

are passed over the linen with very great rapidity, which is no sooner dried, than the ironer again wets the linen and takes another red hot iron. This drying and wetting process is repeated several times before the linen presents the desired glossy appearance. We asked Mr. Perkins what the secret was of putting on this much admired polish. The gentleman smiled, and said: "It is nothing but elbow grease."

After seeing how much labor and scientific work it takes to make a shirt, we drove over to East Bridgeport, and were escorted through Howe's sewing machine factory. This building has a front of 1,256 feet; it is five stories high, and employs 1,500 workmen. They make 500 hundred machines per day. Every part of a sewing machine is a branch of work by itself, and is manipulated in a separate room under the charge of a foreman. We were very much interested in the needle department, which is under the charge of Mr. Thompson, a very pleasant and affable gentleman, who kindly gave us many points of information. Twenty thousand needles are manufactured in one day. One hundred and eighty men and woman are employed in this department. From the wire steel coil up to the time when the needle is ready for use, it passes through fifty different hands.

LETTER FROM UNITED STATES COMMISSIONER
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Since the date of the previous letter, we have made an excursion into South France, visiting the immense iron works of Le Creusot, and the great and busy city of Lyons. Our trip has occupied only four days, but we have seen and learned a great deal and have experienced much pleasure in that short period.

During the year 1872, the total quantity of cast iron produced in France is reported as 1,181,262 tons, of which more than one million tons has been produced by the 113 blast furnaces which use coke fuel, and 178,571 tons were the product of 115 furnaces using charcoal. The production of steel is given as about 140,000 tons during the same year, the amount having doubled in the short space of three and a half years, and nearly trebled in about four years. This production is the result of the united labor of many establishments; but a single one, that of Le Creusot, is sending into market one third of the whole, and we should hardly have been justified in leaving France without visiting this place, even had it compelled far greater expenditure of time, money, and physical energy than it has demanded. We were also bound by our acceptance of the courteous invitation of its hospitable proprietor, M. Schneider, whom we had met as a colleague at Vienna.

The day before leaving Paris on this expedition, we visited the locomotive engine building establishment of

CAIL & CO.

on the Quai de Grenelle, near the Champ de Mars. We found there a fine collection of shops, employing between three and four thousand men in the manufacture of locomotives and of general work. We were received here with the utmost kindness and courtesy, as we have been at all of the great manufactories that we have desired to visit, with the single marked exception of that of Krupp, at Essen. The workshops of Cail & Co. cover an immense extent of ground just outside the city of Paris. They are all of one story in height, the roofs are supported by iron columns and girders, and the interior is generally well lighted and ventilated by windows in the roof.

The transportation of material from one part to another of the works is effected by cars upon a railroad track leading to all the workshops, the traction power being obtained from several light locomotives. In the setting-up shops, traveling cranes are well placed, and are in constant use. The work is generally very good, although some pieces were hardly as well finished as was the average of that which had passed inspection, and it would not have been passed as satisfactory in our own leading shops. The boiler work was quite good. We noticed one riveting machine here, but it would not compare favorably with those that we have seen elsewhere. In the forge shop the work was good. The heaviest steam hammer was said to have a drop weighing 800 kilogrammes—1,760 pounds. Judging from the fact that there were a hundred draftsmen employed, we should conclude that work is not as well systematized as it should be in such a place, or as it is in our own establishments of this kind, and that alteration of designs must absorb a heavy percentage of the profits. It is possible that the variety of work done by Cail & Co., which includes sugar mill work and every variety of machinery, may be good cause for the employment of so much profit-consuming labor. We were pleased to find here a neat chemical laboratory, an auxiliary too seldom appreciated by iron works proprietors.

Taking the 11 A. M. train from Paris, an express running through to Marseilles, we enjoyed a very pleasant ride through the heart of France, arriving at Le Creusot at 9:30 P. M. Our route, almost from Paris to the end of our journey, lay through the beautiful and rich wine-growing districts, of which the produce is sent to all parts of the world. From Verrey to Dijon and Chagny, we were delighted with the beautiful scenery of the

CÔTES D'OR,

where are raised the finest wines of Burgundy, and which district is given its name from the exceptional value of the product of its vineyards. The common table wine of this country, which would, with us, be considered a good wine,

sells for about twenty sous a bottle, while the price of the finer brands of the *Côtes d'Or* is ten francs here, and probably nearly as many dollars in New York, if it is possible to obtain them at all in all their native purity and strength. Both red and white wines are raised, but the red are generally most liked and are best known abroad. Their delicate and delicious flavor and their exquisite bouquet are considered, by connoisseurs, to be beyond rivalry.

The level lands of the valley through which the line of railroad passes, and the beautiful sunny hillsides on either hand, are covered, apparently, by one immense vineyard. This whole district, with an area of 250,000 acres, is devoted to wine culture, and the annual production has an estimated value of fifty or sixty millions of francs—ten or twelve millions of dollars.

We dined at Dijon, the name of which town is familiar to all as one of the places which obtained some celebrity during the late war. Here we met a veteran who had been partially disabled in a skirmish with the Prussians in 1871, and a bright young French student with whom we enjoyed a pleasant and instructive conversation until our change to the branch line leading to

LE CREUSOT.

Long before reaching the latter city, we could see, away across the country, great masses of smoke rising slowly from the valley and floating across the hills, like heavy thunder clouds, obscuring large tracts of the country which was elsewhere beautifully illuminated by the bright light of the moon, then just past the full. As we finally skirted the town and rushed toward the station, a sight burst into view such as we had never before witnessed, and to which no verbal description can do justice. The vast clouds of smoke which we had been watching, miles away, were issuing from the tops of myriads of chimneys and from the midst of numbers of great blast furnaces, which rose, like so many towers of Babel, far above the surrounding building. The long structures, covering the rolling mills and the forges, were plainly seen through the gloom, lighted up by a ruddy glow from great masses of hot metal passing through the rolls, or by the brighter glare of scores of forge fires; and on the hill above and behind the works, barely revealed by the light of the partly obscured moon, we could see the populous town which has grown up here, founded and supported by this marvelous example of recent industrial progress. A dull intermitted roar of escaping steam, the loud clatter of gearing from the rolling mills, and the rumble of the rolls, with the unceasing concussions of many steam hammers, the sound of loud voices now and then rising above the noise of machinery, and the barking of the numerous dogs in the city beyond, mingled and produced almost as novel and exciting an impression upon the ear as did the strange and interesting scene upon the eye.

A frugal and truly French repast of bread and delicious native wine was furnished at the humble inn at which we stopped for the night; and we retired early, sleeping soundly in beds as clean and comfortable as we ever found at an English country tavern, or in our own New England. Before we had finished our breakfast, our kind friend, the proprietor of this wonderful establishment, who had already been informed of our arrival, called to take us in charge, and we spent the day in its exploration.

A century ago, this busy valley was a deserted and sparsely inhabited spot, forming part of one of the least productive estates in France. The discovery of its mineral wealth at that period was the commencement of its development, by the erection of an ironworks, in 1782, which was supplied with coal from the beds beneath it and with iron ore from the neighborhood. The machinery was driven by one of Watt's earliest engines, which is still preserved at Creusot as an interesting relic. The early prosperity of Creusot, then called Charbonnières, was seriously checked by the French revolution, and by the subsequent uncertainty in political matters; but, recovering, acquired such extent, when purchased in 1837 by MM. Schneider, that its value was fixed at 2,700,000 francs, and its production was stated at 40,000 tons of coal and 6,000 tons of iron. The number of workmen was not more than 1,200 to 1,500, and the population of Creusot was not much above 3,000. To-day we find 15,500 people employed in the mines and mills, two thirds of whom are engaged in the latter. The establishment produces 50,000 tons of steel rails annually, and the new works, the construction of which is already begun, will, in a few months, largely increase this figure. Of iron rails, 20,000 tons are turned out this year. A hundred locomotives and an immense quantity of other machinery are also included in the annual out-put of Creusot.

There are twelve blast furnaces making ordinary and Bessemer pig metal. The later furnaces are 20 meters—65 feet—high, while some of the older ones are 25 meters. The maximum efficiency seems to have been found at an altitude which has been found best also in some portions of our own country.

The Whitwell and the Cowper hot blast stoves have both been used here, and the new furnaces have a stove which M. Schneider calls a hybrid "Whitwell Cowper." The temperature of blast is carried at about 600° Centigrade=1,080° Fah. The fuel is coke, from native coal raised on the premises or at St. Etienne, where are mines which have the same ownership. The ores of the neighborhood make very good iron, but, for the Bessemer process, iron is made from ores imported from Africa. These ores are as pure and rich as the English Cumberland, and our best Missouri or Lake Superior ores.

Here we saw, for the first time, the molten iron tapped from the blast furnace into ladles, which were drawn at once to the converters and the iron converted into steel with-

out intermediate casting, cooling, and reheating. The economy thus effected is an important item in these days of close competition, and, in part, accounts for the success of these inland ironworks in competing with English makers of steel and in exporting the rails produced here to the United States. It is a matter of wonder that this coöperation of the furnace with the converter is not oftener met with, since there is no difficulty in making the arrangement, as a matter of engineering, and there must be many localities where the requisite capital may be obtained to take advantage of the natural facilities existing for such an economical combination.

The steel rails made here contain four tenths per cent of carbon, and are as strong and tough, and as resilient, as any made in Europe. They are of Bessemer metal. Where a softer steel is required, the Siemens-Martin process is adopted. I think that it was at Le Creusot that this method was first made successful.

In the magnificent Creusot exhibit at Vienna were some fine samples of the product of this process, but we found the finest specimens here that we had ever seen. Such wonderfully ductile metal is precisely what is wanted to take the place of the weaker and less homogeneous metal, iron, for thousands of purposes. These samples were said to contain one fourth of one per cent carbon.

Eight new Siemens furnaces are in course of construction. The rolling mills are very large and are unusually well arranged. The buildings are neat and substantial and the machinery strong and well proportioned. The driving engines are not what we should, in the United States, consider the best possible design, but are well built and are strong and serviceable. The workshops contain much old machinery and some that is new and exceedingly creditable. The forge contains steam hammers of all sizes up to fifteen tons weight of drop; and here, as well as in every other department, we saw evidence of good management and of intelligent supervision.

We visited the offices and drawing rooms, and found them well constructed, pleasant, and comfortable, with every possible facility for doing work and for communication with the various departments of the works. The telegraph is used very extensively for correspondence. Before leaving, we looked into the houses where the locomotives, used by the works for their own transportation, were kept. There are sixteen now in use, and they are not fully equal to the work. They are plain, powerful machines of the common continental type of freight engine, and exhibit no specially noticeable peculiarities.

The working people here seem to have a more efficient character and more industrious habits than is usual with French workmen, and impress the visitor very favorably by the contrast which they present to the sluggish, inactive, workmen generally seen in Europe.

After a very thorough examination of this greatest of all the French ironworks, after enjoying the generous hospitality of our host, and after a stroll about his pleasant grounds, we took the evening train for

LYONS.

We have not space in which to describe this fine city, or to give even the merest abstract of the memoranda gathered here in the great center of the silk manufactures, where 70,000 looms, in 10,000 establishments, support 140,000 persons, and produce a value of \$60,000,000 per year. The permanent Industrial Exhibition, which was visited with the expectation of learning much that would prove of interest, is a sad failure, although it opened so short a time ago under such encouraging auspices. We saw there some fine castings, in Siemens-Martin steel, from the "*Société Anonyme de Charente*," and a six inch armor plate from Marvel Frères, doubled up without crack, as stated, *cold*. Chevalier & Grénier exhibit a compound portable engine and boiler with removable tubes and firebox, as at Vienna. The engine governor was of the parabolic class, and the whole was a good piece of work. The immense buildings look barnlike and empty, and we came away disappointed.

Before taking the train back to Paris, we visited the observatory on the heights of Fourvières, and spent an hour or more enjoying a splendid panorama embracing many miles of the valleys of the Rhone and the Saône, which have their confluence at Lyons, and, a hundred miles away, over the eastern hills, taking in the hazy outlines of Mont Blanc. Then, after an uneventful all night ride, we were back in Paris, ready to leave the continent and to spend a few days in Great Britain.

R. H. T.

THE ATLANTIC CABLES.—The attempt of the Great Eastern steamer to lift and repair the Atlantic ocean cable of 1868 has failed, owing to stormy weather, and the great ship has returned to England. The work is postponed until next year. The fault has been located at a point not far eastward of the banks of Newfoundland. The cable was successfully grappled and lifted several times. A portion of the original cable, that of 1858, was brought up during the grappling operation and found to be in a fair state of preservation.

THE Preece block system of electric railway signaling is worked on the principle that the trains are to be kept a certain unvarying distance apart. No train can advance until the signal is given that the line for the specific distance ahead is absolutely clear.

THE passengers carried by the railways of Great Britain in 1872 reached the enormous total of 423,000,000. The total number carried in 1850 was only 78,854,422. The increase is mainly owing to the construction of underground and other suburban lines leading out of the large cities.