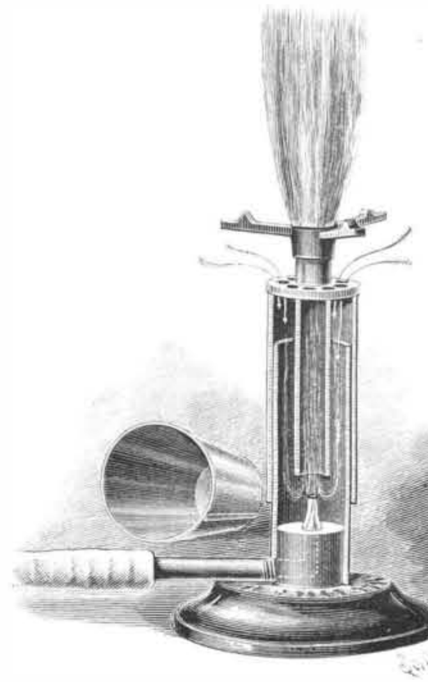
FRIEDBURG'S BUNSEN BURNER.

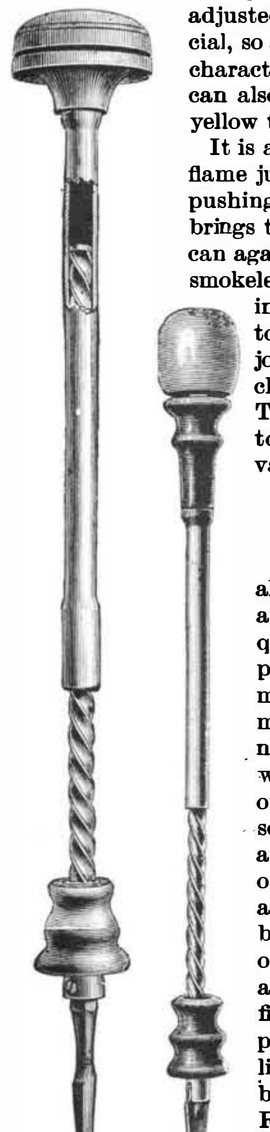
The Bunsen burner illustrated in the cut is the invention of Prof. L. H. Friedburg, of this city, and is designed for chemical laboratories. It disposes of the troubles incident to the ordinary type of construction, such as the jumping down of the flame and smokiness at the tip. It consists of a base with the usual nipple for attachment of the rubber supply tube, and with a tube terminating in a gas orifice in the center of the base. This orifice is of approximately rectangular or slot-like form, one easy to clean and which has proved adapted to secure the mixture of air and gas. The base supports a brass tube, about an inch in internal diameter, which surrounds the gas jet like a chimney. A second brass tube telescopes over this one. The top of the telescoping tube is covered with a diaphragm. A circle of holes are drilled in the diaphragm near its periphery, through which the air for mixing with the gas enters. The combustion tube passes through the center of the diaphragm.



FRIEDBURG'S BUNSEN BURNER.

In operation the gas is turned on, and entering by the central jet, rises into the central combustion tube, and as it does so draws in air which mixes with it. It is lighted at the top of the combustion tube. A very perfect flame results—showing not the least particle of yellow, provided the telescoping tube is rightly set. It is here that one of its best features appears. By raising the telescoping tube more air is admitted to mix with the flame, and by lowering it the supply can be cut off almost completely. Thus the burner can be adjusted for any gas, natural or artificial, so as to give a proper flame. The character of the flame for a given gas can also be made to vary from a full yellow to a blue superoxidized one.

It is almost impossible to make the flame jump down, but if it should, the pushing down of the telescoping tube brings the flame back, when the tube can again be raised to give the desired smokeless flame. The burner will work in any position. It is proposed to mount some on universal joints, so that they can be inclined in any desired direction. The burner may fairly be said to represent an important advance in laboratory appliances.



REID'S "LIGHTNING" BRACE.

This improved brace is especially designed for light boring and screw driving. It is very quick in its work, and as the power is applied on the top, it may be used with great force. It may be used automatically, running the bit both back and forward, or to turn the bit one way only, as is necessary to drive a screw or bore a hole with an auger bit. This is done by means of the divided head, which acts as a fast and loose pulley, there being no ratchet about it to get out of order. It is made strong and durable, the metal part finely polished and nickel plated, and the trimmings of lignum vitæ and rosewood. This brace is manufactured by A. H. Reid, No. 3000 Market Street, Philadelphia, Pa.

STEAM TRAMCARS WITH SERPOLLET'S BOILER.

Mr. Serpollet's generators for the instantaneous production of steam, to which we have several times called the attention of our readers, have, up to the present, been limited to a power of from five to six horses, in consequence of the spiral form given the tubes constituting the element of the boiler. In order to reach a power of from 15 to 20 or more horses, it was necessary to multiply the elements and to substitute for them straight bars grouped quincunxially and mounted in tension, with tubes supporting the high pressures without strain or distortion. This result is now obtained by the use of U tubes that permit of effecting a saving in the weight of the apparatus, of increasing their specific power of vaporization and of thus applying them to locomotion with certain advantages that we shall set forth in taking as an example the application that has just been made of them in the propulsion of tramway cars upon one of the best patronized Parisian lines. The vehicle that is now running in Paris, from the Madeleine to Clichy Place, is an ordinary type of the car of the Tramway Company of Paris and of the Department of the Seine.

The system, as a whole, adapted to the car, in order to render it automobile, motors, generator, accessories, water and fuel, weighs about 1,500 kilogrammes, the car weighing 3,500. The car, empty, in running order, therefore, weighs five tons. With forty passengers of 70 kilogrammes each, the total weight reaches 7,800 kilogrammes.

When the automobile car hauls another weighing, when empty, 3,200 kilogrammes and carrying thirty-two passengers, which represents 5,440 kilogrammes, we reach a total weight of 13,240 kilogrammes.

It is this heavy load that the motive system combined by Mr. Serpollet permits of hauling, with a mechanical part whose weight scarcely exceeds a tenth of the total weight.

The steam generator and the driving apparatus are installed in the front of the car (Fig. 3). These apparatus, few in number, comprise a starting pump, a regulator of speed through a return of feed water to the tank, and a reversing lever.

The motor is fixed beneath the platform, with its axis in the same plane as that of the axles. It consists of two steam cylinders of 13 centimeters internal diameter and 13 centimeters stroke, arranged at each extremity of the car and acting upon the axis through two cranks keyed at right angles.

The entire mechanism is hermetically inclosed in two iron plate boxes, in which are disengaged the vapors of the lubricating oils eventually produced in the running at a high temperature. These two boxes debouch in the ash box through a wide conduit, and it is through the latter that the air enters that supplies the firebox (Figs. 1 and 2). The vapors of oil carried along by the air are consumed on the grate before reaching the chimney. The noise that might be produced by the exhaust is suppressed by the use of a deadening reservoir interposed between the chimney and the exhaust. The cloud of steam is suppressed by the very fact of the use of superheated steam as soon as the system of tubing has reached the normal temperature. The cloud of smoke likewise is suppressed through the use of coke as fuel.

The boiler consists of eighteen elements, each comprising two straight tubes connected by an elbow. These tubes, which are 45 centimeters in length, have the form of an inverted U, and are 12 millimeters in thickness. These eighteen elements, connected in series, are arranged horizontally, and so distributed as to break the ascending column of hot gases. A gutter shape has been adopted in order to increase the rigidity and permit of reaching high pressures without distortion. Instead of working by flexion, the sides work one by traction and the other by compression.

The injection of cold water is effected through the lower part, while the steam at 250 or 300 degrees escapes from the last element in order to reach the valve box. The tubes being arranged at the lower part of the boiler, nearest the firebox, thus always preserve a relatively low temperature, and run no risk of being burned.

Such a boiler weighs only 600 kilogrammes. With a total external surface of tubes of 4 square meters and a grate surface of 26 square decimeters, it produces sufficient steam to develop a power of 20 horses at a pressure of 5 kilogrammes per square centimeter—a power that may reach that of 40 to 50 horses on allowing the pressure to reach from 10 to 15 kilogrammes per square centimeter.

A boiler is heated with coke, which is packed in small boxes each containing a supply sufficient for a run of from 10 to 12 kilometers, and that are put in at the terminus. The quantity of water carried is likewise renewed at the terminus at the rate of about 12 liters per kilometer traversed. The consumption of coke is about 1·7 kilogrammes per kilometer on a level for the automobile car alone.

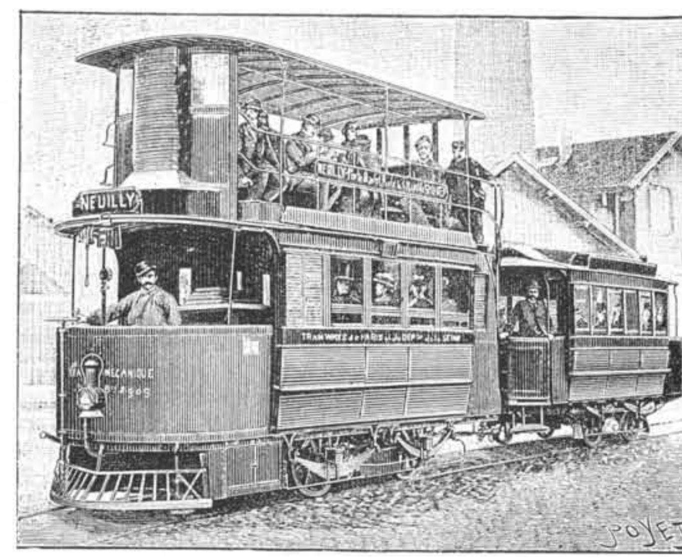
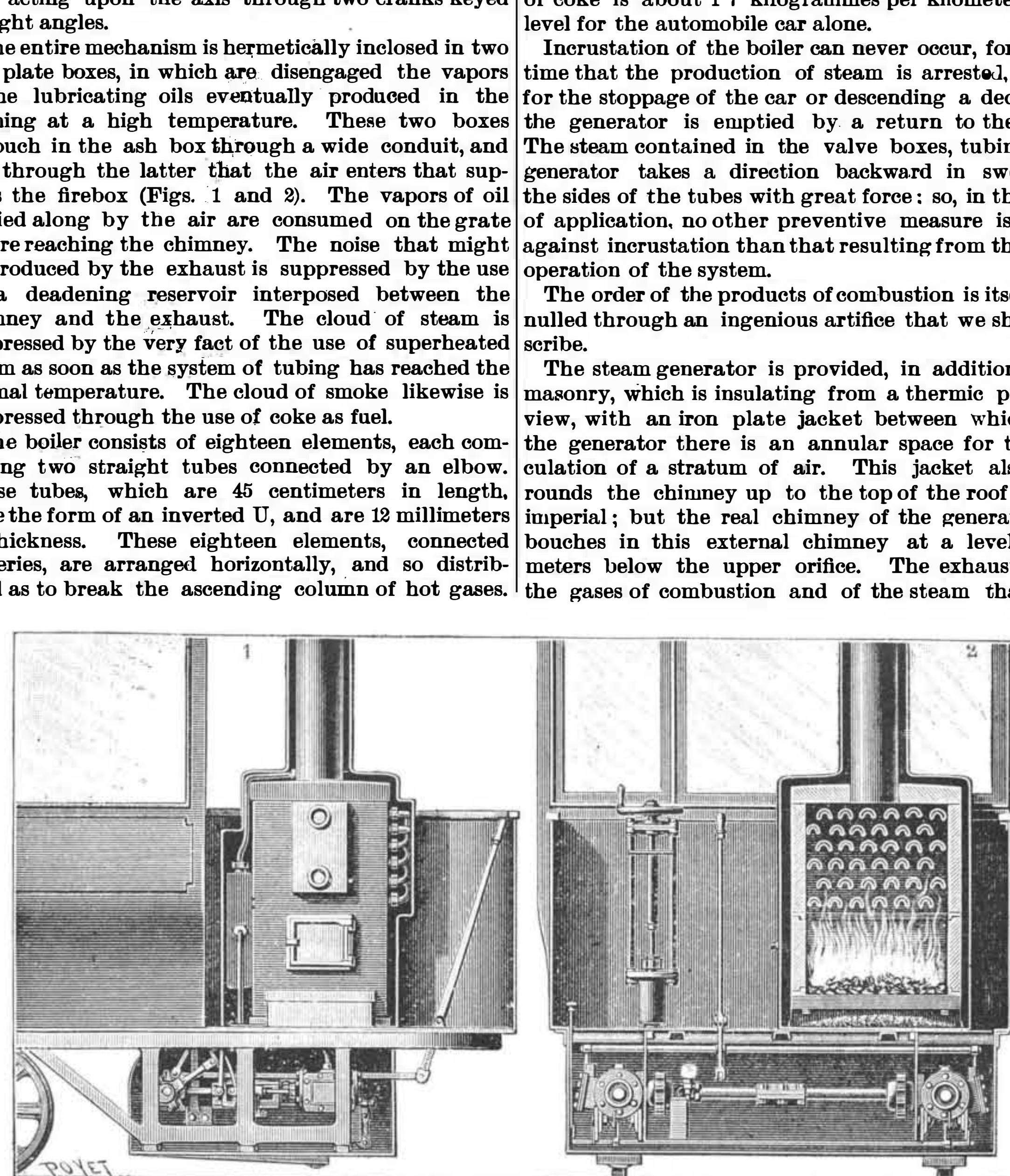


Fig. 3.—GENERAL VIEW OF A SERPOLLET TRAMCAR HAULING ANOTHER CAR.

Incrustation of the boiler can never occur, for every time that the production of steam is arrested, either for the stoppage of the car or descending a declivity, the generator is emptied by a return to the tank. The steam contained in the valve boxes, tubing and generator takes a direction backward in sweeping the sides of the tubes with great force; so, in this sort of application, no other preventive measure is taken against incrustation than that resulting from the very operation of the system.

The order of the products of combustion is itself annulled through an ingenious artifice that we shall describe.

The steam generator is provided, in addition to its masonry, which is insulating from a thermic point of view, with an iron plate jacket between which and the generator there is an annular space for the circulation of a stratum of air. This jacket also surrounds the chimney up to the top of the roof of the imperial; but the real chimney of the generator debouches in this external chimney at a level of 1·5 meters below the upper orifice. The exhaustion of the gases of combustion and of the steam that has



Figs. 1 & 2.—DETAILS OF THE MECHANISM OF SERPOLLET'S STEAM TRAMCAR.

been used brings about a strong influx of air into the annular space, and the diffusion of the gases in the air takes place in the conduit before they make their exit into the open air.

On another hand, as the chimney is perfectly concealed behind the front side, it is impossible, at first sight, to recognize the mode of propulsion employed. The motor actuates the axle through the intermedium of two parallel chains, the ratio of the wheels of which is 1 (driving shaft) to 3 (axle).

The chains are so arranged that one of them alone shall be capable of assuring the service. The chain wheels are keyed in such a way that one of them alone shall operate, the other having to operate only in case of breakage of the other. The two axles are rendered interdependent through a third chain.

The transmission by chain makes the carriage roll very easily, while at the same time, on account of the multiplication of speed, it effects an almost constant stress and facilitates starting.

Owing to such arrangements as a whole, the gradients of Clichy Avenue, which reach nearly 5 to 100, are easily traversed at speeds that reach 16 kilometers per hour.

We find again in this new and interesting application of Mr. Serpollet's quick-vaporizing generator all the characteristic general advantages of his invention, and which have so often been brought to notice in connection with previous applications that it seems useless to revert to them. As for the special advantages, we may point out in particular the possibility of approaching and ascending any gradient whatever without loss of speed; the peculiar elasticity of the generator, proportioning at every instant the stress to be overcome; the absence of noise, smoke and odors that other systems of propulsion do not realize to the same degree; the facility of driving; and, finally, the saving in steam resulting from its being used in a superheated state.

These advantages are more than are necessary for assuring steam tramcars of the Serpollet system a certain number of applications, in presence of the opposition met with by the trolley system of electric propulsion on the part of the administrative authorities.—*La Nature.*

Artificial Glaciers.

Teachers who have found it difficult to make the movements of glaciers clear to their pupils may find it helpful to use one of these simple methods, which are given by a German writer. For ice, he substitutes *Yellow Pitch*, the surface layers of which, after exposure to the air, show about the same degree of plasticity and brittleness that ice has. Take a square tray which has a slanting gutter; this gutter must first be lined with a layer of very hot pitch, to prevent the mass from rolling down. Then pour in the rest of the pitch. As it moves downward, cracks are made from the edges toward the center at an angle of 45° to the edges, and join transverse fissures which are produced in the middle. Where the tray widens, longitudinal crevices are produced.

The other method differs from this only in coating the surface of the pitch with a layer of white paint, so that the cracks appear black on white, and are more easily seen. The writer says that particular forms of cracks can always be observed at the same parts of the tray, and that the motion, which has the same kinds of variation noticed in glaciers, can be studied with the microscope.

Limestone Made Into Marble.

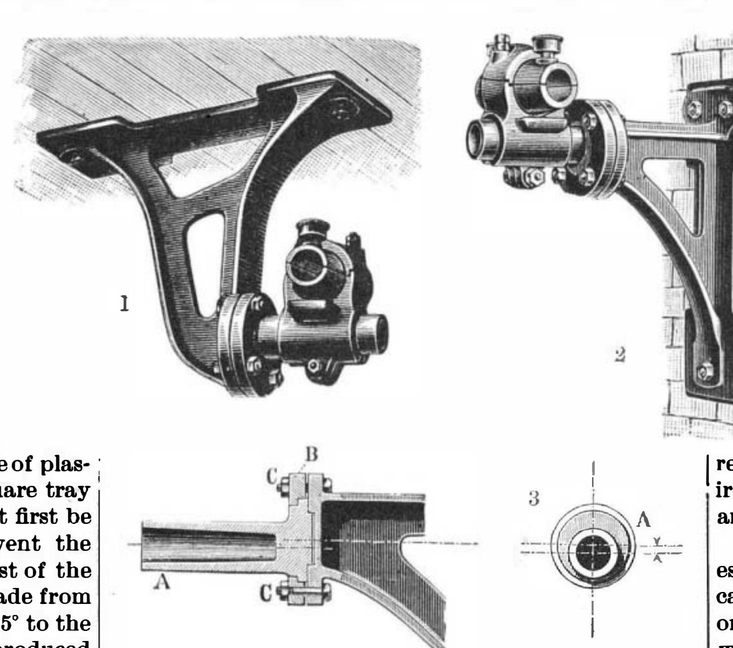
Various modes of coloring limestones have been developed, but the latest that has come under our notice is described in a recent number of *Engineering* as follows:

Marble is a natural product, so that this title is perhaps inadmissible, but works have just been started at Chelsea in which the natural process is so closely imitated by chemical means that there is produced so near an approximation to marble as almost to justify the name. Nature's process is hastened, and is more directly under control, so that although the veining may be varied as art demands, there can be a large production of a uniform tint of stone, if desired. The process known as the Moreau-Rae is simple, and by it all limestones or chalk may be converted into the semblance of marble of any tint or combination of shades, while the specific gravity is increased 25 per cent. With limestone, carving or turning is more easily done than with marble. The first process thereafter is to prepare for veining. On the surface of water there is sprinkled a varnish composed of sesquioxide of iron, gum thus and turpentine; and water being unstable, a freedom of design is obtained, especially when the turpentine is broken up by sprinkling of soap. The stone is dipped on the turpentine and subsequently immersed in baths of metallic solutions. These are of sulphates of iron, copper or zinc, separate or in combinations, the specific gravity varying from 1·2 to 1·5. They may be termed the primary colors, and variety of shade is got by different periods of immersion or in varying the order of tanks used. The varnish prevents the sulphates affecting the stone at those points, according to the density of the varnish.

In the case of some French stones where there is a good deal of shell or flint, this process of artificial veining is not necessary, as the same result is got from the existence of shell, and this Marseilles stone has been made into very effective balustrades, as well as fireplaces and table tops. Very dark colors, for instance, are got by using copper and iron sulphates. Zinc and iron alternately give light yellow, while the use of the three in turn gives dark yellow and brown in variegated tints. Black and gold, too, may be got by making the stone yellow before varnishing, after which the black bath is used, so that the veining takes the gold tint. Infinite variety is possible in the manner indicated. After this treatment in the sulphate baths, the stone is immersed in a water bath maintained at 50° Cent. to thoroughly fix the colors, all air meanwhile being expelled; and here it may be stated that the color permeates the full thickness of the stone, as is shown by blocks cut into several thicknesses. The process thus far takes only a few minutes, and the stone is then dried in an oven of a temperature of 90° to 100° Cent., remaining probably for twenty-four hours. It is then immersed for a corresponding period in an indurating bath—in a solution of sulphate of zinc—which does not affect the color, but effectually hardens the stone, closing up the pores, so that when removed it approximates the density and the specific gravity of marble, and has all its beauty and wealth of coloring. It is afterward polished in the usual way.

IMPROVED JOURNAL BOX SUPPORTS.

The construction shown in the accompanying illustration, for the support of journal boxes, is simple and durable, and admits of convenient adjustment according to the position of the shaft. The improvement has been patented by Mr. Jean Hey, of Strasburg, Germany. Figs. 1 and 2 show the application of the improvement in connection with a hanger or bracket support, made to form a pivot to support the bearing, which is arranged to turn eccentrically, and be thus raised or lowered. The circular box, A, eccentric to the axis of support, as shown in longitudinal and cross section in Fig. 3, has an eccentric base flange or disk with a circular offset on its rear face engaging a circular recess on a disk of the hanger or bracket. The base flange or disk is rabbeted, and engaged by a correspondingly rabbeted ring, B, held in place by bolts, C. When the bolts are screwed up the ring clamps the base flange or disk, but when the bolts are loosened a complete revolution may be given to the base of the support, thus permitting a wide range of adjustment.



HEY'S ADJUSTABLE JOURNAL BOX SUPPORTS.

Long Distance Transmission of Steam.

At a recent meeting of the American Society of Mechanical Engineers, Mr. Eckley B. Coxe described a method he had used in carrying steam a long distance. At a colliery they wished to carry steam to a waterworks about 4,500 feet over a hill from the boiler plant. A trough was made by nailing the edges of two boards together, so that they formed a right angle. The trough was supported by two stakes driven in the ground, and crossing just beneath the trough. The pipe was laid in the trough resting on cast iron plates, the pipes surrounded by mineral wool, and a similar inverted trough placed over the top. To allow expansion, a bend was made to one side at the top of the hill, and then it was turned back to its original direction. A large receiver was introduced in the pipe at the pumps. This was made of three sheets of an old boiler, and was 34 inches in diameter. This also served as a separator. As the elevation was 1,800 feet above the sea, the cold was excessive in the winter time, but this arrangement has been in use since 1877, has cost nothing for maintenance, and has given no trouble. Mr. Coxe believed that the secret in carrying steam long distances to an engine without causing a drop in the steam pressure was in the use of a receiver or reservoir.

Our Exports of Ferro-Manganese.*

A short time ago the *Engineering and Mining Journal* called attention to the wonderfully low cost at which pig iron is being produced at well located furnaces in Alabama, the figure given, viz., $6.37 per ton, being, we believe, lower than anywhere else in the world. We can now claim also that ferro-manganese is being produced in this country at a lower cost than anywhere abroad, and the credit for this is due to the Carnegie Works, which have always been in the van of industrial improvements, and which have been one of the chief producers of ferro-manganese for many years past. So successful have they been in reducing the cost of production that they are now able to ship ferro-manganese from Baltimore to Glasgow, Antwerp, Hamburg, and Rotterdam, sending more than one thousand tons in October, November, and December, 1893, and a certain amount also from New York, while more than 1,200 tons have been shipped in the first two months of the present year. We are not advised as to whether any was shipped from Philadelphia also.

A part of this ferro-manganese has been exported under the name "manganese ore," but there is no mystery as to what the material actually was. The invoiced value was a little less than two cents per pound, or about $44 per gross ton. At present the market quotations of ferro-manganese are $52 to $53 per ton in Pittsburg, the present import duty being three-tenths of one cent per pound, or $6.72 per gross ton. Ferro-manganese and spiegeleisen are very important products used in steel making, and our consumption of them may be appreciated from the fact that the production of spiegeleisen and ferro-manganese in 1892 amounted to 179,131 gross tons, though in 1893 it declined to 81,118 tons. The high price of the product has caused earnest search to be made in this country for an ore well suited for its production, and numerous mines have been opened, but for one reason and another they have not succeeded in supplying the demand. The production of manganese ore in 1892 was 19,117 gross tons, and in 1893 it reached only 9,150 tons, a decline almost proportionate with the falling off in the output of spiegel and ferro. The remainder of the ore used comes from the imports of iron ore (including manganiferous ores) which, in 1892, amounted to 806,585 tons and in 1893 to 526,951 tons.

The Carnegie Company certainly deserves the highest commendation for the skill shown in the economical management of its plant, which has enabled it not only to produce steel rails in competition with the world, but to make ferro-manganese in part from imported ores, and actually export it to the home of ferro production, Belgium.

Origin of the Dollar Mark—Five Theories.

Below I give five theories of the origin of the dollar mark ($), they being selected from about twenty seemingly plausible solutions:

1. That it is a combination of "U. S.," the initials of the United States.

2. That it is a modification of the figure 8, the dollar being formerly called a "piece of eight."

3. That it is derived from a representation of the pillars of Hercules, consisting of two needle-like towers or pillars connected with a scroll. The old Spanish coins marked with the pillar device were frequently referred to as "pillar dollars."

4. That it is a combination of "H. S.," the ancient Roman mark of money unit.

5. That it is a combination of P and S, from peso duro, signifying "hard dollar." In Spanish accounts peso is contracted by writing the S over the P, and placing it after the sum.

According to one writer the symbol of the dollar is a monogram of the letters "V," "S," and "J," the dollar being originally a "thaler," coined in the valley of Sankt Joachim, Bohemia, and known as a "Joachims thaler," and the monogram the initials of the words, "Valley Sankt Joachim." A writer in giving his opinion of "Reason No. 3," as given above, says:

"The American symbol for dollar is taken from the Spanish dollar, and the origin of the sign, of course, must be looked for in associations of Spanish coins. On the reverse of the Spanish dollar is a representation of the pillars of Hercules, and around each pillar is a scroll with the inscription 'plus ultra.' This device in course of time has degenerated into the sign which at present stands for American as well as Spanish dollars, '$.' The scroll around the pillars represents the two serpents sent by Juno to destroy Hercules in his cradle in mythologic lore."—*St. Louis Republic.*

* From the *Engineering and Mining Journal.*