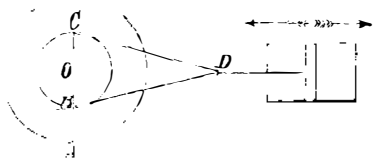
make the transit of Venus and the total eclipse of the sun contribute to our stock of astronomical knowledge?

Brownville, Neb. W. B. SLAUGHTER.

Adjusting Journal Boxes Horizontally.

To the Editor of the Scientific American:

Apropos of recent suggestions for taking up the wear of journal boxes, permit me to say that there is a common error among machinists to the effect that the wear upon the side of the main journal box nearest the cylinder is double that on the side opposite. Strange to say, the same idea is advanced as a theorem in a work on machine drawing, recently published by a noted writer on graphics. Some machinists, again, think that the wear is equal on each side of the center. The following is a demonstration of the true case:



The diagram being the skeleton figure of a locomotive or stationary engine, let A, the point of traction on belt or rail, be taken as the axis of moments.

Let P = pressure on piston, let x = pressure on front of box at O, let y = pressure on back of box at O, let R = radius of wheel, and r = radius of crank. With crank pin at C, we have $x = \frac{P \times (R+r)}{R}$ by equaling moments. With crank pin at B, we have $y = \frac{P \times (R-r)}{R}$. Whence $x \div y = \frac{P(R+r)}{R} \times \frac{R}{P(R-r)} = \frac{R+r}{R-r} = 1 + \frac{2r}{R-r}$, by performing division. But if $x = 2y$, then $x \div y \; 1 + \frac{2r}{R-r}$ must equal 2; whence $\frac{2r}{R-r} = 1$ and $2r = R - r$ or $R = 3r$. That is, the pressure on the front of box is double that on the back of box only when the radius of the wheel is three times that of the crank.

Or in a locomotive, let P, x and y be as before, and T = train resistance. Then going forward, with crank at C, $x = P+T$: or with crank at B, $y = P-T$, whence $x \div y = \frac{P+T}{P-T} = 1 + \frac{2T}{P-T}$ which, as before, is equal to 2 only when $P = 3T$. The wear on both sides of the box will be equal only when $T = O$. The wear on the front box will always therefore be practically the greater, but not necessarily twice as great.

Since the wear is proportional to the pressure, the formulæ $x \div y = \frac{R+r}{R-r}$ and $x \div y = \frac{P+T}{P-T}$, may be used to determine the relative thickness of the two sides of the box.

Notwithstanding the weight of the engine throws the point of greatest wear towards the top or bottom of the box, the fact of unequal wear, proved above, shows the necessity of making the boxes adjustable horizontally, as suggested by your correspondent. W. L. C.

Lehigh University, Bethlehem, Pa.

Animal Electricity and Magnetism.

To the Editor of the Scientific American:

Among the components that make up the whole of man's vital parts, animal electricity and magnetism are of prominent importance. Their existence has long been known, but almost all else in regard to them seems mystery.

Air when taken into the lungs gives up a portion of its oxygen, which passes into the blood, and, when expired, is converted into carbonic acid gas. The latter gas amounts to about three and a half per cent of the whole expiration. In the process a combustion takes place, wherein a portion of the oxygen combines with the blood, and another portion with carbon, to be exhaled as carbonic acid gas. I presume that this combustion or transformation is the cause of animal heat. But this is foreign to the present subject. Faraday discovered that oxygen was the most magnetic of all gases, holding the same place among gases that iron does among metals. When reduced to proportions and figures, if 17·5 represents the magnetism of oxygen, air would rate 3·4, while carbonic acid gas is diamagnetic and would be represented by 0·0. The amount of carbonic acid gas taken into the lungs with air is quite small, but from each healthy person sixteen cubic inches are exhaled per minute, or twenty-three thousand cubic inches per day. As this gas is composed of carbon one part and oxygen two parts, it follows that about fifteen thousand three hundred and thirty-two cubic inches of oxygen, charged with magnetism in the proportion above stated, has the total amount of magnetism daily eliminated from it by the vital organs of each individual. What becomes of this magnetism thus extracted from the oxygen of the air? It enters the lungs; it does not go out again. The sequence is beyond question: it is taken up by the organism and remains there to be used in the vital forces. Thus in the life giving gas, not only is to be found the property of supporting life, by purifying the blood and furnishing heat for the body, but, also, the magnetism that performs an important, but a far more subtile part. An atmosphere of pure oxygen, if supplied to the lungs, increases the heat, magnetism, and electricity of the body, by the conversion of a much larger proportion of oxygen into carbonic acid gas, and quickens life to such an extent as to cause death from exuberance. When an absence of oxygen from the blood has almost caused a cessation of magnetic and electric currents in the body, an injection into the circulation of blood charged with oxygen will cause their instant return; and just in proportion as carbonic acid gas is exhaled from the lungs, do we find a supply of these fluids remaining.

I have referred to animal electricity and magnetism as identical. In vital economy I believe them to be so in source of supply; and while manifestations of one may be had without the apparent presence of the other, yet there is so much to join them together, and so little to separate them, that the day of doubting their identity, in this respect, has about passed. Oxygen and ozone are the same, and yet how different! Are not both different conditions of the same thing? JOHN HILL.

Columbus, Ga.

THE SILVER MINES OF PERU.

BY PROFESSOR JAMES ORTON.

Peru was conquered and explored by the early Spaniards under the belief that it was *El Dorado;* but there are no famous mines of gold in the Republic save those of Carabaya. It better deserves the name of *La Plata,* for its Andes are threaded with silver. The annual yield of Peruvian silver, however, is decreasing, owing to mismanagement. A thorough scientific survey of the country is needed, and then a judicious system of mining. We are confident this will reveal

> "Rocks rich in gems and mountains big with mines,
> That on the high equator ridgy rise."

The most famous silver mines in South America, after those of Potosi, are the mines of Cerro de Pasco, sixty leagues northeast of Lima. They are situated on the Atlantic slope of the Andes, over 13,000 feet above the sea, where the prevailing rock is conglomerate. The silver, discovered by an Indian in 1630, occurs in the native state; also as sulphuret mixed with pyrites, with *cobrizo* (a carbonate of copper and lead, with sulphuret of copper), and with oxides, forming what are known in Peru and Mexico as *pacos* and *colorados.* The ore is treated to salt and mercury, but so rudely that generally one pound of mercury is lost to every half pound of silver extracted. Fortunately, Cerro de Pasco is only 200 miles from the celebrated quicksilver mines of Huancavelica. According to Herndon, the ore yields only six marks to the cajou. (A mark is eight ounces, and a cajou is three tuns). A representative specimen in our possession contains 0·004 of silver. During the last two centuries and a half, the mines have produced about $500,000,000. The annual amount of ore mined has been 50,000 cajous, yielding an average of four and a half marks, the amalgam containing 22 per cent of silver. Just now, work has nearly ceased, owing to the inadequate means of drainage. But at Cerro de Pasco, as at other places, it has been found profitable to re-work, by the improved modern method, the tailings left by the old Spanish miners.

Hualgayoc, fourteen leagues north of Cajamarca, has long been celebrated for its rich mines; but it is also afflicted with a plethora of water. There are many good mines in the vicinity of Lampa and Puno on the borders of Lake Titicaca; those of Manto, Salcedo, Chupica, and Cancharani were famous in Spanish history. The ores of Huantajaya near Iquique yield from 2,000 to 5,000 marks to the cajou. Masses of pure silver have been found on the surface of the plain, one weighing 800 lbs. Rich deposits occur also in the province of Cailloma, north of Arequipa; and at Yauli, San Mateo, and other localities near the Oroya Railroad. Extensive veins have been recently discovered at Chileta, the terminus of the Pacasmayo railroad, the ore assaying from $60 to $200 a tun.

But the most numerous and promising silver mines of Peru are, without doubt, located in the department of Ancache, just north of Lima; not because it is a richer region than the eastern cordillera, but because it is the only district which has been scientifically explored. This has been done by the accomplished naturalist, Professor Raymondi, under the patronage of Mr. Henry Meiggs. The report just published at Lima contains assays of specimens from the most valuable mines in which the silver occurs. It appears: (1) That silver is not very common in the native state. (2) That the minerals richest in silver are pyrargyrite ("rosicler" or ruby silver) and stephanite (brittle silver glance). (3) That the greater part of the silver, however, is extracted from tetrahedrite, galena, and many mineral oxides (*pacos* or *colorados*). The pacos richest in silver ore are those which result from the oxidation of stephanite and pyrargyrite; the poorest are found in great part of oxide of iron, in which the silver is minutely disseminated in the native state. (4). It is worthy of notice that the silver ores are constantly associated with antimony. Even the galenas having a cubical structure always contain a small percentage of antimony.

New Houses.

The coincidence of a man's moving into a new house and dying soon after has frequently been a subject of remark, and there is an avoidable cause—the house is moved into before the walls and plaster and the wood are sufficiently dried. Sometimes the cause of death is the poisonous character of the water conveyed through new lead pipes. No water for drinking or cooking purposes should be used in a building supplied with new lead pipes, in whole or in part, for at least one month after the water has been used daily; this gives time for a protecting coating to form on the inner surface of the pipes, when their chemical change from contact with water generally ceases.

But the damp materials of the house have the most decided effect, especially on persons over fifty years old or of frail constitutions; whereas if the person were in the full vigor of life and health, not even an inconvenience would be experienced.

In building a new house, or on going to live in another locality where the water supply is not far from the house, it should be ascertained with the utmost certainty that the spring or well is higher than the privies or barnyards. Insidious and fatal forms of decline and typhoid very often result from persons drinking water which is drained from the localities named.

The safest plan, and the only safe plan for furnishing dwellings with the most healthful and unobjectionable water, is to have a watertight cistern, and let the water from the roof of the house or barn, or other outhouses, be conveyed into it through a box of sand several yards long, this box to rest on a board, or cemented bottom and sides, so that no outside water could not get into it.—*Hall's Journal of Health.*

Solvent Powers of Water.

Water is a physical rather than a chemical agent in bleaching and dyeing; it is the vehicle which carries the chemical substance to the cloth to be operated upon, or which removes the matters necessary to be removed from it. When a substance is mixed with water, it may either be dissolved by it, and disappear, as salt does; or it may remain in suspension, as chalk does. Nothing is considered to be actually dissolved in water if it can settle out again, or if it will not pass with the water through a filter made of paper or calico; thus to talk of dissolving ground chalk in water is incorrect, for if allowed to stand it would settle out; or, if the mixture were filtered, the water would pass clear, while the chalk would remain upon the calico; but blue vitriol (sulphate of copper), for example, does really dissolve in water, and the liquor all filters through together; to deprive the water of the blue vitriol would require chemical means different in kind from filtration. Water, therefore, dissolves some substances and not others. Water does not dissolve the same quantity of all soluble substances; of some it can dissolve its own weight, and more; of others a small portion; and of some extremely little. As a rule, hot water dissolves more than cold, and more quickly than cold: but, upon cooling, the excess mostly falls out as crystals. This point deserves notice, for a liquor, which is of right strength when a little warm, may be too weak when it becomes cold; left in a carboy, for example, in a cold place, because the salt crystallizes out; this is the case only with those salts that are but sparingly soluble, as chlorate of potash, cream of tartar, sulphate of potash, etc. The crystallizing is sometimes troublesome in steam colors which, right enough when freshly made, become filled with small crystals, and rough on the machine; it is felt in the case of an ageing liquor, which contains chlorate of potash as an active agent, which, crystallizing out, leaves the liquor weak and not able to do its work. As a usual thing, the drug room upon a printing or dyeing works should be cool, but there are some liquors better in a moderately warm place; brown vitriol, for example, in winter time is apt to go solid in the carboys, if kept in an exposed place.—*Am. Tex. Manuf.*

Sir Richard A. Glass.

Sir Richard Atwood Glass died recently at Southampton, aged 53. It was at his factory that 1 250 miles of the first Atlantic cable of 1866 was wholly constructed, under the direction of Mr. Glass, who, on the successful completion of the undertaking, after ten years of unremitting labor, received the honor of knighthood. He retired from the company in 1867, and afterwards became chairman of the Anglo-American Telegraph Company. He was for a short time a member of the House of Commons.

The Detection of Death.

The late Marquis d'Ourche, one of whose friends was buried alive, left a sum of 20,000 francs ($4,000) to the French Academy of Medicine, to be given to the inventor of a simple process of ascertaining when death has really occurred, and a further sum of 5,000 francs to be awarded to the discover of a scientific method of verifying death. Altogether 102 essays were sent in for adjudication. Most of the papers contained such absurd suggestions that the list was practically limited to 32 competitors. The large prize was not awarded, but the 5,000 francs were divided between four competitors. No new facts, likely to enlarge the domain of forensic medicine, have been elucidated by these investigations.

MESSRS. MACNAUGHT, ROBINSON, & CO., of Southwark, London, England, have sent us diagrams of a most complete system of wrought iron girders for building purposes, made by them and kept constantly in stock. Their sections are cheifly of the double T form, and range from 2 to 6 inches in width, and from 3 to 14 inches in hight. The list also includes fiitch plates, bolts, nuts, washers, etc., an arrangement very convenient for builders, who by consulting the chart can ascertain the approximate cost.

WE have received from Messrs. Goodnow and Wightman, of 23 Cornhill, Boston, Mass., an illustrated catalogue of tools, lathe attachments, and machinists' supplies, which provides for nearly all the possible wants of model makers and experimenters in mechanics. The line of small gearings is extensive and complete, and the book describes several new gages and combination tools, of value and interest to all inventors and amateur mechanics.

A NEW APPLICATION OF GYPSUM.—Gypsum mixed with 4 per cent of powdered marshmallow root will harden in about one hour, and can then be sawn or turned, and made into dominoes, dice, etc. With 8 per cent of marshmallow, the hardness of the mass is increased, and it can be rolled out into thin plates, and painted or polished.