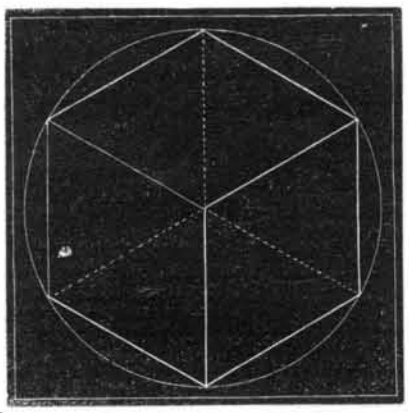
rather the area, of the piston of which is equal to the sum of the others. Answer: To determine the power of the hydraulic press, measure the diameters of the pump plunger and the ram of the press. The square of the diameter of the ram is divided by the quantity obtained by multiplying the square of 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, when 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 produce acids by their decomposition, and serious injury is thus sometimes caused.

To E. E.—To form a perfect cube in perspective, inscribe a regular hexagon in a circle, then connect each alternate angle with the center by 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, however, 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 400 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 thoroughly 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 I send you is broken off from a larger piece weighing ⅝ 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 ¼ 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 found possible. 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 together 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 latter is ignited.

B. St. J. says: I am running a steam saw mill. When getting up steam after the boiler is cold, 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 flue 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 so 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 subject.

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 household use, what is called Javelle water, to be had of druggists, can be used to bleach linen and 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 purpose? Answer: It is difficult to manage the electric light without employing Foucault's lamp, and this is expensive. 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 light.

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

W. E. G., of Ky., sends a mineral specimen, asking what it is, and of what use. Answer: It is pure galena, 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 pressure is exerted perpendicularly at the right hand extremity of the lower part. Another lever, of similar dimensions and with its fulcrum similarly placed at the left hand extremity of its lower part, is of shape ⊥. Which will exert the greatest pressure? Answer: The latter, or ⊥ 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 ⊥.

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 paraffin.

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 editorial page.

C. M. asks if anthracite coal is injured by exposure to the weather, or by immersion in water? "I have soaked it in water for some days without any increase in weight." Is carbon soluble in any liquid without chemical change? Answer: Anthracite coal is considerably 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 Manufactures 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 manufaeture, 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." Answer: The heat of the sun's rays is very much diminished in its passage through glass, but not nearly so much as the artificial heat from other sources.

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? What is 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 the 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 physics.

H. C. S. asks if frost will follow down an empty pipe, covered at the top, so as to freeze at six or 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 consequently 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 evaporation. 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 light 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 fallen 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 heated, it is placed upon a wooden pin of a convenient length, and scraped from the tip downwards, removing a shaving the whole 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. I have jacketed my pipes with fine hay, and have had no freezing since.

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 flat, 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 formations of the same system.

H. M. W. says: C. A. de S. wants to be helped in his indexing. Having had to index 29,000 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 convenient 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 successively ab, ac, etc., and distributed those slips further. When arranged alphabetically 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 base soft 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 as good 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, but do not let it touch the sides. It is better to keep turning it round. If the temper draws too fast, where held by the tongs, cool it off; move backward and forward until the right color is attained. This, too, depends on quality of steel and the size and make of the tap, and lastly the purpose for which it is intended.—P McC.

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 stove: 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 firebox 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. I simply assert that I have seen belts as wide as four inches work admirably 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 again in 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 H. 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. A. L.

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 Extinguishing Fires in New York. By W. B. D.

On the Detection of Explosive Oils. By J.

[OFFICIAL.]

# 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.]

### SCHEDULE OF PATENT FEES:

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| 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 |
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| On filing a Disclaimer | $10 |
| On an application for Design (3½ years) | $10 |
| On an application for Design (7 years) | $15 |
| On an application for Design (14 years) | $30 |

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