

and rail which enables the two raw materials to be brought together at the furnace at a low cost of transportation which cannot be matched in any part of the world. The lake steamer, with its engines placed at the stern and the whole of the hull available for carrying the ore in bulk, the vast systems of ore pockets equipped with labor-saving machinery in the way of hoisting cranes, cableways, etc., and lastly the American system of cars and locomotives, enabling vast loads to be hauled by single units of exceptional power, all combine to give to the industry a long lead in the race, even before the raw materials have been mixed ready for smelting.

But the economies do not stop with the mining and transportation, but are continued throughout the whole process of smelting, blowing, and rolling into finished shapes ready for the market. European ironmasters who have come over to study the cause of our cheap production, have frankly admitted that by our peculiar system of management and persistent endeavor to substitute mechanical for manual labor, we have succeeded in producing a larger output from a given plant than is possible under their own methods.

As to the last essential to success mentioned by Mr. Hewitt in 1855, the necessity for abundance of capital to build, equip, and carry on the works, it is enough merely to call to mind such vast industrial concerns as the Carnegie consolidated interests, representing an aggregate capitalization of \$500,000,000, to realize that our position in this respect is as strong as in every other. The commanding position of the iron and steel industry in this country in respect of its geological and geographical advantages alone would be sufficient to secure a response to any possible demand for capital.

There is every reason to expect that our growth in the future will at least keep pace with that of the past. Of course, our competitors will gradually approach us in the matter of management and improved methods of handling; but in the wealth of our natural resources and the facilities due to geographical position, we shall always hold a commanding and unassailable position.

THE DANGER FROM THE IMPORTATION OF ANIMALS.

An abstract of J. S. Palmer's essay on "The Danger of Introducing Noxious Animals and Birds" appears in *Our Animal Friends*. There are several societies in this country for the express purpose of purchasing and importing European birds. One society in Cincinnati has contributed \$9,000 to this object, and other cities have raised considerable sums. Our contemporary thinks it would be well that all such experiments should be made under the sanction of government experts of the Department of Agriculture. In addition to voluntary importations, it often happens that animals are unintentionally brought into the country, as trading vessels have carried the European house mouse all over the globe, and the introduction of rabbits into Australia is perhaps the most striking example of the dangers of unconsidered importations. They were introduced for purposes of sport, and were liberated near Melbourne in 1864. Within twelve years they had spread over the country and became a veritable plague, and millions of dollars have been spent for bounties, poisons and other methods of destruction. Thousands of miles of rabbit-proof fences have been built, and in 1887 no less than 19,182,539 rabbits were destroyed in New South Wales alone, and the rabbits seem to be on the increase. The little Indian mongoose was imported into Jamaica to cope with a plague of rats and proved most effective, but after it had destroyed the rats it turned its attention to the domestic animals and poultry, so that the islanders would now be glad if they could get rid of the pests. Such are a few examples of the danger of disturbing nature's balance.

WIRELESS TELEGRAPHY TESTS IN SWITZERLAND.

A series of interesting experiments in wireless telegraphy has been carried out between Chamonix and Mont Blanc in order to find out the effect of the high altitude and different atmospheric conditions of those regions. This work was undertaken by two French engineers, Messrs. Jean and Louis Lecarme, who afterward made a report to the Academie des Sciences. The experimenters wished to find out also the effect of the atmospheric electricity, and whether the absence of moisture in the frozen soil would render the earth connection impossible. The tests were carried out for several days in succession, commencing with the 25th of August; it was found that the signals were easily transmitted and read with a distance of two centimeters between the spheres of the oscillator. It was found that the absence of moisture in the soil did not interfere with the earth connection, and also that clouds interposed between the two stations had no appreciable effect upon the signals. The action of atmospheric electricity made itself felt at times, but on the whole the effect was not sufficient to prevent the practical working of the apparatus. It was also observed that the operation of the alternating current

dynamos of the Chamonix lighting station had a marked effect upon the apparatus, and it was impossible to work while the dynamos were running. These machines are of the three-phase type and give 2,500 volts.

IMPORTANCE OF PATENTS AND TRADE MARKS IN GERMANY.

The afternoon session of the fifteenth day of the International Commercial Congress, at Philadelphia, was devoted chiefly to the question of international trade marks. Papers of great value were read by Commissioner Duell and by Mr. Francis Forbes, one of the committee of three appointed by the President to revise the trade mark laws so far as they relate to foreign commerce. Commissioner Duell's paper was printed in the *SCIENTIFIC AMERICAN* of November 11. In the discussion of Mr. Forbes' paper on "Present Trade Mark Needs in International Trade," the Hon. J. C. Monaghan, United States Consul at Chemnitz, Germany, referred to the value of patents in Germany as follows:

I do not know that just what I am going to say is exactly germane to any particular paper; but after long experience abroad, I have come to the conclusion that it would be wrong for me to omit so excellent an opportunity to call the attention of American inventors and manufacturers to the importance, the very great importance, of securing letters patent in Europe, and particularly in the German Empire.

I have sometimes been accused of calling the Germans a race or nation of imitators. While they are one of the greatest nations of imitators in the world, I would not be understood as saying that they are not great originators. Any person familiar with the fact knows that they have practically given gunpowder to the world through their monk Schwartz, and the printing press, the greatest probably of all inventions, through Gutenberg, Schœffer and Faust, and that they are to-day in chemistry and in various branches of the sciences and arts, leaders among all nations.

I repeat, when one is familiar with these facts, it becomes impossible to deny to the Germans the credit of being great inventors and great originators. What has stood particularly in the way of their progress as a race of inventors in the past is this fact, that prior to the year 1878, when Germany had passed her Imperial Patent Law, it was absolutely necessary to take out Letters Patent in Saxony, Wurtemberg, Bavaria, Mecklenburg, etc., etc., and some twenty-eight or thirty petty states and sovereignties. The Imperial law has got away with that fact, and since 1878, she being number fourteen among the inventive nations on the earth, has become, if I remember, mentioned among the first, second and third nations, being led by our own people. But the point I wish to make is this: That American manufacturers and inventors, being magnificent inventors, neglected patent rights in the German Empire, and the law is that the clever genius of that people, watching, as perhaps no other people on the face of the earth, the scientific progress of the world, took out patents. In my city I suppose there are dozens of men, manufacturers, who take the patent papers and the various technical papers of this country, and keep themselves posted as to everything that occurs here. The technical school of my city, the leading technical school, has on file the leading patent papers of our country and the records which they give here, and they see our machines of all kinds. They buy more or less and take them home, where they take them apart and use them as models.

I had in my mind the case of a manufacturer in this city, one builder, who invented the finest gear cutter probably there is in the world. He sold the machine to the leading toolmaker in my city and sent a young man for the patent and set up the machine. They bought another, and then another, and had some correspondence. I am told—in fact, I know—they could not take one machine apart, and they are now constructing a machine for themselves and selling them.

Now, Mr. Chairman, I do not want to be understood as finding fault with that concern for doing that thing. The point I want to make is that Mr. Fletcher, or any inventor in this country, who has taken care to ask an American patent lawyer to have the patent taken out in the German Empire, will be protected, and I think these gentlemen here who are more familiar with the patent laws than I am, know there is no patent country, except perhaps ours, where an inventor has better protection than in the German Empire when he does get a patent.

THE AUTOMOBILE IN BUENOS AYRES.

The use of the automobile in Buenos Ayres is rapidly increasing, and vehicles of the electric and petroleum types are now frequently met with in the streets of that city. These include not only private carriages and tricycles, but also heavy delivery wagons for the use of large stores. The fact that facilities for making repairs are lacking has been hitherto a drawback in the use of these vehicles, but as a result of their adoption

there is no doubt that these facilities will soon be provided, and besides, the condition of the roads is beginning to improve. A further step in advance has been the formation of the Argentine Touring Club, which has been founded not long since by a number of influential amateurs and commercial men. The new society will devote itself to the question of automobile interests, and one of the first steps taken has been that of the establishment, in all the provinces of the Argentine Republic, of roads which are specially reserved for bicycles and light automobiles. These roads have already commenced to radiate from Buenos Ayres to a distance of 60 to 70 miles, and it is intended to continue the work until a good system of roads is established throughout the country.

END OF THE CREUSOT STRIKE.

The Creusot Works, which has now recommenced operations after the recent strike, is one of the great European centers of production, and not only transforms the ore received into iron and steel, but also produces in its extensive factories a great variety of manufactured products, such as cannon, shells, boilers, locomotives, armor plate, and also builds different types of dynamos and other electrical apparatus. As is of course necessary in a large establishment of this kind, everything is carried out upon an improved plan with an extensive and modern equipment; the great pieces are handled and transported with ease by the cranes arranged for the purpose, and a well studied system reigns throughout the entire establishment.

The factory covers an extensive area, and is situated in a plain or basin surrounded on all sides by hills, and under these the railroad penetrates by a tunnel to reach the extensive system of tracks which have been laid for the handling of the ore and finished products. The establishment was founded as far back as 1808, and started at that period as a glass works; from that date to 1818 it was under the direction of the Société Perrier. The venture was not a paying one, however, and the losses of the company during the ten years of operation reached as high as 14,000,000 francs. It then passed into the hands of M. Chagot, who came out of the affair with a loss of one million; an English company, Manley & Wilson, then spent without success eleven millions upon the plant, and it was not until 1836 that under the direction of the Schneider Company the Creusot Works began to assume a prosperous condition. From that time to the present there has been a continual progress up to the flourishing condition which is now to be seen. There are over 9300 workmen employed in the different shops, and these are distributed as follows: Forges, 2827; machine shops, 2131; steel works, 1450; artillery, 568; blast furnaces, 513; mines, 388; electrical machines, 341; besides different auxiliary services, which are estimated at 1085.

The working day is of ten hours, and day and night turns are taken each alternate week. The wages paid vary from 2.50 francs to 3.75 for the laborers, which includes a quarter of the personnel; from 4.50 to 8 francs for skilled labor; and for special kinds of work as high as 10 to 15 francs are paid. These figures must naturally be compared with the cost of living, which is much lower in France than in the United States. The workmen have established six mutual aid societies and twenty or more co-operative establishments and stores; the bakery, for instance, supplies 3,500 families. Up to the time of the last strike the works were in full prosperity, with an abundance of orders from all quarters, and there is no doubt that within a short time the normal state of affairs will be restored. The production of electrical apparatus is now an important branch of the establishment, this being materially facilitated by the abundant supply of metal, and the attention which has been given to the production of magnetically good iron and steel for the machines. The production of armaments and ammunition of all kinds is one of the principal features of the establishment, and orders are received from the home government and the different nations of Europe.

The company owns extensive mines, but these do not suffice for the supply of coal and minerals necessary to carry on the work, and in consequence, extensive importations are made; a large part of the coal, for instance, is brought from England. In order to facilitate the handling of materials, the company is now erecting a branch establishment at Cette, an important sea port of the Mediterranean, and from these works the heavy products may be put directly on board, thus eliminating railroad expenses. At the same time, coal will be landed from the Algerian mines as well as from those of other Mediterranean countries. The yearly consumption of materials may be observed from the following figures for 1898: Coal, 510,000 tons; coke, 150,000; ores, 200,000; pig or cast iron imported, 40,000 tons. As to production, the figures for the same year show cast iron of all kinds, 105,620 tons; steel, 125,680; wrought iron, 46,740. When the works at Cette are finally installed, the Creusot establishment will keep only the steel works, artillery, and electrical machinery.