Formerly the annual damage to ships by lightning involved an expense of $30,000 to $50,000. Between 1810 and 1825, no less than thirty-five sail of the line and thirty-five frigates and smaller vessels were completely disabled; and in 200 cases recorded, 300 seamen were either killed or injured. When the lightning rod was introduced, every mast was furnished with a capacious conductor permanently fixed and connected with bands of copper passing through the sides of the ship under the deck beams, and with large bolts leading through the keel and keelson, and including, by other connections, all the principal metallic masses employed in the construction of the hull (Harris). Since the adoption of this arrangement, "it appears that damage by lightning has positively vanished from the records of the navy." In one case, while the small frigate Conway was under refit in the harbor of Port Louis, the topgallant masts were down on the deck, and a small spar, not having a conductor, was substituted for the time to support the pennant. A thunderstorm came up and the spar was shivered to atoms. No further damage was done, however; for the conductor on the topmast below the spar immediately carried off the terrific flash. No further examples are needed to prove that a lightning rod, constructed according to the principles set forth, is a protector to life and property.

RECENT METEORIC INVESTIGATIONS.

On the tenth of the present month, the earth passed through the first of the two great rivers of meteors which intersect its orbit; and on November 13 or 14 it will encounter another shower of shooting stars, of equal magnitude. The band recently traversed, known in ancient times as the Tears of St. Lawrence, is about 10,948,000,000 miles in its greatest diameter, and 4,043,350 miles wide at the point of the earth's crossing.

Probably the most recent investigations into the nature of the erratic masses which constitute these vast belts are those made by Father Ferrari and others in the fall of last year, recently published in *Les Mondes*. They are based principally upon the observation of a remarkably brilliant aerolite, which fell near Orvinio, in Italy, during the latter part of August, 1872. The course of the body was from the southward and eastward, it appearing at first quite small and emitting a reddish light which gradually increased in brilliancy, leaving behind a misty train. Suddenly the bolide flamed up apparently as large as the moon, and then instantly disappeared, a long cloud, of serpentine form, remaining in its place. About three minutes after, a violent explosion was heard, followed by two others of less intensity. From the point of first observation to that of its disappearance, the meteor traveled over a trajectory of 62 miles, and its altitude at the beginning was measured at 30°, corresponding to an elevation of about 114 miles. The first detonation took place at a hight of 10·2 miles, and the final bursting into small fragments at a few hundred feet above the earth. The velocity of the mass was calculated at 32·2 miles per second.

In order to determine the amount of heat developed by the aerolite after entering our atmosphere, Schiapparelli's investigations were employed. That astronomer has demonstrated that, if a meteor enters the limits of the earth's atmosphere at a minimum velocity of 9·6 miles per second, when it has arrived at a point where the atmospheric pressure is at ·36 inch, it will have already lost $\frac{1}{11}$ of its velocity, and $\frac{13}{131}$ of its *vis viva*. It is evident, therefore, that so great a proportion of lost motion must be converted into enormous heat. Applying suitable formulæ to the case in point and assuming the specific heat of the body to be ·22 of 1° centigrade, which is not far from the truth, it has been found that the augmentation of temperature, after plunging into the earth's atmosphere, would be 3,468,107·8° Fahrenheit, a degree far more than sufficient to explain the phenomena of light and heat, as well as of the explosion or total dispersion of immense masses.

A number of fragments of the meteorite above referred to, quite small in every instance, were picked up and subjected to careful examination. The mass was crystalline, and formed of various substances. An angle was polished with difficulty, owing to the extreme hardness. An abundance of malleable granules of nickeliferous iron were recognized. The interior of the fragments appeared porous, but outside they were covered with a pellicle of vitrified matter. Beyond the iron above mentioned, the greater part of the mass contained soluble silicates, principally those of magnesium and of iron. From the fact that it has been noted that the meteors of the August and November showers, travelling at the rate of from 36 to 40 miles per second, find an insurmountable obstacle in the atmosphere, Schiapparelli has pointed out that only bodies of an enormous magnitude would be able to penetrate it and reach the surface of the earth in a fragmentary condition. Ferrari observes that, from this, it may be considered that the meteor he describes, having a velocity nearly equal to the above, must have been of tremendous size, and he notes, as a remarkable fact, that an unusual number of these bodies, ten in all, fell in Europe between July and September of last year.

The author states the result of his observations to accord with the following conclusions previously enunciated by Schiapparelli: 1. The intimate correlation between the comets, shooting stars, and meteorites is now placed beyond doubt, and the immense velocity observed in some meteorites renders it impossible to ascribe to them a planetary origin; consequently the hypothesis of stellar origin is the most probable. 2. From this supposition, the masses come from no single body, since divers cases demonstrate the fact that they arrive from totally different regions in stellar space. 3. The hypothesis admitted, it must follow that the chemical and molecular structure of the bodies of the universe, situated in different positions, must be of similar nature to that of the meteorites themselves.

The below given views regarding the mineralogical structure and composition of aerolites are ascribed to Danbrée, and are the results of examination both by spectral and chemical analysis: 1. Hundreds of analyses by the most eminent chemists prove that meteorites contain no simple body unknown to our globe. 2. There have been recognized with certainty twenty-two elements, given below in the descending order of their importance: Iron, magnesium, silicon, oxygen, nickel, cobalt, chromium, manganese, titanium, tin, copper, aluminum, potassium, sodium, calcium, arsenic, phosphorus, nitrogen, sulphur, chlorine, carbon, and hydrogen. It is a very curious fact that the three bodies which predominate in nearly every meteorite, iron, silicon, and oxygen, are also those which predominate in the earth. 3. Meteorites have also many peculiar mineral compounds, principally native nickeliferous iron, sulphide of iron and of nickel (schriebersite) and sulphide of iron (troilite). There are also common to the meteorites of the earth a great number of combinations, similar not only in chemical composition but even in crystalline form. 4. Meteorites indicate in a measure the temperature at their formation, and that by which they are caused to disaggregate. 5. Lastly, these bodies demonstrate the existence of innumerable masses disseminated through the remotest regions of space, which would be completely unknown were it not for their sudden and splendid apparitions.

LEAD POISONING AND ITS TREATMENT.

Cases of lead poisoning are becoming more frequent now than formerly because there are more persons engaged in manufacturing this metal, who are, more or less, surrounded and enveloped by a lead-poisoned atmosphere. In a metallic state lead enters into alloys; its salts are used in paints and dyes; it is a constituent of enamels and cements. Lead pipes conduct our drinking water; and the purer the water that flows through it, the more danger there is; while, if the water contain certain salts, they are deposited on the sides of the pipe and protect the water from the metal. Zinc vessels contain lead, and while in some countries the law limits the quantity of lead to ten per cent, even six per cent is fraught with danger to health. Horse hair and silk are dyed black with lead; the laces worn by ladies, as well as their cosmetics and hair dyes, contain lead. No doubt many cases of colic, whose origin seems shrouded in mystery, were caused by lead in the solder of metallic vessels or the glazing of stone ones. The foil used in wrapping tea and tobacco causes lead poisoning, and so do the granules of lead that are sometimes left in tin cans and jars. An old soldier has been known to suffer severely from using leaden shot; and the workmen in glass houses where lead salts are used are similarly troubled. Even type setters are occasionally poisoned by handling type made of an alloy of lead. Many other ways may be mentioned in which lead is introduced into the human system, but these must suffice for the present.

Whatever may be the cause of lead poisoning, it is certain that it is generally observed in summer when the heat favors the colic. Lead may be taken up by the digestive and the respiratory organs and through the skin, principally by the former, even in the case of insoluble salts, which probably dissolve in the gastric juices. Indeed some writers claim that cases produced by lung absorption are caused by salts deposited in the pharynx. The most striking symptom of lead poisoning is the peculiar color of the gums, and this is not due, as has been supposed, to the deposit of little particles of lead which are then acted upon by sulphureted hydrogen. It is rather one symptom of the general phenomenon, for it appears whether lead is taken inwardly or lead water is used on distant parts of the body.

Lead colic is usually preceded by indigestion. The size of the liver diminishes; and after the use of powerful cathartics, it becomes normal, and then contracts again. The nervous symptoms caused by lead poisoning are of several kinds, such as paralysis of the muscles, sleepiness, convulsions, blindness, and pain in the back bone; while on the other hand, insensibility and deafness may result. The skin on the back of the hands swells up as in gout. Albumen in urine is a most common occurrence, but the most striking symptom is *anæmia*, or lack of blood. Distention of the veins is frequently observed, and ulceration of the bones is not an infrequent consequence of lead poisoning.

While lead has so many ways of entering the system, there are very few ways for it to pass off. Little or no lead is secreted in the urine, except when it contains albumen, and there is very little lead in the perspiration. It seems that the metal is deposited where it is absorbed. When soluble lead salts are taken, an albuminate of the metal is formed; while insoluble salts, as before stated, settle upon the walls of the organs and are protected from absorption into the system. This explains the fact that lead workmen are sometimes attacked with colic long after they have abandoned their dangerous calling, the accumulated lead being very gradually dissolved and absorbed.

When lead produces indigestion, it is due to the lead's stopping the action of the digestive fluid. When digestion ceases, colic begins, which is the result of the local action of the lead upon the intestines, for it does not occur when absorption takes place in another way. The change of size in the liver is dependent upon changes in the vascular system. Just as far as this whole system comes under the influence of the poison, *anæmia* takes place, with chills, loss of elasticity in the arteries, and diminished capillary circulation. Pallor of the skin, contraction of the liver, and diminished quantity of urine are all referable to these causes. The asthma with lead poisoning is characterized by pain in the breast bone and difficulty of breathing, which, however, is not because the entrance of the air is obstructed, but because the blood does not come in contact with the air. Paralysis is one of the effects of a disturbance in the blood vessels.

In the treatment of lead patients, the pain must be relieved by the use of chloroform or chloral; opiates are to be avoided, as they produce constipation. The lead salts must be expelled from the digestive canal, and the constipation relieved; both these are best accomplished by drastic purgatives. The incrusted particles of lead, which remain attached to the walls of the intestines, must also be removed; and for this purpose, the use of sulphur is recommended, after purging, so as to convert the lead into the insoluble sulphide of lead, which can then be removed by cathartics. Insoluble lead salts, which still remain in the system, are best removed by administering iodide of potassium, which carries off the lead through the urine. Lead workers whose skin absorbs the poison should protect themselves by the use of salt baths. In France, Labarraque's solution (hypochlorite of potash) is used for this purpose; and to this should be added an excess of carbonate of soda. These baths are more useful than mere soap baths; and the bather, while in the water, must rub himself thoroughly. Instead of Labarraque's solution the following may be employed: 15 ounces chloride of lime, and 30 ounces crystallized carbonate of soda, dissolved in 10½ quarts of water.

The Permeability of Cast and Rolled Iron to Gases.

Both these kinds of iron are permeable to hydrogen and carbonic oxide gases. This is an important scientific fact, and the mode of penetration is a beautiful example of what the late Professor Graham named "occlusion," the mass absorbing the gas at one surface, transmitting it to the particles of the interior, and finally allowing it to escape into another gas, in contact with the other surface. This action differs from that of filtration essentially, and it takes place at a very high temperature only, when wrought iron is softened, cast iron changed in crystaline structure, and meteorolites are heated nearly to the point of fusion.

In all these cases, the iron mass retains several times its volume of hydrogen, carburetted hydrogen or carbonic oxide.

While, on one hand, this action corresponds to that where blister steel is formed, on the other it closely resembles the so-called alloying of palladium with hydrogen, the gas assuming a new physical condition.

The writer has learned that this interesting fact has been misunderstood so far as to lead to the belief that cast iron is porous when heated, and allows these gases to pass through castings; and in case of furnaces in use for heating dwellings, the hydrogen compounds and carbonic oxide, produced in imperfect combustion, pass through the iron and enter the air chamber, flowing with the heated air into apartments.

Such conclusions are wholly destitute of proof, as this action takes place, in carefully conducted experiments, only at very high temperatures, and involves molecular changes in the iron. It would now be novel and disheartening to learn that cast iron gas retorts, heated red hot for months and constantly containing carbonic oxide and hydrogen compounds, allowed the gas to pass through the metal even under pressure. Those who have had chemical experience with cast iron vessels highly heated, holding these gases, will not believe that iron has of late gained new properties. Those who use cast iron furnaces for warming may sleep quietly, if they are assured that all joints are tight.

A. A. H.

ELECTRO-DEPOSITION OF ALUMINUM.—John A. Jeançon, Newport, Kentucky, is the author of the following process: Dissolve the desired salt of aluminum or a double salt of aluminum and potassium, sodium, etc., in distilled water, and concentrate to 20° Baume, (at 50° Fahrenheit.) The battery used is either four pairs of Smee's zinco-platinum or three Bunsen's zinco-carbon, the elements connected for intensity. The solution is heated to 140° Fahrenheit, slightly acidulated, and a plate of aluminum is attached to the negative wire in working.

At Mont Clair, N. J., recently, the rods on a dwelling house were struck by lightning and the fluid passed off into the ground, thence upon a gas pipe near the terminal of the rod, to an air-gas carbonizer, located a short distance from the house. The gas apparatus was blown up, but no other damage was done.

OPERATIONS OF THE CANADIAN PATENT OFFICE —From the 12th of February to the 8th of April, 1873, almost two months, one hundred and sixty-four patents were granted in Canada, of which eighty-five were issued to citizens of the United States.

Dr. TOBIAS' VENETIAN HORSE LINIMENT.—According to the analysis of Schaedler, published in the Berlin *Industrie Blätter*, a bottle of this celebrated liniment contains 1 ounce ammonia, half an ounce camphor, 1 ounce tincture of Spanish pepper, 7 ounces alcohol, 2 ounces water.

AT the close of 1872, there were in operation in the United States 67,104 miles of railroads, operated by 436 different companies. Average cost per mile, $55,116. Average dividends, 3·91 per cent.