G. E. K. Jr. says: In answer to E. D. E. you say that the earth turns on its axis 365 times in 365 days. I supposed that it only turned 364 times, the solar day being not a revolution of the earth once on its axis, but the return of the sun to a given meridian, which I think is less by about four minutes than a complete revolution (or sidereal day) on account of the onward motion of the earth in its orbit, which would necessarily make one day in a year if the earth did not turn on its axis at all. Am I not right? A. The tropical year, or interval between two successive passages of the sun through the mean vernal equinox, equals 365·24222 mean solar days, or 366·24222 sidereal days.

F. W. B. asks: 1. What chemical reaction takes place between carbolic acid and iodine, when they are mixed in solution? A. Little if any chemical action. The iodine colors the carbolic acid a dark reddish brown color. 2. Is it known whether the action of carbolic acid on iodine would produce such a change in the iodine as would alter the therapeutic action on the system? A. No.

J. H. B. asks: Can a man lift more with a rope over a large pulley than with one over a small pulley? A. In the case of a stiff rope, yes. It is harder to bend a stiff rope over a small pulley than over a large one.

F. A. says: I am told that the coins of the United States for one particular year are at present very scarce and valuable. Will you please tell me what year that is, and also what are the several present values of silver dollars of 1796 and 1799? A. Dollars of 1804, but three known. Dollars of 1794, very scarce. The rest are easily procured at a small premium, if at all rubbed or indented. No dollars were coined from 1805 to 1835. Half dollars of 1804, but one known. Of 1797, very rare. None coined from 1798 to 1800, nor in 1816. Quarter dollars of 1823 and 1827, very rare. Coined irregularly until 1831. Dimes: Very rare for the four following years, varied in the order of their rarity: 1804, 1797, 1802, 1808. Coined yearly from 1827. Half dimes of 1802, but three known. Of 1794 and 1803, very scarce. None coined from 1806 to 1828. Three cent pieces of 1855, very scarce, Cents of 1799, 1799, and 1804, very rare. Coined yearly from 1793, except in 1815. Half cents of 1796, rare. Not coined in a regular series. But few of the gold pieces are very rare. The quarter eagle of 1797 is most valuable.

J. P. R. asks: How much power has an engine, 1 inch bore x 2 inches stroke, running at 200 revolutions per minute? How large a boiler should I have, and what kind of metal would be best? A. See article entitled "Indicating Steam Engines," in SCIENTIFIC AMERICAN for January 31, 1874. Allow about 20 square feet of heating surface for a horse power. You can make the boiler of copper or sheet or cast iron, whichever is most convenient.

I. S. S. asks: How thick should a cast lead sphere of 36 inches diameter be to stand a pressure of 35 lbs. to the square inch? How thick one of 30 inches diameter? A. For the sphere, the bursting pressure is equal to the product of the tenacity of the material multiplied by the thickness, and divided by the diameter. For a cylinder, the bursting pressure is equal to the product of the first two terms, divided by the radius of the cylinder. From these rules you can find the necessary thickness.

W. D. G. asks: Why is it that in the block and tackle every additional pulley (the pulleys being all of one size) gives an increase of power? A. It is not true that every additional pulley increases the power, but it tends to increase the space over which the force acts in overcoming a given resistance; so that the same force can overcome more resistance, but requires a longer time. Thus the power developed, which is composed of force or pressure exerted over a distance, remains the same.

X. Y. Z. asks: 1. How can I make a small crucible? A. With fire clay, or a mixture of fire clay and plumbago. Your best plan will be to buy one. 2. What is laminated steel? A. It is a mixture of steel and iron. 3. Is $\frac{\text{diameter}}{180\times60}$ = the chord of one minute? A. No.

M. E. asks: Why is it that, after digging a hole in the ground, the dirt will not fill it up as compactly as before? A. It will, if moistened and rammed.

C. E. M. is correct as to the weight of the 40 feet cube of granite. It should have been given at about 5,333 tuns.

G. McK. asks: 1. How can I mend a hydraulic cylinder that has a very fine flaw in it? I cannot see the crack when I have no pressure on it. A. Possibly you can secure a patch with bolts, and braze the joint. 2. What is the best preparation for putting on a rope that has to run on or wrap around a small pulley under water, so as to make the rope last? A. Tar.

J. V. says: 1. We have a boiler of 40 inches diameter, 22 feet long, with two flues of 13 inches diameter. What should be the size of stack to insure the best draft? We have 16 square feet grate surface. Would that be enough to burn sawdust, provided the draft were strong enough? A. Make the area of chimney from ⅛ to 1-10 area of grate. 2. Which saw will cut the easier for both hard and soft wood, the one which is swaged sufficiently for clearance, or one in which the teeth are sprung for set? A. This is a question between rival manufacturers. It can readily be determined by experiment. 3. How can I make the most durable friction wheel, for the feed of a circular saw? A. Probably cast iron will be as suitable as anything.

E. B. L. says: 1. Some of our steamboat chimneys get very hot when running, and others keep quite cool. What are the cause and remedy? A. It is because of improper design in the boilers, or on account of unduly forcing the fires. 2. Is there anything I can put on pine plank to make it fireproof or incombustible? A. There are several varieties of paint that are said to make wood fireproof.

J. B. says: I have some young evergreen trees growing under some walnut trees, but they do not thrive. Can you tell me the reason? A. The reason is that the walnuts shade the evergreens and deprive their roots of proper nourishment. As an antidote, remove the trees where each may have abundance of air, light, and root space.

F. H. H. asks: Why does water form an exception to the law of contraction by cold? What are the principles of its expansion when turning to ice? A. One volume of water at 32° gives 1·102 of ice at the same temperature. There is then an increase of one tenth of the volume in passing from the liquid to the solid condition, the temperature remaining the same. But previously fixing themselves rigidly in certain positions so as to form crystals of ice, the particles of water take up relative positions with regard to one another, in which they occupy a larger volume.

A. T. R. asks: What is the principle on which the Giffard injector works? A. The steam imparts sufficient velocity to the water with which it comes in contact to overcome the resistance offered by the pressure within the boiler.

Z. Z. asks: 1. What is the coloring matter of the leaves of plants? A. The coloring matters of flowers are referred to three distinct substances by certain chemists, one of which is a blue or rose color, while the other two are yellow. The former is produced by a compound which has been termed cyanin. Cyanin may be obtained from the petals of the violet or of the iris. To the yellow matter which is insoluble in water the name of xanthine is given, and to the yellow matter which is soluble, the name of xantheine. See article "Chromatology," *Quarterly Journal of Science*, 1873. 2. Are not the metals of the highest specific gravity the scarcest, and is not this caused by their sinking near the center of earth when the earth was in its molten state? A. The rare metals, which are also noble metals, are of great specific gravity, and many geologists have supposed that this had a close connection with their slight diffusion. But it is a theory difficult of satisfactory demonstration.

J. C. M. asks: 1. How are the salts of nickel and ammonia used for plating? A. See pp. 91, 139, vol. 29. 2. How is wood stained in imitation of ebony? A. Steep the wood for two or three days in lukewarm water, in which a little alum has been dissolved: then put a handful of logwood, cut small, into a pint of water, and boil it down to less than half a pint. If a little indigo is added, the color will be more beautiful. Spread a layer of this liquor quite hot on the wood with a pencil, which will give it a violet color. When it is dry, spread on another layer, dry it again, and give it a third; then boil verdigris at discretion in its own vinegar, and spread a layer of it on the wood; when it is dry, rub it with a brush, and then with oiled chamois skin. 3. What is your price for binding two volumes (in one book) of the SCIENTIFIC AMERICAN? A. Two dollars.

W. T. says (in reply to J. H. P., who says: Astronomers tell us that the earth for ages past has been gradually cooling, but the glacial theory necessitates the belief that the earth was once much colder than it is at present. Has any attempt been made to reconcile the two theories?): Allow me to answer this question, Such an attempt has been made, and, it seems, very successfully, by the celebrated geologist Oscar Von Heer. Astronomers tell us that the sun, with the earth and the other planets, is steadily progressing in space, moving in a very long period around its central body, very probably the star *Alpha Centauri*. It is almost certain that matter is not equally distributed in space, and that there are regions of the heavens where there are more celestial bodies in one given space than another, and consequently these regions are warmer from the heat coming forth from the stars, which all are surrounded by glowing gases, as the spectroscope proves. But in the regions in which they are less abundant, the temperature is colder. O. Von Heer now suggests that formerly, especially during the eocene period, the sun (with the earth) was in a region thronged with stars, and therefore the climate on earth was warmer than it is now; and by gradually progressing to other regions, the climate became colder and colder, until the lowest temperature was reached in the glacial period, and that it moves now to regions that are warmer again. It is my opinion that the earth's heat has not affected its climate since the end of the jurassic period at least, and perhaps very much earlier."

J. L. R. says, in answer to F. O. C. H., who asked how to put a patch on a boiler with bolts so as not to leak: "I put one on a boiler about two months ago, and it does not leak and never will. The patch was 24 bolts long and 4 wide, over where the sheets were riveted. The inside sheet was cracked from one hole to the other for that length. Proceed as follows: Punch or drill your holes and fit the patch to the boiler; make the holes to fit well for ⅝ bolts 1½ inches long, with heads of 1 inch, made solid, and good threads. Put 4 rounds of candle wick with stiff white lead round each bolt and draw it tight. In putting the bolts in, have the heads square with the boiler, and hold them so; be sure not to let them turn. After screwing on the nuts, hammer the heads down hard and screw again, also hammer the patch after it is screwed tight. Caulk the same as a new boiler. It may leak a little before you get up steam; but when you get 30 lbs., and your engine started, it will be tight and will stay so."

M. Y. R. says that P. and G. G. can make a good invisible ink, that will appear upon the application of water, by dissolving powdered alum in the juice of a lemon; the density of the ink is procured by the amount of alum used, but half a teaspoonful to the juice of one lemon is enough.

C. D. S. says to J. H. P., who asks if any attempt has been made to reconcile the glacial theory with the theory that the earth was once in a molten state: The reason assigned by Benton for the change of climate which caused the glacial epoch [is that the axis of the earth may not have had the same inclination to the plane of its orbit during the glacial epoch as at present; at the early stage of the earth's existence, volcanic action must have been much more frequent and powerful than at present, and this volcanic action may have caused an upheaval at some point of the surface, accompanied by a corresponding depression at an opposite point, which would be sufficient to alter the center of gravity to such an extent as to change the inclination of the earth's axis to the plane of its orbit. As there is no trace of glacial action within the tropics, some geologists contend that the part of the northern hemisphere on which traces of glacial action are found may have occupied a position analogous to the poles of the earth at present. For a full and satisfactory explanation of this and many other points, read Benton's "Lectures on Geology in America."

S. T. says, in reply to H. C. R., who asks for a plan for an apron for a double ended ferry boat: "The first engine I ever handled was on such a boat on the Ohio river, and the two aprons were hung to the bow and stern decks, much as a barn door is hung, with the difference that the battens were of 5x8 timber and 24 feet long. The apron was 10 feet long. The apron boards were bolted to under side of timbers, and long iron hinges were bolted to apron and deck. This method throws the timbers near each side of the boat, out of the way of teams; and a large clevis on deck, looping over end of timbers, secured the apron up when crossing. On nearing shore, the clevis was dropped off, letting the apron fall on shore. The steering oar had a pin fast in its balance center, and a hole in the outboard of either apron to receive it, so that both ends of the boat could go ahead."

C. S. says that J. H. P. can cure the gapes in his chickens by taking a stiff horsehair, some eight inches long, making a loop of it, putting it down the chicken's throat, and withdrawing it quickly, two or three times, for as many days. This is a sure cure.

F. A. R. says, in reply to P.'s query as to hydrogen: Probably your zinc is too pure; sometimes we are compelled to use very pure zinc and sulphuric acid, and then the hydrogen will come out very slowly, the pure zinc resisting the action of the sulphuric acid. By adding a few drops of chloride of platinum, however, the hydrogen will be produced very quickly, and probably sulphate of copper would be just as well for your purposes as chloride of platinum.

W. S. X. says, in answer to J. H. D., who asks how to reverse an engine: First make a mark on the side of the eccentric, near the shaft, with a scribe or small chisel; make a corresponding mark on the shaft at the same point, then place one point of a pair of calipers on the mark on the shaft, and with the other point find the center of the shaft on the opposite side. Then, with a scribe, mark this point also. Now unscrew the eccentric and move it around in the direction in which the engine is intended to run, until the mark on the eccentric comes into line with the second mark on the shaft; then make the eccentric fast, and the engine will run in the opposite direction. It does not make any difference in what direction the crank is when the eccentric is moved.

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

A. M. G.—No. 1 is oxide of iron: No. 2, quartzose rock.

W. N. L.—These two specimens are iron pyrites.

J. W. Z.—No. 1 is clay ironstone; No. 2, sandstone impregnated with oxide of iron; No. 3, the same as No. 2; No. 4, brown ocher, a clay colored with oxide of iron. This might be of service as a pigment.

M. D. W.—This material is shale.

J. P. M.—This is an impure clay.

C. J. H.—The specimen sent is limestone. In answer to your other question: We know of no such process, but you can experiment.

G. W. S.—The sample is an impure silicate of alumina.

G. & W.—One of these specimens is a fossil bone, and the other argentiferous galena. The subscription price of this journal is $3 per annum, in all parts of the United States.

W. R. Jr.—Your specimen is an alloy consisting of copper and zinc, in other words, brass. It is possible that a piece of brass may have accidentally fallen into the stamp copper. Native brass has not as yet been found.

M. R. asks: 1. How are sewing machines japanned, what ingredients are used, and how are they applied?—O. S. asks: If 2,000 feet of 6 inch iron pipe is supplied by a pump driven by 24 horse power, will it be any advantage to attach a similar pump, driven by 18 horse power, at the other extremity of the main pipe, in throwing water from a hydrant placed in the center? If so, what?—J. C. C. asks: After being drowned, how long will a person lie under water before he will rise? Is there any difference in the time between fresh and salt water? What is the cause of the rising? If it be gas, what produces it? What is the theory of firing cannons over the water where it is supposed that a person has been drowned?—E. H. K. asks: In the drive wheel of the locomotive engine, where does natural philosophy place the fulcrum, the power and the weight respectively?—E. C. B. asks: What do jewellers use for cleaning diamonds? Is it a solution of arsenic or potash?—J. A. McC. Jr. says: Take a tube, 3-16 inch in diameter, of any length, and cut a round piece of pasteboard 2½ inches in diameter. Make a hole in the center of the board, and insert one end of the tube in the hole:

then cut a round piece of paper of the same size as the pasteboard; place it on the pasteboard, and the other end of the tube in the mouth, and the strongest lungs cannot blow the paper off. Will you give me the philosophy of it?—B. says: I see in the SCIENTIFIC AMERICAN that Dr. Brown-Séquard advises people to cultivate the use of the left hand and left side of the body, thus exercising the left lobe of the brain, teaching it to think. He recommends learning to write with the left hand. Can any of the readers of the SCIENTIFIC AMERICAN give directions for the proper holding of the pen and the proper slope of the writing in left-handed penmanship?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Steam Boiler Explosions. By W. M. D.

On the Attraction of the Sun and the Earth. By A. D., and by A. F.

On a Problem, etc. By G. W. E.

On an Aurora visible in Michigan. By B. B. S.

On Preventing Scale in Boilers. By C. L. E.

On the Beech Blight. By D. E. R.

On the Chameleon. By H. A. H. G.

On the Philosopher's Hunt. By T. H. C.

On a Double Lamb. By J. H. P.

On some Useful Recipes. By C. B. L.

Also enquiries and answers from the following:

T. O'D.—E. P. J.—J. B. S. H.—G. N.—D. F.

Correspondents in different parts of the country ask: Who makes back rests for holding lumber in a lathe? Who sells small brick-making machines? Who sells lath-splitting machines? Who makes artesian well boring machinery? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

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.]

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