sand. The water passes in through a pipe from the upper step. By the action of the water the fish are hatched. It sometimes takes one hundred and sixty days to hatch them. Salmon in their first form are ungainly, having depending from them a little bag. This after six weeks passes away, being used by the fish as its nutriment. Having grown quite lively, they are removed to ponds, care being taken not to allow fish of different ages to live together, for they are cannibals and devour those younger than themselves. After a time they are allowed to go down to the sea, and it is noticeable that salmon always return to the place where they were bred, making allowance, of course, for those that are destroyed. He had made an estimate of the value of artificial cultivation of trout and salmon, from observations made at tanks on the Tay and in Vermont. Ova sold $8 per 1,000. In pond No. 1 there were 10,000 fish fed daily by three quarts of curds. In pond No. 2 there were 8,000 fish of the second year fed upon six quarts of curds daily. In the third there are 7,000 fish fed upon twelve quarts of curds. The total return which these fish produced, was $4,350, and the net profit $3,644. From this he inferred that the cultivation of fish was well worthy of adoption.

Mr. Waterhouse Hawkins, in a response to a request from Professor Joy, added some particulars to what Captain Gilmore had stated. He wished that that gentleman had said something about the cultivation of the delicious fish called char. It was conducted in the same manner as that of trout and salmon. Some two years ago, while acting as the honorary secretary of the Acclimatization Society, in the absence of Mr. Buckland, he undertook to propagate some char. He received the ova from Windermere. They were in—some 30,000—admirable condition. He treated them as Mr. Gilmore had already described, but the gravel was boiled to remove all its inhabitants previous to being used in the troughs. The impregnated ova were removed to the ponds just before the pellicle burst, as soon as the eyes appeared. Mr. Hawkins then detailed his efforts to send some ova to the Duke of Argyll, and strongly impressed on the lyceum the value of pisciculture. In compliance with a request of Professor Joy, he explained, by means of the blackboard and one of his inimitable freehand sketches, the difference between the salmon, trout, and char.

Mr Gilmore at the suggestion of Mr. Hawkins, detailed the circumstances which led to his discovery of the char in this country. He had caught some magnificent fish in this country of striking appearance and luscious taste.

No other matter matter coming before the lyceum it adjourned.

A Coal Miner in the British Parliament.

Mr. Carter, alderman and coal merchant, is the liberal colleague of Mr. Baines in Leeds. The *European Mail* says he is a remarkable man and perhaps may astonish the House. He began life as a worker in a colliery, and by his own unaided ability has risen to be a merchant, alderman, and member of parliament. He has had but little school education, but from assiduously reading bluebooks he has got to be fairly instructed in politics. He is a fluent speaker, and is never at a loss for a word. He speaks with the real Yorkshire burr; has not an H in his vocabulary; and if any preceding speaker says anything with which he (Mr. Carter) cannot agree, he says "I am of the *contrairy* opinion." His manner is energetic, even forcible; and takes with the Leeds clothweavers. He is in politics a radical of the radicals—bold, defiant; denouncing the church, denouncing the state, the army, the navy—denouncing, indeed, everything. He is president of the Leeds branch of the Reform League, and is said to be the only member of that illustrious association returned to parliament.

Military Cart.

This is a cart which was designed by Mr. W. J. Addis, executive engineer to the Local Fund Works at Bombay, to meet the exigencies of the Abyssinian War, comprising many essential points, and differs from any existing construction. The wheels are formed of segmentary parts of wrought iron, circumferenced with wooden fellies, and tired in the usual manner. By this arrangement the shrinkage is reduced to a minimum, so that the wheels are better adapted for hot climates. Among other advantages, it is calculated to be more durable than the ordinary wooden wheel, and runs much easier. The nave is flush with the spoke and tire, thereby lessening the risk of collisions. The axles are two in number, nine inches in length, and work in two plummer blocks fixed in the frames of the cart, and are easily arranged in case of damage. Another palpable advantage is that the pole is so arranged as to admit of the cart being drawn back without the necessity of turning, while it can also be wholly withdrawn and passed through the center of the box in the body of the cart, which contains a tent, and it can also be used as a tent pole.

How to Preserve Sodium Untarnished.

Many teachers, particularly in our high schools, have sodium preserved in the usual way, under naphtha. But the beautiful metallic luster is not seen under these circumstances; and if the metal is taken out and a fresh cut made, this only shows the luster for an instant. By the following artifice the *metallic appearance of sodium may be permanently exhibited.* Take two test tubes, one a little smaller than the other, so as to slip into the latter without leaving much space between the two glass walls, put some carefully cleaned sodium in the wider tube insert the more narrow tube, having previously given a thin coating of beeswax to the upper part of this latter; then gently heating the whole on a sand bath. The sodium will fuse, and by a gentle pressure, the inner tube was pressed down, so as to force the fused metal over a large surface between the two tubes, while the air is totally excluded by the beeswax. I have kept sodium for more than six months in this way, and it is now as bright and brilliant, as when first put up.—*Prof. Gustavus Hinrichs.*

New Method of Mixing Mortar.

A correspondent from Syracuse, N. Y., sends us an account of an invention perfected in that city for mixing mortar, which is simply this: The lime is first slacked in a vat with water enough to make it to a paste, and allowed to retain its heat for about twenty-four hours—it is next run off into a second vat, from which it is pumped by a chain pump to a revolving cylinder that has a large quantity of spikes on the inside. As it flows from the cylinder, it passes through a sieve of ten meshes to the inch, and every particle that is used has to go through these very fine holes no larger than a pins' head. From this machine it falls into a large vat, from which it is pumped as required to a similar revolving machine called the mixing machine, into which it flows in a continuous stream, and sand, previously sifted, is added at the rate of about eighty bushels per hour. The mortar made in this way is said to be of a very superior quality.

INFLUENCE OF THE OXIDES OF CHROMIUM AND TITANIUM ON THE COMPOSITION OF PIG IRON.

BY AUG. A. AND S. DANA HAYES, ASSAYERS TO STATE OF MASSACHUSETTS.

Within the last four years we have been frequently employed in chemical investigations of the altered characters of some pig irons, which resulted apparently under the usual circumstances in the reduction of uniform ore.

In these cases the amount of carbon united with the iron had been diminished, without the introduction of other matter, in quantity sufficient to influence a change in this connection, and generally no variation in the composition of the ore was known or suspected. We had analyzed the ores in some of the beds in former years and regarded them as well adapted to the production of pig iron of good quality; but in pursuing the research we were convinced that the change in quality of iron could be traced to altered composition in the ore of part of the beds used for supplying the furnaces.

The correctness of this view was confirmed by our analyses of many iron ores, in some of which we found the oxides of chromium or titanium, existing where they were not indicated and connected with the ore in beds which have been considered as pure iron ores.

Both the oxide of chromium and oxide of titanium, seem to act in the furnace or the crucible in a way to withdraw a portion of the carbon, or prevent that true union of carbon with a portion of the iron, which constitutes gray pig iron, without the metals of these oxides really alloying with the iron and thus indicating the cause of change. We have analyzed samples of pig iron where the alloys of chromium or titanium existed in the pigs, and where the oxides accompanied the ores in the beds, but we were not prepared to find an influence exerted on the quality of the pig metal *without the refractory metals forming a part of the composition.*

The occurrence of oxide of manganese with iron ore is common, and titanium compounds are often found in both magnetic and brown iron ores, as insoluble substances, in small proportions, and these compounds combine with and are removed by the fluxes without injury to the pig metal. These compounds of titanium are the cause of the often superb blue color of the cinder, produced under varying conditions of glassy or stony character, and must be carefully distinguished from those we regard as more detrimental in their influence on the metal.

In a number of analyses of iron ores we had found both oxide of chromium and oxide of titanium in a state rendering them soluble in diluted acids, and in a condition to escape detection in the ordinary modes of analysis. Both magnetic and brown iron ores have been found to contain either oxide of chromium, or oxide of titanium in this soluble state. Among the samples from contiguous beds, this diversity in composition made by the presence of some oxide of chromium or oxide of titanium existed; and while the bulk of a bed of ore was pure, continuations of the bed, or associated ore, yielded notable weights of oxide of chromium or oxide of titanium in the different samples.

The suggestion we would make to the iron master in view of these facts is, the possibility of the quality of the pig metals in anomalous cases being greatly influenced by the admixture of some ore, containing the oxides of chromium or titanium, with the basis ore of good quality. This may take place by the main bed being crossed by veins of mixed ore, or by the workings passing into contiguous beds where one kind of ore is used. In other cases, where the iron master can gain the great advantage arising from mixing ores, one of the kinds may contain the contaminating oxides and injure the iron.

We subjoin some results of analyses showing the proportion of oxide of chromium to the metallic iron contained in the ores:

1st. Magnetic ore—iron, 49; oxide of chromium, 1·40. 2d. Hematite ore—iron, 42·47; oxide of chromium, 1·60. 3d. Brown Massive ore—iron, 54·32; oxide of chromium, 1·90. 4th. Same—iron, 46·70; oxide of chromium, 1·04.

More traces have been discovered in some cases, while in other instances a larger proportion of chromium formed an alloy with the iron produced from the ore.

"ARE PAINTED LIGHTNING RODS ANY PROTECTION?"

BY JOHN H. PATTERSON.

We do not believe that paint or rust totally destroys the conducting power of a lightning rod; only in proportion to the amount of impurities with which it is coated. There is, doubtless, a point beyond which a conductor will cease to be one, because the impurities upon it may be so great that it will possess no more facilities for conducting the fluid to the earth than the building itself. It would all depend upon the extent of the charge, and whether there was any tin or zinc spouting in connection with it. The very best scientific authority says that iron has 12° of conducting power, tin 14°, zinc 24°, and copper 92°. All admit that electricity will follow the best conductors only. If such is a fact it cannot be reasonably supposed that if such spouting was in contact with a perfect iron rod, that a charge of electricity would follow the main conductor to the earth. Would it not rather leave the iron rod and pass over the spouting? It certainly would if the theory alluded to is correct. Whether or not the lightning rod was painted, it is natural to suppose that combustion would ensue. The explosion might not be very great, and no serious damage might be done, and no lives lost, yet that does not refute the principle. Every few days we read of the freaks of lightning, and upon buildings, too, protected by iron rods. Why is this? Professor Douglass, of the University of Michigan, in an elaborate paper upon this subject says, that the design of a lightning rod is to prevent a stroke of lightning by silently relieving the positive atmosphere of its overcharge. This idea looks very reasonable, for Dr. Franklin said that explosions only occurred when conductors could not discharge it as fast as they received it. Now if a conductor cannot discharge the fluid there must be a cause for it. Either it is not large enough, is not perfectly applied, or it is coated with impurities. We know that an ordinary iron rod will conduct off an ordinary stroke of lightning, for it has been seen; but when an explosion occurs it cannot be stated which of the other two causes is the particular one unless the conductor is in direct contact with spouting of a superior conducting metal. Then the case is very clear. If it is in contact with such spouting, the idea that electricity follows the best conductors is correct. If the rod is insulated from both building and spouting, then the cause must be the impurities on the rod, be they paint or rust.

Lightning rods of a proper metal, copper, applied in a proper manner, are certainly a means of protection.

A recent writer quotes Professor Henry to prove that conductors should be brought in contact with the spouting on a building. This principle is certainly true respecting copper, but for the reasons given above, we hardly think it correct to expect electricity to leave a good conductor (the zinc spouting) for a poor one (an iron lightning rod), and we do not believe that Professor Henry desires to be so understood.

There can be no doubt but what the conducting power of a lightning rod is affected in proportion as it is coated with impurities of any character. If electricity, in its passage to the earth, passed into the conductor, there might be some reason to suppose that paint would not interfere with it; but when it has been demonstrated by scientific investigation that it resides only upon its exterior surface, we are not at a loss to understand why the surface of a lightning rod must be free from such impurities. That electricity does not enter into a conductor, we will refer to "Silliman's Natural Philosophy," page 540; "Olmsted's Philosophy," by Snell, page 327; and "Nichol's Cyclopedia of Physical Science," article—Electricity. In "Parker's Philosophy," page 280, we read: ". . . . and paint destroys the conducting power of a lightning rod."

We are aware that our ideas are at variance with one of the most distinguished scholars in the world—Professor Henry—and, of course, we do not think of setting aside his authority; but we have given them, and let them go for what they are worth. In this connection we refer to a letter from Professor Henry, of the Smithsonian institute, in which he says:

> The paint with which lightning rods are usually covered consists principally of carbon, and as this is, in itself, a good conductor, it could hardly interfere with the conducting power of the rod. Beside this, though the electricity tends to pass at the surface of a conductor, it in reality passes within the metal, as a wire which fully conducts a discharge from a battery, may be coated with non-conducting varnish or sealing wax.
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> The office of a lightning rod is to protect a building from a discharge from the heavens. As a general thing its effect upon a distant cloud must be too small to silently discharge its redundant electricity, though in some rare instances it is possible that it may so reduce the intensity of the cloud as to prevent a discharge, when, without such reduction, a discharge would take place.

JOHN MACADAM---INVENTOR OF MACADAMIZED ROADS

BY JAMES PARTON.

Few persons are aware who ride over the excellent macadamized roads of the Central Park, that Mr. Macadam, the inventor of the roads which bear his name, was once a resident of New York, and probably often walked or rode over the fields and farms which then occupied the site of the park. Yet such was the fact. Though born and buried in Scotland, he lived for some years in New York; and, possibly, the horrid condition of American roads before the revolutionary war, may have first impressed upon his mind the urgent necessity there was for a better road system.

John Loudon Macadam was born in 1756, in Ayr county, Scotland, not far from the birthplace of Robert Burns. His family was ancient and highly respectable. When he was little more than an infant, one of his uncles, William Macadam, accompanied the British forces which came to America under Lord Loudoun, during the old French war, for the conquest of Canada. This William Macadam, it appears, had something to do with supplying the British army with provisions; and when the war was over, instead of returning to Europe, he settled in the city of New York, where he became a thriving merchant. When John Macadam was fourteen years of age, his father died, and the boy was sent to America to become a member of the family of his uncle William, who procured him a place in the counting-house of a friend.

This was in 1770, when New York was a quaint old place, half English, half Dutch, situated at the end of Manhattan Island; the residue of which was verdant with woods and farms, and adorned with the villas and mansions of the wealthier citizens. People who are only acquainted with Manhattan Island now, when its beautiful groves are gone, its commanding bluffs dug away, its surface excavated and excoriated for rail-