were kept at a red heat for two or three days, and subsequently left to cool in the furnace for three days. The second process is a mere modification of the first. Cast iron articles, without being melted or having their form altered are thus rendered malleable.

Wrought iron is incapable of being melted and cast, but by mixing it with three times its weight of pig iron it will fuse under a strong heat and may be cast and annealed. Castings possessing the same properies as those of malleable iron may thus be obtained, but unless made of cheap scrap iron they would cost more than castings entirely of pig iron malleableized.

ENAMELING IRON.

Enameling iron is almost a new art. No metal is capable of receiving a coating of vitrified porcelain or enamel unless it is capable of withstanding a red heat in a furnace. Articles of cast iron, as a preparation for enameling, are first heated to a low red heat, in a furnace, with sand placed between them, and they are kept at this temperature for half an hour, after which they must be allowed to coolvery slowly, so as to anneal them. They are then subjected to a scouring operation with sand in warm dilute sulphuric or muriatic acid, then washed and dried, when they are ready for the first coat of enamel. This is made with six parts, by weight, of flint glass broken in small pieces, three parts of borax, one of red lead and one of the oxide of tin. These substances are first reduced to powder in a mortar, then subjected to a deep red heat for four hours, in a crucible placed in a furnace, during which period they are frequently stirred, to mix them thoroughly; then toward the end of the heating operation the temperature is raised, so as to fuse them partially when they are removed in a pasty condition and plunged into cold water. The sudden cooling renders the mixture very brittle and easily reduced to powder, in which condition it is called frit. One part of this frit, by weight, is mixed with two parts of calcined bone dust, and ground together with water until it becomes so comminuted that no grit will be sensible to the touch when rubbed between the thumb and finger. It is then strained through a fine cloth, and should be about the consistency of cream. A suitable quantity of this semi-liquid is then poured with a spoon over the iron article, which should be warmed to be enameled, or if there is a sufficient quantity the iron may be dipped into it and slightly stirred, to remove all air bubbles and permit the composition to adhere smoothly to the entire surface. The iron article thus treated is then allowed to stand until its coating is so dry that it will not drip off, when it is placed in a suitable oven, to be heated to 180° Fah., where it is kept until all the moisture is driven off. This is the first coat; it must be carefully put on, and no bare spots must be left on it. When perfectly dry the articles so coated are placed on a tray separate from one another, and when the muffle in the furnace is raised to a red heat they are placed within it and subjected to a vitrifying temperature. The furnace used is similar to that used for baking porcelain. This furnace is open for inspection, and when the enamel coat is partially fused the articles are withdrawn and laid down upon a flat iron plate to cool, and thus they have obtained their first coat of dull, white enamel, called biscuit. When perfectly cool they are wet with clean soft water, and a second coat applied like the first, but the composition is different, as it consists of 32 parts, by weight, of calcined bone, 16 parts of China clay and 14 parts of feldspar. These are ground together, then made into a paste, with 8 parts of carbonate of potash dissolved in water, and the whole fired together for three hours in a reverberating furnace, after which the compound thus obtained is reduced to frit and mixed with 16 parts flint glass, 5½ of calcined bone and 3 of calcined flint, and all ground to a creamy consistency, with water like the preparation for the first coat. The articles are treated and fired again, as has been described in the preparation coat, and after they come out of the furnace they resemble white earthenware. Having been twice coated, they now receive another coat and firing, to make them resemble porcelain. The composition for this purpose consists of 4 parts, by weight, of feldspar, 4 of clear sand, 4 of carbonate of potash, 6 of borax, and one each of oxide of tin, nitre, arsenic and fine chalk. These are roasted and fritted as before described, and then 16 parts of it are mixed with the second enamel composition described, excepting the 16 parts of flint glass which is left out. The application and firing are performed as in the other two operations, but the heat of vitrification is elevated so as to fuse the third and second coats into one, which leaves a glazed surface, forming a beautiful white enamel. A fourth coat, similar to the third, may be put on if the enamel is not sufficiently thick. The articles may be ornamented like china ware, by painting colored enamels on the last of the coats, and fusing them on in the furnace. A blue is formed by mixing the oxide of cobalt with the last-named composition; the oxide of chromium forms a green, the peroxide of manganese makes a violet, a mixture of the protoxide of copper and red oxide of lead a red, the chloride of silver forms a yellow, and equal parts of the oxide of cobalt, manganese and copper form a black enamel when fused. The oxide of copper for red enamel is prepared by boiling equal weights of sugar and acetate of copper in four parts of water. The precipitate which is formed after two hours moderate boiling is a brilliant red. The addition of calcined borax renders all enamels more fusible.

MORE ABOUT NOVA SCOTIA GOLD FIELDS.

A pamphlet on this subject has just been issued by Dr. Gesner, of this city, as a communication to the London Geological Society. On page 7 present volume SCIENTIFIC AMERICAN we presented some extracts from an article, by Mr. O. C. Marsh, on this subject. Dr. Gesner has visited the mines, and this pamphlet is the result of his labors and observations. In a geological sense it is interestng.

In the central portions of Nova Scotia there are extensive ranges of granite and other rocks varying in hight from 500 to 1,000 feet above the level of the sea. Metamorphic rocks of great thickness lean against the granite, and these are succeeded by the silurian and coal formations and trap rocks. Dr. Gesner informs us that "the gold has only been discovered in the metamorphic rocks which touch the granite on one side and the silurian on the other." At Tangier gold was accidently discovered, in 1860, in a small stream flowing into the Atlantic about fifty miles from Halifax. Gold is found in this place in quartzite, metamorphic clay, and greywacke. In form it resembles rough, feathery metal obtained by pouring any molten metal among cold water. The average yield of gold to the tun of ore is not stated, but about 600 miners were employed at this place last summer. Seven other diggings were visited, but the description of Tangier would nearly apply to them all, with the exception of "The Ovens," which seems to be a curious place. The name has been to the given locality on account of large and peculiar excavations made in the rocks by the sea. They are formed in a peninsula which is about one mile in length by a half in breadth, jutting out into Lunenburg Bay. The precipices are about fifty feet in hight above the water, and the southern side of the peninsula is principally composed of metamorphic slate containing thin seams of quartz in which the gold is found mixed with sulphurets of iron, mispickel and mica. In one of the caves in "The Ovens" considerable quantities of gold have been washed by hand from the sands on its floor. The amount of gold obtained at this place, without machinery, from June to December, 1861, was valued at $120,000. It varies in size from small spangles up to rough pieces about the size of a walnut. By Dr. Gesner's essay Tangier gold contains 96.50 of pure metal and 2. of silver. The gold of "The Ovens" contains 93.06 of gold and 6.60 of silver.

Of the gold-yielding rocks of Nova Scotia Dr. Gesner says:—The Province contains an ample amount of the precious metal to warrant most expensive operations and the construction of machinery for its mining and purification.

ACCORDING to the London *Times* one serious defect, of an almost if not quite irremediable character, exists in the construction of iron-cased ships, as constructed at present, and is fully exemplified in both the *Warrior* and *Black Prince*. This evil is the penetration of water between the teak and armor plates. This water naturally forces for its exit a passage between the joints of the armor plates, and the opinion at present is that nothing can remedy this under the circumstances of tongued and grooved-edged plates hung on a ship's sides by through bolts. Caulking is stated to be useless, and that cannot be wondered at considering the slung weight to be dealt with, and the ship's motion at sea. But the effect of the action of the water in the grooves of the plates and upon the iron bolts can only be expected to be such that in four or five years from the time of commission each ship will require replating.

THE COMPARATIVE ECONOMY OF STEAM AND WATER POWER

A correspondent writes from Wisconsin asking our opinion in relation to the comparative cost of steam and water power.

A few years ago the proprietors of whale ships in New Bedford, seeing that their business was likely to be ruined by the manufacture of lard oil, cast about them for some other investment by which they might keep up the prosperity of their town. Among the plans suggested was the erection of cotton manufactories to be driven by steam; but the very obvious objection occurred that it would be impossible to run steam mills in competition with those driven by water in which there was no current expense for power. At that time General James was receiving large pay for superintending the erection of cotton manufactories, and on being consulted by some of the New Bedford capitalists, he wrote a plausible pamphlet to prove that steam was cheaper than water! This pamphlet was loaned by one of the schemers to Mr. Rhodes, a very clear headed business man of large wealth, who had not heard much of the discussion, having been absent on a tour through the West. When Mr. Rhodes returned the pamphlet, the lender asked him what he thought of it. He replied,

"Oh! it is conclusive. He makes out his case. By the way, did I tell you my experience in Cincinnati when I was there?"

"No, Sir."

"When I landed in Cincinnati the shops were all closed and I supposed at first that it must be on account of the funeral of some prominent citizen. But the drays were rumbling about the streets, persons were going into and coming out from the stores, and everything seemed to be in activity, so that I was quite puzzled. Finally, I went into a large store, and found it brilliantly lighted with a great number of lamps, and ladies busy as possible buying goods. I asked the proprietor what it meant. He looked up and asked me what I referred to."

"Why," says I, "this closing your shutters and lighting up your stores with lamps."

He straightened up, and staring me in the face with the greatest astonishment, replied,

"My friend, is it possible that you have lived to this age, and don't know that lard oil is cheaper than daylight?"

SULPHUROUS ACID AS A DISINFECTANT.

There are three classes of disinfectants; the first removes offensive odors by absorbing them, the second by destroying them, and the third prevents their formation. The most powerful of the first class is charcoal, of the second chlorine, and of the third sulphurous acid.

The decay of vegetable matters is generally effected by the absorption of oxygen from the atmosphere. Sulphurous acid has a very strong affinity for oxygen, and when it is present the oxygen combines with it instead of combining with the organic substance, and thus the decay of the latter is prevented, or, at least, retarded. In other words sulphurous acid acts as an antiseptic. This is not the case with either charcoal or chlorine; neither has any tendency to preserve substances from decaying. If a piece of meat which has begun to spoil is buried in charcoal it will soon taste and smell perfectly sweet, but its decay will not be retarded. Charcoal is not an antiseptic.

Sulphurous acid acts as a disinfectant not merely by preventing the formation of offensive odors. There is a class which it destroys, some by taking out their oxygen and thus decomposing them, and others by combining with them and forming new substances.

For use in stables probably the best disinfectant known is sulphurous acid mixed with magnesia. While it has a very powerful action in keeping the air sweet, it is perfectly dry and consequently not injurious to the feet of the horses, and it does not impair the value of the manure.