is right? A. Every physical part of any solid body turning upon an axis or center, moves; but the axis or center being an imaginary line only, is not supposed to turn. There is a quibble in the argument, which we think you will be able to divide with your friend. 2. How long does it take the planet Jupiter to make a revolution around the earth? A. The earth revolves to the same relative position in regard to Jupiter and the sun, in about 398 days. 3. How long does it take Venus to make a revolution around the earth? A. Venus does not revolve around the earth, but swings apparently like a pendulum across the heavens as it revolves around the sun in an orbit inside the earth's orbit. It becomes evening star, or comes to the same position in regard to the sun and earth, every 584½ days.

(12) L. N. S. asks how to keep steam boiler from corroding. I have seen in your paper a prescription for that purpose, but have forgotten what it was. The boiler is new, and I want to keep it clean. A. If you are using clear hard water, your boiler will become coated upon the inside with lime. Blow off daily, at least one cock. Clean out by washing and scraping once a month, or once in two months if there is but little incrustation. Put into the boiler a day before cleaning about one quart of tanner's liquor or a strong decoction of tan bark, oak, or hemlock per horse power. If this is not to be had then use one half pound caustic soda or potash to the horse power. Dissolve the soda or potash in water, and pump it into the boiler through the usual channel, as also for the tanners' liquor. The day's boiling will dissolve and crack off the scale, so that the boiler can be readily washed out. If you are using water that is considered soft, such as creek or river water, you may not need one-half the above quantity, or possibly nothing but thorough washing out every two or three months.

(13) C. W. P. asks: Will you inform me through the columns of your valuable paper, the SCIENTIFIC AMERICAN, wherein English steel comes into competition with American, and in what particular lines of manufacturing it does so most successfully? A. We do not think that English steel now holds a successful competition against American steel, especially in the grades that are much used. The vast increase in the American steel trade during the past few years, the ingenuity displayed in economizing machinery and labor to meet the increasing demand, have brought prices low enough to command the market. Our machinery, tool, and heavy spring steel is now fully equal in performance to the English, and ranges from 10 to 20 per cent less in price. The only kinds of foreign steel that have little or no competition here are the "Mushet steel," which is an alloy, and cannot be worked except in the forge and upon the grindstone; it is very tough, and is growing in favor for rough work; and the fine kinds of spring and Swiss steel, much used for clock and watch springs, gravers, and very small turning tools. More skill is required in the working, hardening, and tempering tools than falls to the lot of most machine shop blacksmiths. It is not advisable to put into the shop two or three brands of tool steel that requires to be often reworked and tempered. Take the advice of some large dealer in steel as to the kinds of steel sold for various uses; you can generally rely upon it.

(14) M. L. S. writes: I wish to devise a large cog wheel to be operated by a smaller wheel and a crank turned by hand. The large one to have attached to it a draw and rope, which will lift 1,000 pounds, from a depth of 500 feet. The machine to be worked by one or two man power. Please inform me what must be the circumference, weight, and number of cogs in large and small wheels. A. A man can exert upon a crank 15 inches long, or a swing of 30 inches, a lifting power of 30 pounds for ten hours with occasional rests. With the above crank, a pinion of 6 inches diameter at pitch line, working in a wheel of 6 feet diameter and winding drum of 1 foot diameter, a man will hoist 1,000 pounds from a depth of 500 feet in one hour and forty minutes. If you make a double crank for two men, you can make the drum larger so as to accomplish the task in one hour. Make 18 teeth in pinion; 216 teeth in the large wheel, 2 inches face for both. Cannot give the weight without making a detail drawing. You should decide as to the kind of rope you will use before you lay out the wheels. A hemp rope will have to be 1¼ inch or 1½ inch diameter for safety for such a load. The one foot drum would have to be 20 feet long to wind up 500 feet, unless you double up, which is injurious. If you can make the drum 3 feet diameter and 7 feet long, and put in a pair of intermediate gears to increase the power three times, you will have a more proportionate machine. The first pinion may be 4 inches, geared into a 12 inch wheel, and the 6 inch pinion into the 6 foot wheel. With this combination, the faces of the first and second should be 2 inches and the third and fourth should be 3 inches for safety. If you use wire rope, the drum should not be less than 4 feet diameter, wire rope five-eighths inch diameter, which would require the drum to be only 30 inches long. In this case you must increase the ratio of power in the gearing to suit the diameter of drum.

(15) R. L. M. asks: Can you inform me if there is any way of testing cutlery while purchasing without injury to the looks? If so, what is it? A. An examination of general appearance, in workmanship temper, character of edge, etc., are generally sufficient to enable a buyer to form a fair opinion of such goods. We know of no chemical or other special test applicable. 2. Also, can you give me a good receipt for silver plating? A. You will find good silver plating formulæ, etc., in SUPPLEMENT, No. 310.

(16) F. and T. ask: Would a steam launch, 16 feet in length, 4 feet 3 inches breadth of beam, and 2 feet deep, be a safe craft for two men to use in and about the inlets near Rockaway and Long Beach, and would she be able to make the trip from this city? What weight, including boiler and engine, would she carry? What power would be required to get the greatest speed practical in such a craft? Would we require a license to run her? A. We should consider the boat too small to be efficient with steam power. You would require a licensed engineer to run the boat, and probably the boat would have to be inspected and licensed.

(17) P. S. M. asks: Would the immersion of the lower end of a lightning rod in a leaching cesspool, which always contains more or less water, make a good ground connection? The cesspool receives the waste from the house, and, therefore, the water is somewhat greasy. Would such greasy nature interfere with conduction? A. The lower end of the rod should be attached to a metallic conducting surface that has an area of at least eighteen superficial feet in contact with water or moist earth. The mere insertion of the rod in the liquid, say for four feet, is, therefore, not a proper earth connection. Allowing the rod to be three-quarters of an inch square such insertion would only give an area of a little more than one superficial foot in contact with the liquid, instead of eighteen feet as required.

(18) A. W. says: I have been trying to draw water from a well with one inch gas pipe. It is 18 feet from elbow to the water, and the pipe rises 3 feet in the first 300 feet, and falls 36 feet in the next 700 feet. I filled the pipe from the highest point and then plugged it, and opened both ends at once, and it ran about twenty minutes and then stopped. I can draw water through it with a Douglass pump, but it will not flow. Is 15 foot fall too little to overcome the friction in 1,000 feet of pipe; or what is the matter? A. The friction in the long length of pipe is too great for the pressure, when it acts as a siphon. With the pump you have nearly double the pressure to force the water through the pipe. It may be there is an air leak in the pipe, which would soon stop the operation of a siphon.

(19) H. D. B. asks: Can you please tell me which is the fastest steamboat in the United States, where was it built, what line does it belong to, and how fast does it go? A. We know of no faster steamer than the Mary Powell, a fine passenger vessel now running daily on the Hudson River, between New York and Rondout. This boat, we believe, realizes an average of twenty-two miles an hour.

(20) H. and S. ask how the mould boards of plows are tempered so as to leave them in their proper shape, or rather to keep them from springing while tempering. A. Steel mould boards should be annealed before hardening, and receive their final fit, so that there should be no hammer-hardened surfaces or bending strains in the steel when it receives its heat for hardening. They must be dipped plumb, so that the water will touch both sides of the plate even, or at the same time, and not quickly, but rather slowly, with the point end down. If they spring, in spite of these precautions, you can heat the plates to about 300° Fah., and clamp them quickly to a former of the proper shape, and cool them with warm water. This will not draw the temper materially, and works well where accuracy is required. It is supposed, of course, that you use a low grade of steel, and do not draw temper. If you use oil instead of water for hardening, the same precautions apply.

(21) G. J. R. asks: Does steel get larger or smaller in hardening? A. It gets both larger and smaller; in fact, so erratic is its nature under various forms, and the variety of ways of heating and hardening, that nothing but a careful study and trial of the articles that you wish to harden will give you any exact knowledge of its tendencies. For instance, a ring die for punching boiler plates made of Krupp steel and fitted into its socket, say 2 inches or 2⅛ inches diameter, will not enter after hardening by about the one-hundredth of an inch. A 2 inch pipe die of English steel shrinks a little over one-hundredth of an inch upon the inside. As a general principle rings shrink and solids swell. Blocks cut from hammer-drawn flat steel are found to swell across the grain and shrink with the grain.

(22) A. M. S. asks: 1. What is the best method of quickly and thoroughly removing scale from steel forgings after annealing in wood or charcoal fire? A. Treat your forgings to a bath of hydrochloric (muriatic) acid and water, one part acid to eight or ten parts water, for from one to three or five hours, according to requirement of surface and strength of acid bath. If the work is small, a stone jar answers well. Use the mixture continuously, adding acid and water as may be required. If your work is large, you can swab the work over with a stronger acid, as is done with sulphuric acid upon cast iron. 2. Also of removing oil after "burning off" in tempering? A. For removing oil, dip the tempered work in a hot solution of caustic soda, then in boiling water, and dry quickly.

(23) H. H. B. asks: 1. What is the best thing I can use on rubber belting to prevent slipping? I have been in the habit of using castor oil and rosin, but I find that it causes the rubber coating on the pulley side of the belt to peel or strip off. My belts run where the temperature is high and full of hard coal gas. An ordinary leather belt will rot out in a very short time when run in this same hot room; but we bought a second-hand belt that was saturated with some sort of oil, so much so that it dripped from it for months; and it is in a good state of preservation to-day after four years' hard work. A. Use no oil of any kind upon rubber belting. Rub the belt with a piece of beeswax. It is the best for both leather and rubber belting. It does not require to be piled on; a little occasionally will make even a loose belt do large duty. 2. Is there any common oil that I can soak my lacings in to preserve them, as they rot out in about two months now? A. The only proper oil for lacings is that used by the tanners in dressing the leather, which is "neat's foot oil." Your lacings will keep well by wrapping in strong brown paper, and putting in a close drawer out of the influence of light and air. 3. What works can you recommend for the study of electricity, beginning at the first principles? A. "Ganot's Physics," "Prescott's Electricity and the Electric Telegraph," "Gordon's Electricity," also back number of the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT.

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

E. A. W.—It is a variety of chalcedony. If found in any considerable quantity and in large clear pieces it can be used for making articles of ornament, such as clocks, vases, etc.

COMMUNICATIONS RECEIVED.

On the Liver Fluke. By R. W. S.
On the Explosion of a Sawmill Boiler. By H. J. B.
On Thunderbolts. By E. F. D.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

May 30, 1882,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 261 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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