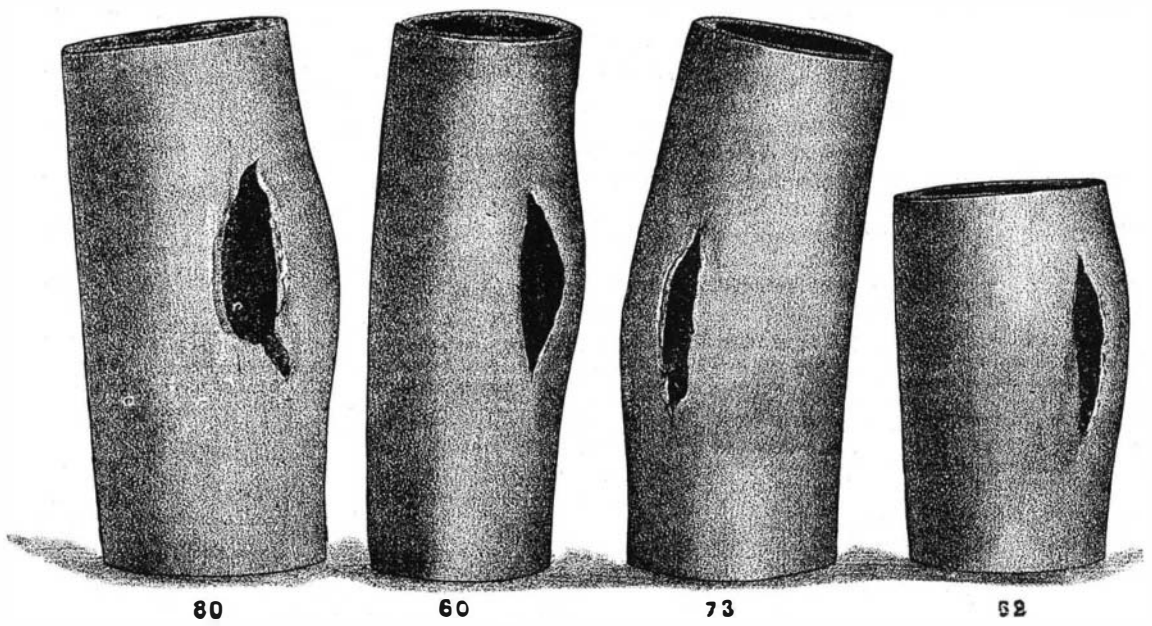
THE STRENGTH OF LEAD PIPES.

The accompanying engravings represent the fractures of several lead pipes tested to destruction by a German firm of manufacturers, from whom the Pintsch's Lighting Company obtain the lead pipes used in the installations of compressed oil gas apparatus, by which a number of the railway companies of this, among other countries, supply their railway carriages with oil gas. After trying the lead pipes of several English makers, the Pintsch Company was forced back upon the German makers, for lead pipes which would, for any length of time, stand the high pressure—90 pounds to 105 pounds—at which the gas is distributed for charging the carriage receivers. The makers of these pipes assert that they use only pure lead, but we are inclined to think that the figures representing the bursting pressure indicate the use of an alloy. The numbers placed below the several pieces of pipe shown in the engraving give the number of atmospheres at which the bursting took place, except in the case of that marked 73, which should be 75. The external and internal diameters of these are respectively 1·5625 inches and 1·125 inches; 1·3125 and 0·9375 inch; 1·4375 and 1·0625 inches; 1·375 and 0·9375 inch.



80 60 73 62

THE STRENGTH OF LEAD PIPES.

Calculated by the formula $S = \frac{p}{\text{hyp. log. } R}$, in which R = ratio of external to internal diameters, p = pressure in pounds per square inch, S = stress in pounds per square inch of the material of the pipe, the bursting pressures give a stress S = respectively 3,720 pounds = 1·66 tons; 2,679 pounds = 1·19 tons; 3,750 pounds = 1·67 tons; and 2,460 pounds = 1·1 tons; or an average of 1·405 tons per square inch of section of the lead.

M. Jardine found that a lead pipe 1·5 inches diameter and 0·20 inch in thickness sustained a pressure of 1,000 feet of water, or 29·5 atmospheres, without alteration of form. Under 1,200 feet of water, or 35 atmospheres, it began to enlarge, and it burst under 1,400 feet of water, or 40 atmospheres, having swollen to a diameter of 1·75 inches. A 2 inch pipe 0·20 inch thick sustained a pressure of 800 feet of water, or 23·5 atmospheres, with scarcely any enlargement; but it burst under 1,000 feet, or 29 atmospheres. From these results, as given by Mr. D. K. Clark, it appears that the resistance of lead to a tensile stress is equal to 15 cwt. per square inch of sectional area, and that its ultimate strength is equal to 1 ton per square inch. We are not told how long a time these pipes were subject to the lower stresses mentioned; but there is little doubt that under long continued stress enlargement would take place at lower pressures than those which equal a stress of 15 cwt. per square inch of the material, so the ratio R would gradually decrease, S consequently become greater, and p less. The stress necessary to burst the pipes we have illustrated was no doubt brought to bear without much reference to the time occupied, and under the circumstances the bursting pressure might be somewhat high and would also be somewhat irregular, which probably explains the difference in the figures above given. These give a mean breaking stress of 28 cwt.; but it is not very likely that the same material in other form than that of a pipe would withstand so high a pressure, because at a slightly weak place extension commences, and though fracture is thus localized, the material is not supported by that around it.

It will be observed from the forms of the fractures, which are clearly shown in our engravings, that they are those which are usually seen in lead pipes in vertical or approaching vertical position, and are burst by frost in winter. These, as well as other fractures, are usually attributed to the expansion of water in freezing; but a little reflection will show that as this expansion takes place as the water solidifies, the fracture produced by it alone would be in the form of a long crack only wide enough to permit of the slight expansion which takes place between 39 degrees and 32 degrees Fah.

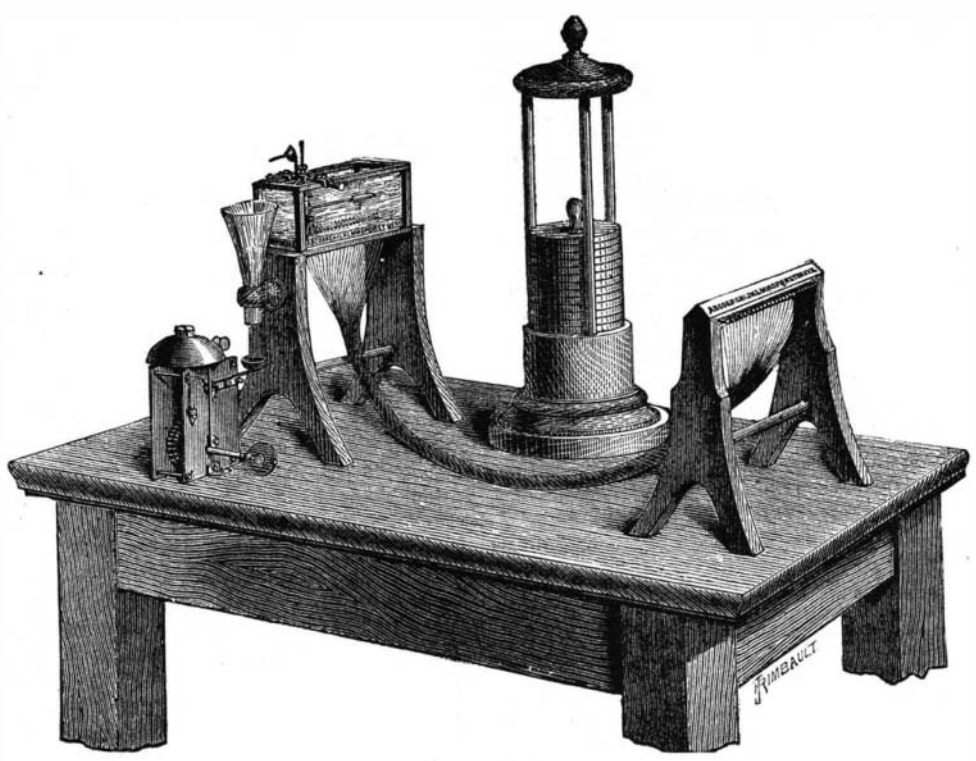
When lead pipes are burst during frost, the fracture being more or less wide, short, and localized at a considerable swelling, the bursting is not always directly due to the freezing and consequent expansion of water and solidification.

In freezing, water gives up a large quantity of its contained air, and this rises to the upper parts of a pipe, or to any part where it gets caught, as in the upper part of a bend.

As the water in the pipe falls from 39 degrees to 32 degrees Fah., or from 4 degrees to zero Cent., its volume increases from 1 to 1.000122, and this, acting on the imprisoned air, compresses a highly elastic medium, which remains under pressure even after the water has become solid. By this means the pipe is swollen and thinned where the air is imprisoned, and by a repetition of the process a burst takes place, which is assisted by the expansion of the air when the thawing sets in, the expansion of air per degree being 0·00217, which is so much greater, as above seen, than that of water.—*The Engineer.*

SOEMMERING'S ELECTRIC TELEGRAPH.

The rapid success of Napoleon's Austrian campaign in 1809 was partly attributable to the good use he made of the optic telegraph; and when he had left the country the Bavarian minister suggested to Soemmering, a member of the Academy of Sciences of Munich, that the Academy of Sciences might advantageously turn their attention to the subject of telegraphy, the great advantages of which had been so completely demonstrated before them. Soemmering caught at the idea, and appears to have immediately recognized that electricity was the agent of all others calculated to render the required service. At that time, says *Engineering*, the only known effect of an electric current which was suitable for the purposes of telegraphy was the evolution of gas, and upon this he commenced to experiment. He first constructed a small apparatus. He made a cable of five wires insulated by sealing wax. The ends of the wires, at one extremity of the cable, were connected to gold terminals in a vessel of acidulated water, and were marked *a, b, c, d, e,* respectively.



SOEMMERING'S ELECTRIC TELEGRAPH.

The other ends were placed, two at a time, to the terminals of a voltaic pile, composed of plates of zinc, silver coins, and felt soaked in dilute acid. The contact was followed by the evolution of gas from two of the gold terminals, and thus any two of the five letters could be indicated simultaneously. The possibility of effecting the transmission of words by this system having been demonstrated, Soemmering proceeded to construct the full sized instrument shown in the annexed illustration, which was sketched from his original apparatus.

It consists of a receiver and transmitter connected by a cable of 35 insulated wires. Here the transmitter has 35 copper terminals in connection with the conductors, marked with 25 letters and 10 figures. Any pair of these terminals could be connected to the poles of the voltaic battery by flexible connections not shown in the figure, and thus a circuit established. The receiver had likewise 35 terminals; these were of gold, and were contained in a glass tank of acidulated water. To call the attention of the attendant an inverted spoon was arranged horizontally in the liquid, and collected the gases that were disengaged from certain terminals. When it became sufficiently buoyant it rose, and at the same time turned down a rod upon which there was loosely threaded a ball. The ball slid off, and, falling down a funnel, dropped into a cup at the end of a detent lever on a call bell worked by clockwork, releasing the mechanism and putting the bell into action. In signaling, the gas rose simultaneously from two of the gold terminals, the quantity from one being double that from the other, and thus two letters were sent at once, it being understood that the one which evolved the greatest quantity of gas preceded the other in the written word. This apparatus was completed in August, 1810, but it was used without the call bell in July, 1809. The first experiments were made over a distance of 38 feet, and then were rapidly extended to 1,000 feet, and, as soon as the inventor had perfected the insulation of his cable by caoutchouc dissolved in ether, to 10,000 feet. The telegraph was presented to the Academy of Sciences of Bavaria in August, 1809, to the Academy of Sciences of Paris in December of the same year, and afterward to various royal personages, but no one took it up, and although it was twenty-five years before a practical system was brought out, yet no one seems to have tried to bring Soemmering's invention into a form from which useful service could be expected.

Superstitions about Precious Stones.

Cornhill Magazine in an article on the above subject concludes that the superstition that yet lingers about the precious stones represents, happily, a fast diminishing quantity. Who would think now, says the writer, of attributing to each stone a special influence over each month, and wearing, therefore, the sapphire in April, the agate in May, and so forth? Yet our ancestors did this, and even appropriated to twelve kinds of stones the twelve signs of the zodiac and the twelve apostles. Perhaps there was some pious intent in making the jasper the symbol of St. Peter, the chrysolite of St. Matthew, or the uncertain beryl of the disbelieving St. Thomas; but the modern spirit needs not these reminders, and their value at any time must have been very doubtful. But, smile as we may at the superstition that ruled in bygone times with regard to precious stones, we have to admit that it was not altogether without its brighter side. In the dark ages, for instance, it can have been no mean happiness to possess gems which, like the diamond and amethyst, reduced war to a safe and pleasant pastime. What charm have we wherewith to face the perils and misfortunes of life comparable to the faith in their talisman which supported our ancestors? Who that remembers the agitations of a law suit and the nervous reliance placed in his solicitor, but might regret the faith which in a previous age and similar plight he might have felt in a morsel of chalcedony?

Science, moreover, in many cases leaves no compensation for the belief she dispels. It was no trifling alleviation of the peasant's lot that he might hope any day to find a rich jewel left by a snake in the grass, or vast treasures hidden in a mountain.

This hope is now gone, or going, from him, and perhaps few living Cornish peasants now look for the blue stone ring which their ancestors attributed to the action of snakes breathing upon hazel.

Who now that drinks the refreshing Vouvray wine, from Vouvray, in France, would ever think that the name of both wine and place had come from an old local belief in a dragon or viper (vouivre) that possessed a single eye, or carbuncle, which it laid aside on the ground, and which, if discovered, would lead its finder to immeasurable riches?

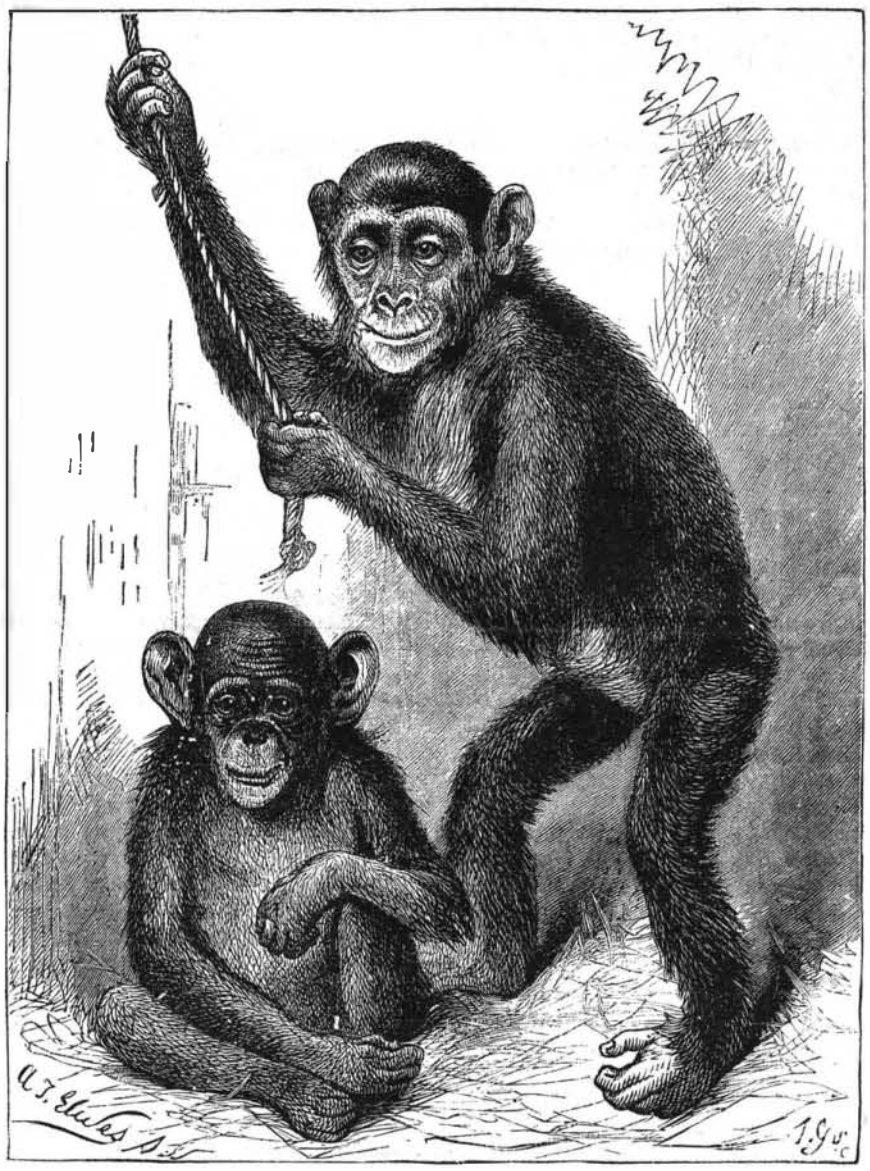
Connecticut Valley Fossils.

At Portland, Conn., on the Connecticut River, three large blocks of freestone have been lately taken out of the quarries, 300 feet below the surface, for the Putnam high school, which are said to be the most singularly marked of any yet found there. On the upper surface of two of the blocks are visible, plainly indented, some of them being a half inch deep and sharply cut, the footprints of birds of a past age; some are large and some small. The third block has the fossilized remains of a creature that in shape resembles a turtle. It is about 1 foot and 6 inches wide, octagonal in shape, and oval like the back of a turtle, it is firmly attached to the rock, and there are no traces of legs.

THE CHIMPANZEE AND KOOLOKAMBA.

The subjects of our illustration were purchased by the Zoological Society of London on Oct. 24; but, unfortunately, the chimpanzee, after living a few days, has succumbed, as many of this species have before, to the fatigue and close confinement of a long and tedious journey.

He was the largest specimen the Society ever had the chance of procuring, and is, consequently, a great loss. He stood, if upright, about 4 ft. 7 in.; and, although slight in comparison with some of his brethren, was of a very powerful frame. It is but seldom that these monkeys are kept alive in Europe for any lengthened time; they almost invariably succumb to cold and lung disease, owing, of course, to the changes in our climate. The other animal, the little koolokamba, is of a rarer species, and is happily thriving well. He appears to be of a hardier constitution. The koolokamba, which gets its name from saying "Koola! Koolo!" over and over again in a strong voice, dwells in the forests of equatorial Africa, and is often seen in company with the chimpanzee. This is the first specimen that has appeared in England, and is an object of great interest to zoologists on account of a certain resemblance, in some points, to the 'nschigombouvie," the chimpanzee, and the gorilla; but is unlike them all in its general appearance, which is rather frog-like. It has an immense belly, and is a vegetable feeder, like all the troglodytes: its skull is globular, it has long ears, and seems to have great intelligence, or rather cunning. Its gait is like that of the gorilla in walking on all fours, resting on the backs of the fingers. We may congratulate the Society upon the acquisition of so valuable a specimen of this rare little creature.—*Illustrated London News.*



THE CHIMPANZEE AND KOOLOKAMBA.

The Alaska Volcano and Tidal Wave.

The Kodiac, eleven days from Kodiac, arrived Dec. 27, and Capt. Cullie, together with C. T. Sands, talked with a *Bulletin* reporter at the office of the Alaska Commercial Company. Mr. Sands says that the tidal wave came about thirty minutes after the eruption, and from shore it appeared like an approaching wall of water. Had the first wave come at high tide, Mr. Sands thinks the little settlement at English Bay would have been obliterated and the inhabitants drowned. The interval between the waves runs about five minutes. The receding waters of the first wave carried the fishing boats from the river to the sea, and the next wave stranded the boats high on the beach. Mr. Sands and others noticed along in the month of August that the mountain in Chernaboura was emitting smoke, but there seemed to be no other premonition of the great explosion which occurred at eight o'clock in the morning of October 6. The shower of ashes followed soon after the rumbling was heard, but the earth did not quake or tremble perceptibly. It was remarked by Mr. Sands as something unusual that the fishes disappeared from English Bay on the night of the 5th. On the morning of the 6th not a fish could be caught or a sign of one seen. The atmosphere was warm, evidently heated by the shower of ashes, which obscured the sun and rendered the place as dark as night for two hours. Looking at night to the west from English Bay to Chernaboura, a distance of forty-nine miles, the spectacle was grand and awe-inspiring beyond description. Columns of lurid smoke and flame seemed to shoot from the earth to the heavens. No one has approached nearer than ten miles to the island since the eruption. At that distance the low ground of the island seemed to be a vast crater from which smoke and fire were issuing.—*San Francisco Bulletin*

Disappearance of Lake Tulare.

Tulare Lake once had an area of 1,736 miles, and depth sufficient for steamboat that navigated it, but its area has been reduced to 196 miles and its greatest depth is only 22 feet. Its contraction is attributed to the absorption of water for irrigating purposes from the two streams that feed it. Some San Franciscans who have just returned from a visit to the lake predict its utter absorption, as every farmer who settles near it digs a new canal for irrigation. There are about forty artesian wells within a radius of forty miles around the lake.

Naturalist Club of Victoria.

Before the Field Naturalist Club of Victoria, Mr. Thomas Harrison contributed a paper on the habits of certain spiders, which we find reported in the *Federal Australian.* It was stated that on placing a large spider on the web of a much smaller but very fierce one, suspended across an old water-butt, the latter deliberately cut the web, and allowed the intruder to fall into the water. After about two hours the spider so unfortunately situated was nearly drowned; and was then hauled up, killed, and eaten. A spider, an immense epira diadema, was placed within a glass case, together with a small tarantula. Next day they were found to have actually eaten each other, only the thorax, head, and a few of the legs remaining. Yet they severally held on by means of their respective mandibles, with an eminent deadly grip, both being quite dead. Six spiders, of the species found under the bark of the eucalyptus, were confined under a tumbler, a bull-dog ant being subsequently introduced. The ant speedily killed five of his fellow prisoners, but on approaching the one remaining the latter turned round, and ejecting several threads of web, succeeded in embarrassing the ant. This done, the spider became the assailant, and rushing upon his antagonist almost bit him in two. Spiders are usually brave; but a tarantula dropped upon an ant-hill in most cases curls up his legs and makes no attempt either to run away or to defend himself. If attacked by a large hornet, the spider generally behaves in a similar manner. On the other hand, one species of spider having very large mandibles strives vigorously, and nips many of the ants venturing to approach him. One particular kind of spider, with long legs, very common in dwelling houses during the autumn months, when touched with the finger commences to sway itself to and fro, continuing the motion for one or two minutes. The late Mr. Darwin supposes that the spider resorts to this practice in order to render himself invisible, but it may be remarked that the trick fails entirely so far as the human eye is concerned. The webs of spiders vary very much as to form and arrangement. Some are of a perfectly polygonal shape, and are supported by a number of threads radiating from the center. In some cases there are only a few radial threads, the interstices between them being filled up with short straight lines, which form quadrangular spaces, and present a general appearance resembling that of a Greek bordering. In other webs the threads are arranged in an irregular manner, so that the entire structure of the web reminds one of the intricate maze of the rigging of a full-rigged ship, while one species of spider does not suspend its web at all, but attaches it flatly upon a wall or door. In this latter case the threads are evidently covered with an extremely viscid substance, which retains any insects accidentally alighting thereon. The "vibrating" spiders, if placed on the bottom of a tumbler reversed and standing in a plate filled with water, throw out a web, which, adhering to some adjacent object, forms a sort of aerial suspension bridge by means of which the spider escapes from captivity. The spiders found under the bark of the eucalyptus, if thrown into water, eject threads of web, and these, being wafted ashore, enable the spider to speedily haul itself to dry land. A spider inclosed on a sheet of paper within a circle of wet ink, to all appearance ejected a thread perpendicularly upward until it attached itself to the ceiling. The spider then climbed up the thread and escaped. Some fifty or a hundred common house flies were once noticed to swarm round and follow, for more than a hundred yards, a gossamer spider floating through the air, supported by the quasi balloon which this species is known to construct. This habit of the gossamer is well known to naturalists, but the behavior on the part of the flies has never been previously observed.

Wonderful Insect Eyes.

Physicians call attention to the increasing instances of defective or imperfect sight occurring in civilized countries, and attribute it to various conditions of modern life—the overwork of the eyes in childhood, the study of books in small print, the habit of reading by imperfect light, and many other causes. It appears certain that in the matter of eyesight the savage has usually the advantage of the civilized man. The gift of sight is one very unequally distributed among the animal world. Some creatures enjoy it in excess, like the eagle; others are totally deprived of it, like the earthworm. In many other instances the sense of sight, if not actually lacking, is extremely imperfect, as in the case of the mole. Insects are in many cases far more richly endowed with eyes than even birds or beasts. The little creature called a whirlwig (*Gyrinus natator*), which skims about on the surface of standing water, is furnished with a double set of optics, the upper portion of the eyes (fitted for seeing in the air) being placed in the upper portion of the head, and the lower portion of the eyes (fitted for seeing in the water) in the lower portion of the head, a thin division separating the two. Spiders possess six eyes—some species eight; centipedes twenty, while the eyes of many insects (bees, butterflies, dragon-flies) are composed of a number of facets, each eye being, in fact, a cluster of eyes. Dr. Hook counted 14,000 of these facets in the eye of a dragon-fly, and Leeuwenhoek found as many as 12,544 in another specimen of the same species. The latter naturalist adapted one of the eyes of a dragon-fly so as to be able to see objects through it by means of a microscope, and found that he could view the steeple of a church 299 feet high and 750 feet from the place where he stood; he could also distinguish if the door of a house, at the same distance, was open or shut. Fleas' eyes diminish as well as multiply objects, as Puget discovered by performing a similar experiment to that of Leeuwenhoek. "A soldier viewed through it represented an army of pygmies; . . . the flame of a candle seemed the illumination of a thousand lamps." Blind or imperfectly sighted human beings may think with envy of the beautiful provision of visual organs bestowed by Nature on some of her children; and yet many creatures live happily with but a small share of the blessings of sight. In some of the insects who possess the largest share of visual organs, some other sense—taste, hearing, or touch—is deficient. Huber believes their sense of both hearing and taste to be imperfect. On the other hand, the blind earthworm will retreat rapidly into its hole if the light of a candle is thrown upon it, its sense of hearing or smell warning it of the approach of the danger it cannot see. A bat's senses of touch, hearing, and smell are so acute that it depends little on the aid of its eyes. Spallanzani tested this by the cruel experiment of destroying the sight of several bats, and then setting them free. In their flight through the room they avoided even the smallest thread placed to obstruct their way. Latreille, the French naturalist, states that there is a species of ants which are entirely blind, but pursue the same mode of life as their sighted brethren.—*London Globe.*

The Wonderful Sunsets.

Concerning the wonderful phenomenon of our sun risings and settings of late, and the suggestion that it may be caused by volcanic dust from earthy or lunar volcanoes, I have this remark to make: If it were caused by such dust or mist, it must sensibly affect the rays from the moon and sun, whereas no such effect is perceivable. Heavy and dense as that mist appears the moon rises from and sets below it with not the slightest diminution of its power to shine. The same may be said of Mars and Jupiter. Jupiter rises now in or near the Crab. I do not see that it affects the rays of any star. If it does not, then we may conclude that the cause exists far beyond the most distant star. Those who have the opportunity of ascertaining if these speculations are correct should report. Certainly it would seem that the cause of the phenomenon lies far beyond the orbit of our sun.

C. I.

Oregon, Mo.