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ing cast iron on p. 346, vol. 31.—W. H. D. will find directions for making friction matches on p. 75, vol. 29.—D. J. will find a recipe for paint for outdoor work on p. 409, vol. 31. Celluloid is described on p. 23, vol. 33.—J. McG. will find a recipe for waterproof glue on p. 42, vol. 32.—H. D. E. will find directions for separating alumina from clay on p. 91, vol. 32.—J. I. W. is informed that we cannot recommend a boiler scale preventive unless we know what impurities the water contains.—M. M. H. is informed that his query as to the wagon wheel is answered on p. 293, vol. 31.—J. T. R. should consult a physician.—W. J. will find an answer to his query as to pitches of gas pipe threads on p. 378, vol. 32.—C. L. R. will find a recipe for rubber cement on p. 203, vol. 30.—W. M. will find a treatise on taxi-dermy on p. 159, vol. 32.—A. B. R. will find a description of the process of refining petroleum on p. 340, vol. 26.—J. J. R. will find directions for bronzing castings, on pp. 11, 85, vol. 33.—J. B. K. will find directions for annealing gold on p. 299, vol. 28. D. C. W. can cement rubber to cloth with the compound described on p. 203, vol. 30.—J. J. H. should address a manufacturer of air compressors.—L. M. will find directions for straightening wire on p. 299, vol. 34.—G. W. E. will find directions for making Vienna yeast on p. 185, vol. 33.—W. N. S. will find directions for making marine glue on p. 42, vol. 32.—A. L. L. will find directions for making rubber stamps on p. 156, vol. 31.—F. R. B. should address the manufacturers of the rifle in question.—E. T. C. will find directions for fireproofing shingles on p. 280, vol. 28.—F. M. H., A. L. H., E. P. B., H. A. T., J. A. B., J. B. K., A. B. R., W. M., W. P. M., B. O., and others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) J. S. B. says: I have a room divided by a partition wall, over which is a space of 2 feet; and I wish to know how mirrors may be placed so that a person in one room can see a particular point in the other? A. Place a mirror over the partition in such a position that it will reflect the light coming from the desired point in one room to the observer in the other.

(2) A. McC. says: 1. There is an engine in this vicinity 18x24 inches; it runs at 90 revolutions a minute with 80 lbs. steam, and cuts off at 3/4 stroke. It is estimated to supply about 50 horse power. It takes steam from two boilers, each 4 feet in diameter by 14 feet long, each containing 56 three inch tubes. The grates are 4 1/2 x 8 1/2 feet, and are set 22 inches from boilers. The bridge wall is 6 inches from boilers, and there is a good draft. This engine requires on an average 1 1/2 tons of Illinois coal per day of 10 hours. The company are greatly dissatisfied at the amount of coal burnt, and wish to find some way to reduce it. Is the amount unreasonable? A. Under the conditions stated, the engine is not working as economically as could be desired. 2. Can you suggest any improvement in the setting of boilers? A. Before making any change it would be best to find out the cause of the excessive consumption, whether it is due to defects of the engine or inefficiency of the boiler, and this could only be determined by experiment.

(3) W. J. McG. asks: 1. When was the planet Uranus in perihelion? A. Uranus will be in perihelion in January, 1883. 2. Were Mars and Jupiter in aphelion during October, 1874? A. Yes, Jupiter on the 24th, Mars on the 25th. 3. What angle will the equator have to the ecliptic at the middle of the next Platonic year? A. A Platonic year is a period of time determined by the revolution of the equinoxes. This revolution, which is calculated by the precession of the equinoxes, is accomplished in about 25,000 of our years. Assuming that the Mosaic record of creation is correct, this world is now near the end of the first quarter of the first Platonic year, and astronomy has not informed us exactly in what position the earth will be in 30,000 years hence; but from the latest observations, the angle will be between two and three degrees less than at the present time.

(4) H. B. asks: How can I calculate at what rate of interest, compounded yearly, \$2,000 is of the present value of 120 monthly payments of \$40 each, first payment due at the end of one month? A. We believe it would be necessary to solve this by interpolation, calculating present values for different rates of interest. Some of our readers may be interested in making the solution.

(5) J. D. R. says: A brother and myself are about building a small steamboat, but differ in regard to the kind of engines. We want to use 2 engines 10 inches in diameter, to drive a main shaft at 20 to 25 revolutions per minute. My brother contends that 10x12 engines, geared so as to make 4 revolutions to one of the shaft, would be best, while I contend that 2 engines 10x8 inches, attached directly to the main shaft, would be less liable to break and use no more steam. Which would you recommend? A. We think your plan is preferable.

(6) M. C., Jr. says: I am using 2 engines (on the same shaft, working at right angles to each other) 8 1/2 inches in diameter and 30 inches stroke, making 30 revolutions per minute, with an indicated boiler pressure of 85 lbs. to the square inch. How many feet of 2 inch gas pipe (entirely surrounded by cold water) will it take to condense the exhaust steam from those engines, and leave the water so condensed at a temperature of 170° Fah.? Can I attach the end of the 2 inch pipe to my feed pump directly, in place of the air pump, and so force the water back into the boiler as fast as it is condensed? A. We do not think you can make this arrangement work very satisfactorily.

(7) S. F. H. asks: 1. What would be proper dimensions for a steam yacht about 20 feet in length? A. Make it of 5 feet beam and 2 feet draft. 2. What would be the proportions of an engine, boiler, and screw, and the pitch of screw

necessary to drive the boat at a speed of 5 to 10 miles an hour? A. Use a propeller 2 feet in diameter and of 3 feet pitch, and an engine 3 by 5 inches. Boiler should be 28 inches in diameter, 3 1/2 feet high.

(8) Y. E. says: 1. We have twin tubular boilers, the tubes of which have been in about 4 years, and are now giving out. We have had 3 new ones put in since last summer, all in the lower row. They all crack where they are expanded, just behind the front boiler head. As I think 4 or 5 years too short a time to last, I want to know if you can assign any cause for their failure. We use tannate of soda, and the tubes are not badly scaled. We use common tallow in cylinder, and heat the feed water with exhaust steam. A. It is not uncommon for tubes to give out in this time, even with careful management; and as in other cases they last much longer, the result is commonly attributed to defective material. 2. When we blow some water out of the boilers (which we do once or twice a day) and open the blow-off cock wide, there is a heavy jarring in the boilers, the check valve rattles, etc. I think this is caused by the connecting pipes between boilers and mud drum being too small. Can said jarring injure the tubes? A. The jarring you speak of certainly does no good, and we think it would be worth your while to have it stopped. 3. How was Mr. L. Cooper's boiler of 1 inch gas pipe (described in No. 13 of your current volume) built? A. Mr. Cooper will perhaps oblige this and several other correspondents by replying. 4. Are self-packing or steam-packed rings in cylinders generally considered better than common cast iron rings tightened with springs? A. There is considerable difference of opinion on this subject. 5. Will a glass water gage, placed about 6 feet from boiler and connected thereto by half inch pipe with two elbows, show the height of water correctly, or should the pipes be larger, or the gages be nearer the boiler? A. It would be better to use larger pipes.

(9) W. E. D. says: 1. I have a second hand upright iron boiler, 12 inches in diameter and 4 feet long: when new, it was tested to 130 lbs. pressure. Would it be safe to put in 12 one inch gas pipe flues, and use it for running an engine? A. We think it would answer with a single flue through the center. 2. Which way would be the best to set it, upright or horizontal? A. Set it upright. It would be well to test it before use.

(10) E. A. McC. says: 1. I have for several years used large quantities of peaty muck for bedding stock, and as an absorbent of the liquid manure and the gases from manure while fermenting. The bedding and green muck forms from a half to two thirds of my compost, which I consider very valuable after heating for several weeks and turning once or twice. I have now a pile of peat muck which was put in wet last fall, with two wheelbarrow loads of green horse manure at the bottom to start the heating. A few days since, with thermometer at 40° outside, the pile showed, at 18 inches below the surface, a temperature of 128°. Professor Kedzie, of the Michigan Agricultural College, says that this brown peat muck, so abundant in our Michigan swamps, is worthless. Is this a fact? A. Professor Kedzie's opinion is very probably correct. 2. Does heating benefit or injure it? A. It is to some extent beneficial. 3. Can sulphuric acid be used, on green peat, as a heating agent? A. No.

(11) L. H. E. asks: Having the area of an ellipse, how can we find the two diameters? A. You must assume one.

(12) C. D. P. F. says: In a country place we use water from the river, and it is not clear. We pump by steam through some 1,000 feet of pipe to a cistern about 130 feet above the river level. By the peculiar formation of the river bank, we had to place the steam pump some 20 feet above the river, and the question is what kind of filter we should use, and where it should be placed. We had a small box filled with sand placed in the cistern, and the pipe leading to the house, but it was so small it would not answer. In addition, the iron pipe stains the water; and having been affected by water taken through a galvanized pipe from the well, we are prejudiced against this form and also lead pipes. How can we clean the iron pipe to prevent the discoloration? A. As to filtering the water, see p. 267, vol. 34. We presume the iron rust shows itself in the water only when the pump is first started, and the water afterwards runs clear. If this is so, you should arrange your pipe with faucets to admit of discharging this discolored water outside of your cistern, and also to exhaust your pipe when not in use, that the water may not then stand in it.

(13) J. O. asks: 1. What is the best material to use in the division wall of a double house? I have tried a brick one, but one can easily hear in the next house. A. Where you have tried brick your wall was probably only 8 inches thick, and the floor joints meeting at the center of the wall, they left, in shrinking, open crevices through it. If you make the wall 12 inches thick, and place 4 inches of brick between the ends of the floor joists, your wall will be tight enough.

(14) J. B. T. says: We have been heating a new church, 40x60 feet, with a single hot air furnace in the basement, placed in the center, about 20 feet from the front, with one large register in middle aisle, directly over furnace. The church is only one story high, and the excavation in the cellar, where the furnace is placed, runs across the whole width of church and extends back to the furnace. There are two open windows about 2 feet square inside walls of cellar, about 4 feet from front. One of these has a trough about 1 x 2 feet, running in horizontally, about 12 feet parallel with front wall, for cold air. There is no ventilation in ceiling. Our trouble is that in very cold weather we cannot get the thermometer (placed about 4 feet above floor) higher than 58° or 60° Fah., yet with this amount of heat below, the air in the gallery that runs across front of church, about 12

feet high, is so hot as to be almost unendurable. Can you tell me what will remedy this? A. Try a ventilating register under each window, communicating indirectly with the exterior air; this will enable the heated air in the upper part of the church to expand, and drive out the cold vitiated air at the bottom.

(15) O. O. J. asks: 1. Can the stroke of a common slide valve of an engine be lengthened by the eccentric? A. Yes, by employing an eccentric having more throw. 2. Which is the most economical in fuel, to set the valve at a quarter of an inch lead, cutting off at one half stroke, or at one sixteenth lead, cutting off at three fourths stroke, engine running at 80 revolutions a minute? A. Cutting off at the half stroke would be the most economical. Your condition of lead should be just reversed, however, since, the longer the steam follows, the greater the necessity for lead. 3. Is common black oil good to put in a boiler to keep it from scaling? A. Some people recommend it, but the value of an anti-incrustator depends on the quality of the water used.

(16) A. B. C. asks: Will I lose power by belting a saw and grist mill so that the belt will run from bottom of driver toward driven pulley, and returning on top? A. It is better to run the belt the other way; but the difference, if the belt is given ample width for its duty, will not be practically appreciated unless the belt is very long, or of very common leather.

(17) J. J. asks: 1. Is it possible to case-harden cast iron? A. Yes. 2. Could car axle journals be hardened by the application of any substance while in motion, so as to become harder by friction? A. Not more than they would be by the casehardening which ordinarily takes place on a surface subject to friction under a pressure. 3. Is chilled cast iron or casehardened iron the hardest? A. There is a very little difference in favor of chilled cast iron.

(18) O. D. asks: Why are rubber gaskets injurious to boiler plate? I have several manhole plates in my boiler, and the edges of the sheet iron corrode away quite rapidly. What action, if any, does the rubber have on iron? A. Possibly the sulphur induces a chemical corrosive action.

(19) J. D. J. asks: 1. Can the lap on a slide valve be increased or diminished so as to make it cut-off at any point desired, by setting the eccentric so as to give the valve more or less lead? A. No. 2. You say that a person who wants to run a stationary or portable engine in New York city must furnish a certificate of competency to run an engine. Where can he get the certificate? A. Inquire at the police station of the district.

(20) G. S. N. says: My engine is 2x6 inches with a fly wheel 15x2 1/4, making 200 revolutions per minute. I wish to drive a lathe whose changes of speed on cone pulley are 6, 5 1/2, 4 1/2, and 3 1/2 inches. What sized pulley must I have on drive shaft to give the lathe the proper speed? A. Use one 10 inches in diameter.

(21) P. F. says: If the packing rings in a cylinder were subjected in their travel at one point to a steam pressure of 275 lbs. to the square inch, and at another point in their travel to 75 lbs., what would be the result in one year's use on a locomotive running 100 miles a day? A. The packing used under the greatest pressure would wear the most.

(22) G. B. asks: Will glycerin have any poisonous effect on the system, if used to preserve meat, fish, etc.? A. No. Glycerin is not injurious.

(23) E. W. asks: 1. In what part of the earth's revolution around the sun is our planet at the average distance from the sun stated by astronomers? A. The distance stated by the books is a mean between the shortest and longest distance. 2. How much does the orbit vary in distances from the sun? A. The difference is about 3,000,000 miles.

(24) Sprague & Co., Glenwood, Iowa, say: In your issue of April 15, you tell R. S. Jr. that his engine, of 2 1/4 inches bore and 5 1/2 inches stroke, is rather too small to drive the engine lathe of 16 inch swing. We have an engine (our own make), of 2 3/4 inches bore and 4 inches stroke, that drives a 20 inch swing engine lathe, 6 foot iron planer, drill press, shop grindstone, and milling barrel for foundry, and about 40 feet of main line shaft all at once, with 80 lbs. steam in boiler. It makes 220 revolutions per minute, and cuts off at 3/4 of the stroke.

(25) H. P. B. says: 1. We have two boilers, one upstairs and one down. Can they be connected so that we can draw from the lower when there is not enough hot water in the upper, for a bath room? A. Yes.

1. Of what are eggshells composed? A. Mostly carbonate of lime. 2. Can they be made use of? A. They are used in medicine.

(26) H. A. J. says: We mine clay by sinking large pits, 50 feet in diameter at the surface, hoisting the clay out by means of a derrick and hoisting engine. These pits are often sunk to a depth of 50 or 60 feet, and our trouble lies in getting out the water. We are now hoisting it out with a large hoghead, having seen nothing that we thought was more easily worked. It is impossible to let a steam pump down, as the sides are slanting, and, if broken, would cave in. Can you tell me of any pump, worked by hand or steam power, that would overcome the difficulty? A. From your description we think you could put in what is known as a submerged pump, to be worked by levers wherever desired, or a steam siphon or vacuum pump.

(27) W. S. asks: 1. How is carbon, such as forms in gas retorts, worked into regular shape? A. By sawing. 2. Which is the most powerful electric battery? A. Grove's battery is one of the most powerful. The negative element consists of a thin strip of platinum placed in a porous cell

Notes & Queries

W. P. will find something on the use of petroleum in boilers on p. 164, vol. 30. As to zinc in boilers, see p. 815, vol. 34. Engineers of pleasure steamboats must be duly licensed. See p. 228, vol. 32.—C. H. B. will find a table of the values of metals on p. 169, vol. 32. We publish an index in each volume.—C. S. R. will find directions for galvaniz-