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 or 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, Schoëffer 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.

Automobile News.

Steam plows are to be used in South Africa for intrenching works.

An English physician has driven a motor carriage 5,000 miles at an expense of only $130.

There is a regular service of automobiles between Newcastle and Sunderland, and other systems are projected in various parts of England.

In England the automobile has begun to figure so frequently at weddings, according to The Motor Car Journal, that soon little or no notice will be attracted by the use of the same.

President McKinley has at last ridden in an automobile, actuated by steam. Washington is an ideal place for motor carriages and should be a good field for companies dealing in them.

An unfortunate accident occurred a few days ago on a gasoline-propelled automobile. The tube connecting the gasoline tank with the motor broke, and as might be expected, the escaping fluid took fire and enveloped the vehicle in a sheet of flame. The occupant was badly burned.

It is stated that automobile omnibuses will be substituted at once for the old horse-drawn stages on Fifth Avenue, New York city. We understand that the omnibuses will not be allowed to be crowded, and a little sign bearing the word "Full" will be displayed when every seat is taken. This is the general European custom.

The New York Medical Journal, speaking of the recent explosion of the gasoline tank of a motor carriage, says: "Some new danger is almost always to be expected in connection with novel devices of the kind, but, on the whole, the power carriage, whether propelled by gasoline or electricity, is probably less dangerous than vehicles drawn by horses."

A gold cup for international competition has been offered by the Automobile Club of France. The first test will be held as near May 1 as possible, the idea being to make the date coincide with the great automobile day at the exposition. The rules which will govern this cup have not been made as yet, and it is expected to arrange racing conditions which will be satisfactory to automobilists of all countries.

A test of a truck made by the Auto-Truck Company was witnessed by the prominent officers and stockholders on November 26. It was of the Hoadley-Knight type and was built at the International Power Works at Providence. The truck was brought down by boat, and was run to the air-compressing station of the Metropolitan Street Railway on Twenty-fourth Street with the charge which it had received in Providence. A fresh supply was taken on, and it was demonstrated that it could be satisfactorily run in the streets.

AN X-RAY DELUSION.

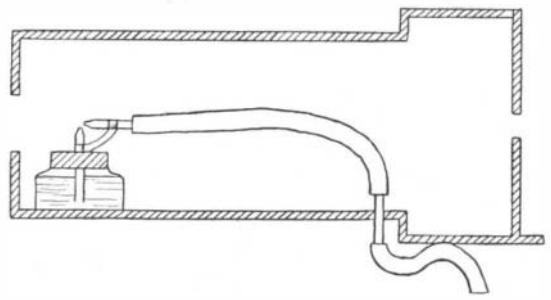
BY GUSTAVE MICHAUD, D.SC.

A Boston firm sells, under the name "X-Ray camera," an apparatus which apparently enables an object to be seen through any opaque substance. It is hardly necessary to say that the X-rays have nothing whatever to do with the phenomenon, which is really produced by a set of four hidden mirrors, that conduct the light around the opaque object. I have recently devised and constructed a little apparatus, which is just as deceitful as the "X-Ray camera," but which is more readily made and gives results by far more astonishing for spectators who have not been told the secret of its construction. It apparently reproduces instantaneously and neatly the interior of the human body, giving to every organ its natural color. The whole operation is performed under the eyes of the bewildered sitter, who watches the X-rays in what seems to be the act of drawing and painting before his eyes his vital organs.

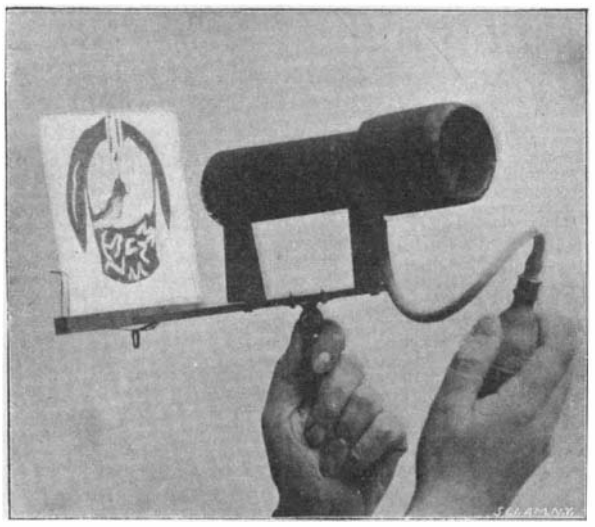
The apparatus looks like the objective tube of a camera, with the plate on which the image is to be produced in full sight of everyone. The apparatus is placed opposite the person whose viscera are to be photographed, and to heighten the effect a lamp may be solemnly placed behind the sitter. The operator invites everyone to look at the white sheet of paper, and presses the rubber bulb of the shutter. A colored image appears instantaneously on the paper. The lungs are of a bright red color, the heart is darker, the veins are blue, the stomach and intestines are of a greenish tint; other parts of the body paint themselves in black on the white paper. This sudden apparition generally startles the sitter; but a few remarks on the healthy looks of his lungs will place him at his ease. The photograph is taken out of the apparatus and passed among the spectators.

Two distinct parts of the apparatus co-operate in the production of that X-ray trick; namely, the sheet of paper and the objective tube.

Before the experiment, the sheet of paper is treated as follows: It is pinned over any anatomical drawing showing the position of the principal thoracic and abdominal organs. If the sheet of paper is not too thick, the drawing can be seen through it. The space occupied by the lungs is then painted with a diluted solution of sulfocyanide of potassium. A more concentrated solution of the same salt is used to fill the space outlined by the heart and principal arteries. A few big veins are painted with a solution of ferrocyanide of potassium. A more diluted solution of the same salt is used for the stomach and a few intestinal folds. The rest of the body is uniformly painted with a concentrated solution of tannin. The whole operation need not take more than five minutes. When the paper is dry, the drawing is absolutely invisible, for all the



INTERIOR OF THE OBJECTIVE TUBE.



APPARATUS FOR PRODUCING AN X-RAY DELUSION.

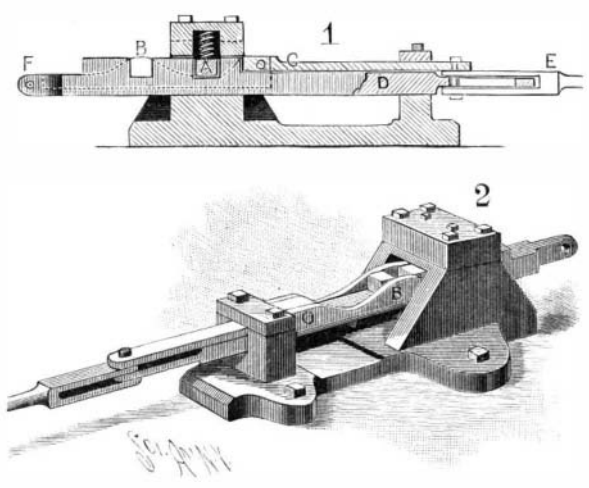
above named solutions are colorless. The sheet of paper is now ready for use in the apparatus.

The objective tube does not contain any lens, but merely a small atomizer filled with a solution of ferric chloride. When pressed the rubber bulb sends air, not as every spectator believes, into a pneumatic shutter, but into the atomizer. As a result a fine and invisible spray of the perchloride of iron solution reaches for a moment the sheet of paper. What follows is easily understood by every student of analytical chemistry.

The reactions between ferric salts on one side, sulfocyanide of potassium, ferrocyanide of potassium, and tannin on the other side, are among the most sensitive of analytical tests, owing to the extraordinary intensity of the red, blue and black colors which originate in these reactions. Hence the instantaneous production of the colored picture.

A SAFETY SWITCH-LOCKING MECHANISM FOR RAILWAYS.

An invention has been patented by William Haney, of Lexington, Ky., which provides an ingenious means for opening and closing railway-switches and for locking the switch-tongue in its adjusted position, to prevent possible accidents.



HANEY'S SWITCH-LOCKING MECHANISM FOR RAILWAYS.

The switch-operating mechanism comprises a shifting-bar, *F*, formed with two transverse notches, in which a spring-pressed locking-bar, *A*, is designed to engage. At opposite sides of the shifting-bar, cam-plates, *B*, are arranged, which are curved so that their highest points are on a plane with the top of the shifting-bar. The cam-plates, *B*, are connected by means of a link, *C*, with an operating rod, *E*, leading to a switch-tower and can be moved independently and with the shifting-bar. The link, *C*, is connected with the rod, *E*, by means of a bolt passing through a longitudinal slot in the shifting-bar.

When the locking-bar, *A*, is in the first notch, as shown in Fig. 1, and it is desired to shift the switch-tongue in an opposite direction, the rod, *E*, is pulled outward, thus drawing the cam-plates, *B*, longitudinally and causing the curved portions to raise the locking-bar, *A*, against its spring. During this motion the bar will remain stationary, because the bolt connecting the rod, *E*, and the link, *C*, is traveling in the longitudinal slot of the shifting-bar; but when the bolt reaches the end of the slot, the cam-plates and shifting bar will be drawn together, until the locking-bar moves into the second notch, thus locking the switch-tongue in adjusted position. The movements are reversed when the parts are shifted to their first position. Since the boxing in which the locking mechanism is contained is covered, the parts cannot become clogged by snow, ice or dirt.

Some Reminiscences of Early Marine Steam Engine Construction and Navigation in America.

At a late session of the Institution of Naval Architects of Great Britain, Mr. Charles H. Haswell, the well-known engineer, who may be regarded as the Nestor of his profession, having recently completed his ninetieth year, presented a second paper on early marine steam engine construction and steam navigation in the United States navy from 1807 to 1850. Mr. Haswell's papers are of great interest in view of the following claims which are set forth in them. According to them, Mr. John Stevens, of Hoboken, N. J., in 1809 applied slides and a crosshead to guide the piston rod of a steam engine. In 1824 James P. Allaire introduced the Woolf engine, the compound of the present day. The first introduction of steamboat towing was made in 1825 by a New York company. In 1826 a fan blower was introduced by Robert L. Stevens. In 1827 J. P. Allaire invented and patented the steam chimney. In 1836 sponsons were first constructed under the water-wheel guards of a steamer. In 1837 the first steam launch was designed and directed by Charles H. Haswell, Chief Engineer, United States navy. In 1839 Francis B. Stevens invented and patented the double eccentric cut-off. In 1842 F. E. Sickles invented the drop valve cut-off; the same year Edwin A. Stevens designed and operated a closed fire-room. In 1844 Charles H. Haswell, Chief Engineer, United States navy, devised the application of zinc to the bottom of an iron vessel and in a marine boiler. In 1846 Capt. John Ericsson designed and applied a surface condenser to the engine of a United States revenue cutter. In 1848 Mr. Pierson improved upon it, and soon after Chief Engineer William Sewell, United States navy, further improved the construction, and in the same year Frederick E. Sickles devised the application of steam to the steering gear of a steamer. The Right Honorable the Earl of Hopeton in the course of some pleasant remarks said: "Gentlemen, may I remind you that Mr. Haswell, the author of this paper, is, I fancy, about the oldest practising engineer in the world. He was Chief Engineer of the United States navy at the time Her Majesty came to the throne, and that was not yesterday. I may also remind you that he was present at the International Congress held about a year ago, and was among the youngest of us. He was here, there and everywhere. . . . I propose that the secretary be authorized to send our best thanks to our veteran friend for his kindness in sending this paper."

Insurance Against Earthquakes.

Dr. Barrata has advocated in the Italian parliament a compulsory insurance against earthquakes. Owners of vineyards and others protect themselves in this way against hail and, therefore, why not against another calamity even more destructive, as they average about 750 shocks a year and certain parts of Italy have occasionally suffered terribly. The idea of the insurance is a shrewd one from the point of view of public economy. It shifts the burden from the exchequer to private purses. The business would be of a peculiarly risky nature, for such an epidemic of earthquakes as has devastated Calabria between 1783 and 1786 might easily bring any ordinary company to bankruptcy. The risk would have to be widely spread, and actuaries would be puzzled to calculate the premiums for different places. Some parts of the peninsula enjoy practical immunity. The great plain of Venetia has never suffered. Rome and Naples are occasionally shaken, although as a rule not seriously, but disaster frequently occurs in volcanic districts, as in Ischia in 1881 and 1883, when the loss both of life and property was serious. Calabria is far the worst as an earthquake region. Over 1,400 people perished in one locality in the period mentioned above.

THE highest observatory in Germany is situated on the Schnee Koppe, the highest summit of the Silesian Mountains, the elevation being 5,216 feet. It will be managed by the Prussian authorities.