double its usual pressure and it is, consequently, reduced in volume one half. If we subject it to a pressure of three atmospheres, it will be reduced to one third, of four atmospheres, to one fourth, of its original bulk. The only variations in the law are near the point of liquefaction of gases. For the pressure of water, see hydrostatics in any book of

H. C. S. asks if frost will follow down an

twelve inches below the frost level. Or, will a hydrant freeze, if the pipe is empty and the cut off valve is from six to eighteen inches below where the ground is frozen? Answer: If both the pipe and the hydrant are empty what is there to freeze

J. L. asks: Is the air which is injected into the receiver or heater of the caloric engine warmed by the exhaust before it is injected or not? Also, is the rigidity of a frozen road bed the only cause of the rails breaking? It is denied by some scientific authorities that iron is less tenacious when it is frosty, but experience seems to contradict such a theory. Answers: The air entering a hot air engine is not usually previously heated. Rails have slightly greater strength, probably when cold, but they have less elasticity and consequent ly are less well fitted to resist concussion. We presume that the last fact may fully reconcile experimental deductions with our experience.

E. H. B. says: The water in Lake Michigan, at one point, is nearly two feet lower now than it was in June, 1871. Some persons have an idea that the wearing away of Niagara Falls and the changing of the current in Chicago River is the cause ; but I am of the opinion that it is caused by the action of the elements or by evapora tion. Will you please inform us what is the cause of the great depression of the waters of this great inland sea? Also where is the wash or caving in of the bluffs and great clay banks along this shore deposited? The wash is immense every year. Answer: The hight of water in the great lakes is greatly influenced by the violence and direction of the winds prevailing during the season, as well as the greater or less amount of rain which has fall en within the drainage area from which the water flows. We do not suppose that the wearing away of Niagara Falls has had the effect noted, but it would probably require a geological survey to determine the real cause precisely. We presume that the soil washed from the banks is widely distributed over the lake bottom, and some of it is probably carried down the Niagara River.

C. A. M. says, in answer to A. J. query 3, page 10, that horn is clarified by first putting into boiling water, and, when thoroughly housed, itis placed upon a wooden pin of a convenient length, and scraped rom the tip downwards, removing a shaving the whol length of the horn at each stroke of the shave. It now has a clean surface, and is sawn into one or more cylindrical pieces of convenient size, each of which is split lengthwise by passing it over a circular saw projecting through a table. These pieces are now placed again in boiling water, and, when hot, transferred to boiling whale oil, from which, while still hot, they are taken and rolled or flattened and placed between sheets of Russian iron in a powerful screw hot press. The press is made of several adjacent cast iron boxes containing square openings to receive the charcoal with which they are heated. The pieces remain in about five minutes according to the temperature of the press, and when removed are in the form of flat, amber colored, transparent plates. The color will be darker according to the length of time the pieces remain in the press.

R. B. M. says, in answer to E. S. S., query 8, page 59: Jacket your pipes with asbestos paste, one half inch thick, and then protect the paste by a cover of thin boards or tin; charcoal pulverized, or any other non-conducting material will answer for the jacket. have jacketed my pipes with fine hay, and have had no

A. G. C. query 24, page 59, can temper his taps in the following manner: After hardening, polish the bottom of one of the cutting grooves until it is bright (an old fine cut file will answer); then place the shank of the tap in the tongs, with point of the tap from you and the polished groove on the upper side, and the point a little elevated; if a taper tap, the large part of the tap should come nearest the fire. Then move it back and forth over a slow fire, that has the coal charred so that it will not smoke. Heat evenly and slowly until the bright groove assumes a deep red color.—Z. D.

C. M. says, in answer to W. L. L., who asked for an explanation of the configuration of frost crystals on windows: The crystalline forms which the vapors of a room assume, while being condensed on the cold panes of a window, depend mostly on the surface condition of the glass. A glass plate, absolutely clean and fiat, would show no forms, the frost being equally distributed. The wiping or cleaning of the window inside the room is usually done in a roundish, spiral, or scroll like manner; hence the first adhesion of vapor, and the subsequent crystallization (if we can call it so) follows these lines and produces the well known fern-like or leaf-like forms But wipe one pane before a frost carefully by horizontal streaks only, and the next to it by vertical streaks; and the frost crystals will be formed in the same directions, respectively, much more resembling those of some chemical salts than vegetable shapes. Snow crystals forming in the air without any chemical or mechanical obstacles, are always hexagonal, with secondary forma tions of the same system.

H. M. W. says: C. A. de S. wants to be helped in his indexing. Having had to index29,000 words I think I have a right to speak about it. In the first place, I got hold of a somewhat stiffish paper (old ledger paper is excellent); then I cut it into slips of conveni ent size (1 inch by 2 inches will be about right). I put down on each slip one word or sentence (depending on the kind of index), with page and other reference if such is necessary. When every word or sentence which I wanted in the index was noted down, I got hold of 24 cigar boxes, which I lettered from a to z. I now distributed those slips into the boxes. This done, I put the contents of each box in a separate paper bag, put the now empty boxes again before me, got hold of a, and distributed all slips bearing words beginning with a between these boxes, thus, aa, ab, ac, ad, etc., to the end of the chapter. This done, I got hold of aa, and succe ly ab, ac, etc., and distributed those slips further. When arrangedalphabetically I pasted those slips belonging to a in proper order on brown wrapping paper. Having treated a in this way, I took hold of b, and so on to the end of the alphabet. It took me a fortnight (6 hours a day) to get through with the distribution, and after that the copying took me several months.

A. G. C., on page 59, asks how to temper taps. He must first of all bear in mind that a tap is simply a series of cutters on a bar; hence the cutting parts must be uniformly hard enough to cut, and the bas as possible to insure durability. This can be best accomplished by dipping at as low a heat as possible and making the outside hard, while the inside will be comparatively soft when rubbed off ready for tempering. Heat a heavy ring (a broken pulley hub is a sgood as anything), which have on side of your fire for use while hardening taps, and also a heavy pair of tongs, made hot in the same way. Take the lever end of the tap with the hot tongs, and insert the tap in the center of the hot ring, butdo not let it touch the sides. It is better to keep B. St. J. says: I am running a steam saw | H. C. S. asks if frost will follow down an turning itround. If the temper draws too fast, where emptypipe, covered at the top, so as to freeze at six or held by the tongs, cool it off; move backward and for-

pends on quality of steel and the size and make of the tap, and lastly the purpose for which it is intended.—P

W. A. W. says, in answer to J. E. S. (query 22, page 10), who asked how to make a boiler for a small steam engine, to be heated by a common stoye: Anything that you can make tight, with heating surface enough to make the requisite amount of steam, will answer the purpose. I saw a boiler and furnace in Grand Rapids. Mich., that was made something like a box stove with boiler set in the top, about one half the diameter of the boiler being in the firebox; there was no grate in fire-box or flue in boiler. It was cast iron and evidently all cast whole, except the bottom of the furnace and front end of boiler. The cylinder of engine was 3 by 5 inches A safety valve one inch in diameter will be plenty large; enough. Ten pounds pressure will be all you will need Why not gear up higher and run your engine at 100 revolutions per minute instead of 150?

J. W. says, in answer to J. E. S., page 378, volume XXVII., and W. G. B., page 27, volume XXVIII., on transmission of motion: I would say that it is simply absurd to refute a thing we have not seen practically tested. W. G. B. seems to be a true disciple of doubting Thomas, and much like the man who, when he heard of the first iron ship being built, swore it would sink. 1 simply assert that I have seen belts as wide as four inches workadmirably on the plan described by me. And further, it has come under my notice, since I wrote my communication, that seven inch belts were worked on this plan at the planing mill (recently destroyed by fire) on President street, Baltimore, and will be used againin the reconstructed building. I have only to add that, in constructing the shifter, it should only allow the edge of the belt to come fairly with the edge of the loose pulley, so that the pressure of the shifter with the pliability of the belt brings it in contact with the revolving fast pulley, when it takes hold quite easily.

## 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 Equatorial Protuberance of the Earth. By J. H.

On Aero Steam Engines. By D. B. T.

On Flux and Reflux. By R. W.

On the Action of Water on the Turbine. By J. B. R.

On a Unity of Action by Inventors, concerning Foreign Patents. By J. A. B.

On the Wheel Question. By II. E. M. On Protection from Fire. By H. & B.

On Financial Science, By N. L. On Tidal Water Power. By W. B. S.

On the Astronomy of the Ancients. By C.

On the Motions of the Sun. By A. D. On the Mineral Wealth of Virginia. By W. De H.

On Marine Camels. By E. S. F. On the Servant Question. By L. C. G. On the Use of River Water for Extinguishng Fires in New York. By W. B. D.

[OFFICIAL.]

On the Detection of Explosive Oils. By J.

## Index of Inventions

FOR WHICH

Letters Patent of the United States WERE GRANTED FOR THE WEEK ENDING

January 7, 1872,

AND EACH BEARING THAT DATE, [Those marked (r) are reissued patents.]

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