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

Williamson's Road Steamer and Steam Plow, with rubber Tires. Address D. D. Williamson, 32 Broadway, N. Y., or Box 1893.

Lathes, Planer, Shaper, Shafting, 30 Boilers, Engines and Stock of Machine Shop, for sale very low. Henry McCollum, Long Island City, N. Y.

Notes & Queries

J. B. asks: Is there anything poisonous from a cast iron furnace when wood is used for fuel?

J. W. J. says: How can I make a cheap calcium light to experiment with? What kind of gas shall I use?

E. T. C. asks: What kind of oil is best for a blacksmith's bellows? Is there anything not injurious to the leather or poisonous that can be used in the oil, that will prevent rats and mice from gnawing the leather?

R. H. D. asks: What advantage have turn-buckles over nuts and check nuts, for the shrouds, stays, etc., of small boats? The latter are so much cheaper, that I would prefer them if as good.

J. Q. asks: What is the difference in the crushing weights of a stamp that weighs 500 lbs., with a face six inches in diameter, and a wheel that is six feet in diameter and 18 inches face, and weighing eight tons, rolling or twisting around on a circle of six feet in diameter.

A. Z. says: I have a portable steam engine, 120 lbs. power, 4 feet stroke, and 3¼ inches bore; the length of the boiler is 6 feet, the diameter 38 inches, with 32 flues. In trying to run a 50 saw cotton gin, I hitched the piston to an ordinary wooden fly wheel with a drum of 5¼ feet diameter. The gin runs perfectly well with 70 lbs. of steam, but soon the speed diminishes till it runs very slowly. What must be done to make it run? What is the reason it does not keep its speed? If I attach two small fly wheels to the main shaft of the gin, on one or both sides, do you think that it will help the steam to keep up a sufficient speed?

A. M. says: I am running a circular saw mill, making 500 revolutions per minute. The saw is 60 inch, friction feed; saw mandrel is 3¼ inches cast steel running in self oiling Babbit lined boxes. The box next to the saw is hot all the time, but the box next to belt runs cool. I have refilled the box several times and in different ways without success. I use lard oil and have changed mandrels twice in six months. It will get hot, whether the saw is on or not, if it runs one hour. Can any one explain?

H. C. D. says: I have an 18 x 75 foot open flat boat, which draws 4 inches; also have (and wish to apply to it as a power, by suitable cog gearing and pitman connections to a steam wheel) a 10 or 12 horse power portable engine of 150 revolutions per minute. I wish to know what are the best length and width of bucket, diameter of wheel, and speed of same. What size should the shaft be to drive said boat 3 miles an hour against a current of 3 miles an hour when the boat is loaded to draw 10 inches?

A. M. says: I am running a twenty-five horse portable tubular boiler with soft coal. How much more fuel will it take to fire with the furnace door open than with it closed? I run steam down hill to one 12 horse engine through 350 feet of 1¼ inches pipe, boxed in and packed with sawdust. Thinking that some of the power was lost in carrying steam so far, we fitted on a steam gage on steam pipe at engine and found 2½ pounds more pressure than the gage showed on the boiler. We then placed our gages together on the boiler and found them both alike, both standing at 80 lbs. How does this occur? I have seen it stated in your paper that steam loses one pound in passing through each ten feet of pipe. We also run steam up hill 300 feet, in 1¼ inches pipe to a 12 horse engine. Placing the gage there, it indicated 5 lbs. less than gage on boiler. But the pipe runs under a road, and the dampness may condense the steam there. Does it take more steam to run up hill than it does down? What is the difference (if any) in the pressure on top of a boiler and on the bottom? Take a very light carriage, something like a velocipede only three wheeled with one person on it. How many pounds of force is required to propel it one thousand yards, on level ground, in one minute, and how much on an iron track? The power is to be applied in the form of a weight.

C. E. G. says: I want to know how the black glove finish is put on to such articles as harness buckles. Answer: Dissolve three sticks of black sealing wax in half a pint of alcohol. Apply with a sponge.

J. L. J. asks: What do you mean by excessive priming? Answer: Priming is water carried into the cylinder of an engine by the steam, and it causes pounding of the piston and wears away both piston and cylinder. Dry steam alone should be admitted to an engine. In answer to your other question: Yes, very creditable. Persevere.

J. B. F. asks: Why is there a star marked in the constellation Leo (second star from point of the Sickle) called Ras-al-Asad, of the third magnitude, while it is not to be seen there? Answer: This star (called Rasatas in Procter's atlas) is to be seen at any time in the designated place.

Several correspondents have called our attention to an omission in the paragraph relating to the cone pulley on page 123 of the current volume of the SCIENTIFIC AMERICAN. The length of line B C is not

given. It should be made equal to the difference between the least and the greatest radii of the cone.

N. C. M. says: On October 15, 1872, a short time before sunset, I saw a spot upon the sun with my naked eye. Viewed through a field glass of good power, it was resolved into two spots, very close together, and several other smaller spots were visible. The atmosphere at that time was quite hazy. Were the sun spots at that time remarkable for their size? Answer: November 10, 1872, and thereabouts was a period remarkable for the size and number of the spots on the sun; one double spot was to be seen as single with the naked eye. Taking into consideration the time of the sun's revolution on its axis (about 25 days) the same group would have been visible on October 15.

C. W. W. asks: When did the vernal equinox fall back from March 21 to March 20? Answer: The answer to the question in regard to the vernal equinox involves the whole theory of the construction of the calendar; it may be found in any encyclopædia and almost every work on popular astronomy. Lockyer's "Elementary Lessons in Astronomy" well discusses the subject, in the chapter on the measurement of time. Our correspondent falls into error in supposing that there is or ever has been any positive fixed date for the occurrence of the equinoxes. It is impossible to avoid some variations, as the time of the sun's revolution from one equinox to the same equinox again is not an exact number of days. It has been the object of all calendars to so correct the resulting errors that the variations are kept within as small a limit as possible. By the system now in use, instituted by Pope Gregory XIII in 1582, the vernal equinox is always reckoned on or near March 21. This year it happens on March 20.

J. W. P. requests us to publish information about how to make good hard soap, and the chemistry thereof. Answer: To make soap, boll fatty oil or oleaginous matter with a weak alkaline lye rendered caustic by quicklime, and add portions of stronger lye from time and time, the ebullition being still continued until these substances, acting on each other, combine to form a tenacious compound, which begins to separate from the water; to promote this separation and the granulation of the newly formed soap, some common salt is added and, the fire being withdrawn, the contents of the boiler are allowed to repose for some hours in order that the soap may collect into one stratum, and solidify. When this happens, it is pressed into molds or cakes and, when quite solid, cut into bars. If the soap be made from the cheaper kinds of fat, it will hardly acquire firmness to satisfy the thrifty washerwoman; but it can be prevented from melting too rapidly in hot water by the introduction of 5 per cent of fused sulphate of soda. Ure says that this addition not only hardens the soap, but improves its color.

W. R. J., Jr., asks at what rate and to what extent mercury expands on the application of heat. Answer: Dulong and Petit found that mercury expands 1.875 of its volume for each additional degree (centigrade) of heat up to 100° C. From 100° to 200°, the average expansion for each degree is 1.275, and from 200° to 300° 1.300.

E. C. H. takes exception to our reply to a correspondent that the rotundity of the earth is 8 inches per mile. By the rotundity of the earth, expressed in inches, we mean the distance of the surface of the planet from the extremity of a line whose other end is tangential to the curve. The common formula is: ¼ of the square of the distance in miles will give the rotundity in feet. Square of 1 mile is 1; ¼ of 1 foot is 8 inches.

P. L. D. asks: Can any of your readers give any information as to the best method of making paper transparent, but the substance used must not prevent the use of muilage on the paper? Answer: Canada balsam and turpentine make a good preparation for tracing paper.

L. E. H. asks: What regions of the world produce gutta percha, and India rubber or caoutchouc? Answer: Gutta percha comes chiefly from Borneo and other islands of the East Indian archipelago, and caoutchouc from South America and the East Indies.

W. F. C. S. asks: 1. What proportion ought the tooth of a gear wheel to bear to the space between it and the next tooth? 2. We have a six wheeled switch engine with four equalizers, two on each side. The engine when started with a train of cars would cock up her front and duck her rear, as far as the vertical play of the laws would allow. The fault was discovered to be caused by the front equalizer. How is this? 3. What is meant by the point of suspension being above the center of gravity? Is it as seen in a scale beam? Answer: 1. The side clearance in gear wheels will properly vary with circumstances. We have seen but a sixteenth allowed in a well cut mortise gear of 4¼ inches pitch, and, on the other hand, that amount of clearance is none too great, in a rough cast gear of an inch pitch. 2. With the second arrangement, the engine was tied down forward, while, with the first, as we understand the two arrangements, the equalizers allowed the main frames to take a position in line of draft 3. Precisely.

H. P. & C. asks: In the construction of a hydraulic ram should the pipe that conducts the water from the ram to the place required be larger than the axle end or vice versa? Is tin lined lead pipe preferable to ordinary gas pipe for that purpose? Answer: A pipe of the same size all through will do. Tin lined pipe unnecessary.

J. B. J. says: You replied to P. R. S. who wanted to know how much water it takes to run a ten horse power steam engine per hour; your answer is from 50 to 200 gallons per hour, according to quality of boiler and machine. Is the answer correct? Should it not be per day? Answer: Our reply reads as we intended it should. A good 10 horse power engine with equally good boiler should require about 50 gallons of water per hour. This is something over 300 pounds, and it would be evaporated by 30 pounds of coal. Three pounds of coal per horse power per hour is extraordinarily good work for such small power. About 1,700 pounds, or 200 gallons of water requires frequently 200 pounds of coal for its evaporation, and a ten horse engine has been known to reach this figure on many occasions.

W. H. W. asks: How is petroleum applied to boilers to remove scales, I mean such as locomotive boilers, that cannot be got into? Is it not apt to make the boilers prime? Answer: When the boiler is empty, and just before filling it, put in the petroleum. Then turn on the feed, and as the boiler fills, the oil, floating on the water, reaches every part and saturates every square inch of incrustation.

M. J. D. asks: Will you give me the rule for finding pressure per square inch on slide valve? Answer: We know of no recorded experiments on this point. If our readers can give the information, we shall be pleased to receive it. We think that some of our friends of the Engineer Corps of the navy can enlighten us.

Answers to Correspondents