

happened, and the arrangement has, in that shape, been used as an automatic feed, with some success.

D. G. says: We have a new kind of a pump lately introduced into this (mining) district; this pump was originally intended for a 14 inch pump, plunger and bucket combined, the object of which is to discharge one half the water on the down stroke and the other half on the up stroke, thus making what is claimed to be a balance pump, with a great saving in power in working in deep mines. The parties who use this pump discarded the bucket and changed the plunger to a 12 inch one, which makes the pump now a 12 inch plunger pump. The builder of this pump has discovered an advantage in discharging the water through the jack head over pump barrel, and a saving of ten feet travel of water, over the old fashioned plunger pump. This pump we call B and the former, A. We place the two pumps in a shaft, 200 feet deep; the foot valves are on a level with one another. Now the best talent in the county claims that the water in B will travel 10 feet further than it does in A, in other words that B raises a column of water 200 feet in height, while A only raises a column 190 feet, and spills water 10 feet in advance of B. I claim that the water in B does not travel any further than it does in A, that they both pump against a column of water of the same height, and that A does not discharge water 10 feet in advance of B. Will you give us your highly valued opinion? Answer: We are inclined to agree with our correspondent on this point. We think, with him, that if, by any contrivance, water is raised from one level and discharged into a reservoir at a level 200 feet above, no modification of the machine will be able to make the lift anything less than 200 feet. We differ from the said "best talent" holding opposite views, and should prefer to accept the opinion of some of the intelligent apprentice boys who read the SCIENTIFIC AMERICAN, rather than subscribe to the views of said "best talent." Any two pumps, pumping against equal heads, will require the same power to do their work, provided frictional resistances are equal.

J. K. says: We have a steam mill for sawing logs, planing matching, etc.; our feed water is hard and causes a great deal of scale on the boiler. Now we have contracted for a new boiler of 30 horse power and wish to know what arrangement we can make to condense the exhaust steam to use for feed water. Answer: We presume that the most satisfactory arrangement will be found to be the usual condenser and air pump, which can be attached by any competent constructing engineer. There are one or two forms of "siphon condenser" in the market which are less expensive, however, and are said to perform well.

J. M. says: I have charge of a nest of three 42 inch boilers, 22 feet long, with 14 fourteeen inch flues in each; the shells are made of 1/4 inch iron and the flues are made of iron of the same gage. They have been in use for 12 years, and I inspected them this week; the scale that is deposited on them is no thicker than a sheet of writing paper and is black and glossy; there are no leaks and they appear to be in as good condition as though they were only two years in use. I am expected to press them to 65 lbs. per square inch. I have had charge of boilers for the last sixteen years and I have read the SCIENTIFIC AMERICAN all that time; but as this is the first time that I have had to deal with boilers with large flues, I wish you to give me information in regard to what you believe would be the highest safe strain that I could carry, and whether the shell or the flues will stand the most pressure before giving way. Will you tell me how to compute the strains on flues in plain arithmetic, as I have no knowledge of algebra? Answer: The shell of the boilers described, if perfectly sound and of good iron, is safe at the pressure of 65 lbs., and the steamboat law has generally allowed 110 lbs. on boilers of that size and of 1/4 inch metal. The flues, if in equally good condition should collapse at about 806,000 x 1/4 x 1/4 - 22 x 14 = 163.5 pounds. One quarter of this pressure, or 40 pounds, is generally named by engineers as the limit of pressure to be carried, and we, ourselves, should object to carrying more than one sixth, 28 pounds. The flues will, therefore, give way first, under the conditions assumed, and should not be subjected to more than 40 or 45 pounds, although they may stand four times that pressure. The weak spot in large numbers of boilers is the flues, and, as our correspondent probably knows quite as well as we do, many accidents occur from collapsing flues. To determine the strength of any flue, made of good iron, well put together, and perfectly cylindrical: Divide 806,000 times the square of the thickness in inches by the product of the diameter in inches and the length in feet.

D. says: Suppose a party owes me. I sue and get judgment entered up against him, and the sheriff reports "no property, except letters patent in the defendant's name for a valuable invention" (cannot say if it is his own or purchased). Can I have said letters patent attached and sold at sheriff's sale? Answer: A patent cannot be taken and sold under an execution in an ordinary action for debt in which judgment has been recovered.

P. L. asks: Would sleeping always with your head to the north tend to magnetize the metallic constituents of the fluids and solids of the human body? If so, would it increase nervousness? Answer: Persons having the "iron constitution" might be so affected.

P. L. asks: How can you construct a pump that will draw water from a well that is 45 or 50 feet deep? Answer: Use a common lift and force pump, the latter placed in the well, say, 25 feet above the water.

L. W. C. asks: Can you give me an explanation of how Chas. G. Page (or his heirs) could take out letters patent in 1863 on electrical instruments which, according to history, were discovered by Professors Henry, Wheatstone and Morse, as early as between 1836 and 1842? Also, could that patent be enforced and thereby close opposition telegraph companies? Answer: The Page patents were granted by special act of Congress. Their validity has not yet been determined by the Courts.

N. B. D. says: I wish you could tell me what is the matter with my magnet. The cores are made of soft iron, about 5/8 inches at one end and 3/8 inches at the other, and are 6 inches long; they are joined at the smaller end by being screwed into a small piece of iron and are wound with about 600 feet of fine covered wire. When I attach the wires of a local battery to them, they have scarcely any attractive power. My magnets are considerably larger than those on my sander, but do not possess any attractive power. Can you tell me where the trouble lies? Answer: Your mistake may be in the connection of the terminal wires of the two coils forming the electro-magnet. If the two coils are wound in one direction and slipped on the cores, at the end furthest from the armature, connect either the two outside, or the two inside, terminal wires with each other. If we had your magnet here, we would correct your mistake, if not too great, without cost.

W. M. E. sends a mineral and asks what it is. Answer: The mineral sent is iron pyrites, or fool's gold. Of no value.

A. M. R. says: 1. What proportion of the weight of a car and load is the measure of adhesion of a 33 inch chilled cast iron wheel and an iron rail? 2. Of brakes with shoes of cast iron 4 x 12 inches, what proportion of car and load must be applied to the brakes to make the adhesion of wheel to brake equal to wheel on rail? 3. All things being equal, what is the measure of difference of adhesion between a rolling wheel and a sliding wheel on an iron rail? Answer: From fifteen to twenty per cent when dry, about ten per cent when greasy, and about five per cent for very light loads on a very greasy rail. 2. The friction is about the same as the preceding, and the same proportion of weight should be applied, rather less if it is desired that the wheels should not slide without turning. 3. Rolling friction of trains on a level being about one third of one per cent, the ratio of rolling to sliding will be 45 or 60 to 1 for dry, 30 to 1 for greasy, and 15 to 1 for very light weights and a very greasy rail. The sliding friction of a rolling and a sliding wheel are about the same.

W. H. C. asks: 1. How can zinc lining in bath tubs be kept bright, or brightened when tarnished? 2. Is there a durable paint or varnish for stoves, to be used in place of black lead? Answers: 1. Use elbow grease and whiting. 2. There is nothing equal to first quality finest ground black lead for stoves.

N. N. says: 1. I have a fire box boiler 18 feet by 42 inches, containing 5 seven inch flues, 3 near the center and 2 nearer the bottom. At about 2 1/2 or 3 inches from the outside shell, a crack has occurred in one of the bottom flues, near the lower side where the flue joins the boiler head, on the under side of the flue and next to the adjoining flue. How can I instruct a blacksmith to repair the break? 2. The flues, from burning light wood, are incrustated with a thick coating on the fire surface of each, apparently deposited from the smoke; how can I remove it? It materially interferes with making steam, being a non conductor of heat. 3. What will precipitate cellulose from its cupro-ammonium solution? 4. What is celluloid? Answers: 1. Take a piece of boiler plate large enough to cover the crack completely, with width enough to allow room for flange through which to bolt. Fit very carefully, working it hot and finally bolt it in place with 1/2 inch head and nut bolts, making the joint tight with a cement of red and white lead and oil. 2. Make a scraping tool for the purpose and remove it with that, if it cannot be detached by a stream of water, or by a brush. 3. Precipitate by neutralizing with excess of hydrochloric acid. 4. From the Latin *cellulosa*, little cells, and *oid*, like.

W. A. P. says, in answer to S. P. S. who asked what are the diameters of English locomotive drivers: Their express locomotives have a single driving wheel on each side, the diameter of which differs on different railroads. I enquired concerning them while in London last summer, and was told that the largest on the London and Southeastern Railway were about 9 feet in diameter; those on the Midland railway from 8 to 8 1/2 feet; and on the London and Northwestern railway and others, they varied from 6 1/2 to 8 1/2 feet. Those on the L. & N. W. railway are chiefly from 7 to 7 1/4 feet in diameter. Their freight locomotives have driving wheels of less diameter; but from what I saw, I should say that they were generally larger than those used on freight locomotives in this country.

J. J. B. says that W. D. O.'s question as to the commencement of the day is a perfectly legitimate one, and the answer is very simple: By the common consent of nations, the 180th degree of longitude from Greenwich is the starting point (or line) for each separate day in turn, and consequently this is the line sought for by W. D. O. When a ship going west crosses this line at noon on Friday, she crosses over to noon on Saturday, and *vice versa*; when a ship going east crosses this line at noon on Saturday, she finds, after she is across the line, that it is only Friday noon. This arrangement is, of course, purely artificial, but I believe is universally adhered to.

G. L. B. says, in answer to E. M. B.'s question on calculating speeds and diameters of pulleys: Multiply the diameter of the pulley (in inches) by the speed that it runs and divide by the diameter of the driven pulley. The answer will be the speed of the driven pulley. He says that machines come to him marked to run at so many revolutions per minute. Let him multiply the diameter of the pulley by the speed that it is marked to run and divide by the speed that his line of shafting runs, and the answer will be the diameter of the pulley required in inches.

J. C. H. says, in answer to T. G. who asks for directions to make a solid emery wheel: Take coarse emery, 2 lbs., Stourbridge loam, 1 lb.: mix to a thick paste and press into a metallic mold, then dry and bake or burn in a muffle to a white heat.

S. T. W. replies to S. L. D. who asked for a method of transferring pictures to glass: My method of transferring pictures is to use balsam of fir and alcohol; varnish the glass, place the picture face down upon it and then, instead of letting it dry for 24 hours, immediately commence rubbing off the back with water and forefinger; of course it requires a little more care, and it should be rubbed very lightly the closer you get to the picture. When allowed to dry for 24 hours, the paper absorbs a portion of the varnish, which prevents its being rubbed down thin, while the other way, with care, will secure a much finer and quicker job.

A. O. says, in reply to J. B. M., who asked what is the result produced by hardening cast steel in water strongly impregnated with salt, and what would be the difference if sal ammoniac were used in place of salt: All substances which increase the conductivity of heat of the water produce also a higher degree of hardness in the steel. This is the case with salt and sal ammoniac. The percentage of calcareous matter exerts no certain influence; so we can explain why the ancients considered certain rivulets and wells especially suitable for hardening steel. For this reason, according to Pliny, steel works were often erected in their vicinity, and at a distance from the mines. There are now used nitric acid, potash, nitre, prussiate of potash, crystals of tartar, etc. The English file cutters add 1 part of oil of vitriol to 30 or 40 parts of water. In some cases where no fresh cold water is at hand, such additions may be very useful, but they may in general be dispensed with.

A correspondent replies to T. E. B., who asked how to remove clinkers from the inside of a stove: Throw three or four oyster shells in the stove, while the fire is hot, and leave them there. They work like a charm.

A. H. M. says, in reply to J. C. C.'s query about cleansing feed water: If you will place your heater and filter above your pump a foot or two, so the hot water will flow to it, and then insert a small pipe in the suction close to the pump, of sufficient height to extend above the head of hot water, leaving the upper end open for the steam to escape, I think you will be able to force your hot water without cooling it again, and thus you will not lose the advantage of heating and filtering.

MINERALS.—Specimens have been received from the following correspondents, and examined with the results stated:

- S. H.—It is galena, the ore of lead.
J. W. T.—It is a siliceous rock, containing either carbonaceous matter or oxide of manganese: analysis would be necessary to determine.
A. H.—It is calcareous marl.
G. C. S.—They are pyrites and mica.
J. F. S.—The specimens contain neither cobalt nor nickel, but considerable iron.
J. A. C.—The metal is lead; but is J. A. C. sure that it came from the dark colored rock sent?
D. H. W.—It is not gold, but iron pyrites.
E.—It is yellow ochre, which is useful as a coarse paint and for polishing. If there is an abundance of it, it should not lie idle.
W. P. H.—The specimen is interesting as being a relic of the superstitious arts practised by the "medicine men" of Africa. We cannot think of any drug, certainly one with which the negroes are acquainted, which would produce the symptoms mentioned. If any other correspondents of the SCIENTIFIC AMERICAN know of the use of the "Hoodoo," or anything similar, among the negroes in the Southern States, we wish they would communicate.

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 Atlantic Disaster. By C. D. O.
On a Plan for an Underground Telegraph. By W. F.
On the Solarity of the Magnetic Needle. By H. S.
On a Railroad Accident near Memphis, Tenn. By A. C.
On a Hydraulic Ram. By J. P.
On Professor Haeckel's Opinion of the Embryo State of Man. By J. L.
On Trying Circles with a Square. By G. B. D.
On Moonites. By W. L. D.
On Double Action Friction Gear. By J. B. H.
On Clarifying the Water of Kansas City. By H. R.

Also enquiries from the following:
J. G.—G. W. S. & Co.—C. E. B.—J. J. E.—J. H. W.—W. J. S.—A. K.—R. D. B.—H. A.—G. G. S.—E. M.—J. D.—F. S. J.—E. F. O.—F. R.—W. G.—J. H. W.—J. S. M.—W. H. C.—T. C. J.—A. H.—J. B.—B. A. C.—A. C.—H. J. N.—R. W. S.—C. D. F.—G. M. E.—A. M.—J. S.

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.]

Index of Inventions FOR WHICH Letters Patent of the United States WERE GRANTED FOR THE WEEK ENDING March 25, 1873, AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Table listing inventions granted by the US Patent Office from March 25, 1873. Includes items such as Acid, boracic, F. Gutzkow; Adding machine, A. M. Stephenson; Air, expelling, G. A. Frear; Alarm, etc., low water, J. Ross; Alkali, incising, G. W. Humphrey; Amalgamator, F. Morris; Aschonia compound, etc., J. Pinchard; Bale tie, cotton, G. Brodie (r); Bed, spring, D. E. Taylor; Bedstead, F. G. Ford; Binder, temporary, D. Dunton; Biscuit, cutting, J. S. Turner; Boats, propelling, J. S. Anderson; Boiler, culinary, I. B. Lewis; Bolt cutter, W. V. Hill; Books, etc., backing, Foster, Bayle, & Harbin; Boot sole presser, Seaver, Southworth, & Anthony; Bran dus'er, J. T. McNally; Breast pin, toigae, L. H. Sondheim; Brick machine, R. T. Barton; Broiler, J. S. York; Bromine, producing, Leyer & Winter; Butter rolls, etc., forming, C. H. Faneher; Can opener, J. J. Reed; Car brake, J. L. Knowlton; Car brake, I. H. Voorhies; Car coupling, C. H. Gearhart; Car coupling, H. E. Marchand; Car coupling, A. Fritz; Car replacer, H. Voth; Car wheel, Wakefield & Berryman; Carpet fastener, A. J. Williams; Carriage spring, C. S. S. Griffing; Carriage capper, G. S. Greene, Jr.; Casks, pitching, F. Brenner; Caster, furniture, C. B. Sheldon; Caster, furniture, C. B. Sheldon; Caster, furniture, C. B. Sheldon; Caster, table, T. Shaw; Chair, reclining, G. D. Gess; Chair, tilting, F. A. Parker; Chair, table, and lounge, J. Croghan; Chest protector, E. F. Wilcox; Cock, stop, J. P. Fern; Cock, weighted gage, Tasker & McMillan; Collar, G. F. Rice; Collar, pad, P. H. Beaver; Cotton, etc., compressing, F. Weldon; Coupling, friction, J. Hendy (r); Crib or hammock, D. C. O'Grady; Cultivator, M. Llewellyn; Cultivator, O. M. Pond.