THE BERLIN ELECTRICAL WORKS.

There has, unquestionably, been greater improvement in electric lighting during the latter half of our century than in any other department of technology, says the *Illustrirte Zeitung*, for which we are indebted for this description and engraving, and this improvement has given us a source of artificial light which cannot be surpassed, for electric light ranks next to sunlight. Assuming that the part taken by German science and German invention in the development of electricity as a practical means of lighting is well known, we will speak here only of the plant that supplies electric light to the German capital, which stands in the first rank of the cities of the world.

Five years ago the Edison-Gesellschaft, now the Allgemeine-Elektricitatsgesellschaft, erected a little plant for 2,000 lamps at No. 85 Friedrickstrasse. When the Allgemeine-Elektricitatsgesellschaft obtained permission from the city to use the streets for laying electric cables, a second central station was built in Markgrafenstrasse, which was much larger than any similar plant. It had a capacity of 1,000 steam horse power. A third small station, with three engines of 270 horse power each, was erected in Mauerstrasse, but in 1887 three more engines of 300 horse power each had to be added to the plant at this station. In the beginning of 1888 the station in Markgrafenstrasse was found to be too small, and had to be enlarged by the addition of four steam engines of 300 horse power each. Then a fourth, a fifth, and finally a sixth station were erected, and they were each provided with vertical engines of 1,000 horse power. The electric light machines, dynamos of the newest type, were supplied by the firm of Siemens & Halske. Each of these machines, the ring armature of which has a diameter of from 2½ to 3 meters, supplies electricity for incandescent lamps of 90,000 candle power; that is, about 6,000 lamps of 15 candle power each.

Our illustration shows the above mentioned central station in Markgrafenstrasse, the building of which, on account of the expensive situation of the ground, is carried up high as possible, instead of being spread out. The engines are built like hammer machines, and are of the compound system, with two cylinders placed one above the other. The tubular boilers are in the story above the engines. The dynamos are coupled directly to the shafts of the steam engines, thus avoiding a complicated system of belting. In order to allow for driving the dynamos in this direct manner, they had to be arranged for a much smaller number of revolutions than had been customary, and therefore they were constructed to deliver, the required electric current while operating at the rate of 85 revolutions per minute.

A very important part of the plant is the switching apparatus, with the switch board. By means of the levers of this apparatus the different groups of lamps are brought into the circuit or cut out, as is desired or required, while the measuring and controlling apparatus attached to the switch board permits an oversight of the supply of the current delivered by the dynamos to the different sections of the system. Other apparatus serve for equalizing the current in the network of wires, for testing the insulation of the conductors, etc.

The electricity produced by these dynamos is first carried by heavy copper conductors to the switch board, and from there to the cable vault, from which it is carried to the street conductors. These street conductors, which are embedded sufficiently deep below the pavement, consist principally of cables, the twisted copper wires of which are properly insulated, incased in lead pipes, and then protected from external injury by iron bands.

The driving power of the entire electric plant of Berlin will amount to 18,000 horse power, when the central stations are completed, which corresponds to an addition of 200,000 lamps, that will have a lighting power equal to 25 per cent of all the gas lights in Berlin.

Tin.

Tin, which every one knows, but which few, except men of science and metallurgists, are acquainted with, is one of the most precious and most interesting metals. After gold and silver, it is intrinsically the most precious of those in use. It is nearly of the same color and almost as bright as silver, but has less resistance and is less valuable. When warmed by friction, it has a pronounced odor and taste. When it is bent, the derangement of the crystals of which its mass is formed causes it, without any fracture taking place, to emit a peculiar sound which metallurgists call its cry, and by means of which an expert can nearly determine its degree of purity. The places where tin is produced are few, scattered sparsely over the surface of the globe, and it disguises itself under the form of a blackish mineral which, to the profane eye, gives no sign of the treasure that is within it.

One of the richest as well as most ancient tin mining districts is in the Malay Peninsula, the Golden Chersonesus of the ancients. The name of the province, Pérak, signifies silver, but it is peculiarly the province of tin. The use of tin dates from extreme antiquity. Homer mentions it as *kassiteros*, in the descriptions of the arms of his heroes. Herodotus speaks of the British Islands as the *Kassiterides*. The Phenicians obtained the tin which they furnished to the ancient world chiefly from those islands, but partly also from Gaul and the Iberian Peninsula. Before the Phenicians and the Greeks, however, the Chaldeans knew this metal under the name of *kastira*. The most ancient document in which a mention of it has been found is probably a hymn to the fire, which M. Oppert has translated from the Acadian language, a tongue the knowledge of which has been recently revived from cuneiform documents. Tin was designated in them, five thousand years ago, as *anaku*.

The Biblical text in the book of Numbers in which Moses names tin in the enumeration of the metals is therefore comparatively modern, for it is of fifteen hundred years later date than the hymn to the fire. Even more definite than these texts is an Egyptian statuette in bronze (an alloy of tin) of the age of the pyramids, or 3,600 years B. C. Let us return to our own age, and see what is the present annual production of tin. In a recent book on the Industries of the Netherlands, M. De Ramaix gives as the production of the Dutch East Indies 10,000 tons, of Cornwall 8,000 tons, and of Australia 7,000 tons, in all 25,000 tons. These figures show that the English mines have fallen off since the days of the Phenicians, when Cornwall was the principal center of production. They have been left behind by the Dutch East Indies, and will soon be overtaken by Australia, if the number, 7,000 tons, given as the present production of its mines, is not exaggerated.

Saxony and Bohemia, which still figure in the cyclopedias as sources of tin, are not mentioned in M. De Ramaix's estimate. A graver omission is that of the Malaccan mines, which I have mentioned as the most ancient, and also perhaps the most productive. According to Mr. Patrick Doyle's Tin Mining in Larut (London, 1879), the Malay states of the Malaccan Peninsula exported to Penang in 1877, in round numbers, 2,500 tons of tin, and the Siamese states of the same country 7,000 tons, making 9,500 tons in all. From personal information, I estimate the exportation from the single Malay state of Perak, in 1881, at 6,139 tons. The production of the Peninsula having grown steadily since 1876, I believe I can assert that it now takes the lead among tin-producing countries, and that the world's total present annual production of this metal is not less than 45,000 tons. Yet this production is hardly sufficient to supply the needs of existing industry, for the price of tin before the crash in copper, by which it was also affected, had reached the high figure of $800 a ton.—*Popular Science Monthly.*

Oilcloth.

The body of oilcloth is what is called burlaps, made of jute and imported from Scotland. This coarsely woven fabric is limp, and is stiffened by being passed through a mixture of starch and glue and over hot rollers, coming out, it might be said, laundried. It is then ready for the paint machine, where it is given the body. There are four qualities of oilcloth, depending on the number of body coats of paint. That which is to be the best quality receives five or six coats; the poorer grades, a less number. The cloth, in pieces twenty-five yards long by two yards wide, is dried in racks which are constructed in tiers of twenty. The factory has a rack capacity of 11,000 square yards. The thickness of each coat of paint is governed by a steel knife, in manipulating which a workman becomes so proficient that he can tell nearly to the pound what a piece of cloth will weigh when the coating process is completed. Three men at a paint machine can turn out in a day one hundred pieces containing fifty square yards each. The operation of coating the first quality cloth occupies a week, as each coat requires twenty-four hours in which to dry. It is then sent to the rubbing machine, where surfaces coated with glue and sand pass rapidly over the side which is to be printed, ridding it of all irregularities. The better qualities are afterward given another coat of paint, when they are ready for the printers. This is the most interesting part of the operation. For every color in the pattern to be transferred to the oilcloth there must be a block. These blocks come from Maine. They are about two inches thick, two feet square, and are composed of several layers of wood. The surface to be used is of maple, crossed and recrossed by narrow grooves, which form a surface of small squares, 144 of them to the square inch. Those squares look like, and are in reality, so many pegs. Where the pattern is desired to show, the pegs are left standing, those on the portion of the surface which is not to be printed from being cut away. The styles in pattern change twice a year. Some are designed in Utica, and others come from Philadelphia and New York. Some patterns containing many colors require from twenty-five to thirty blocks, and consequently that number of impressions, to reproduce the design. Rug patterns are the most difficult to make, as it requires different blocks for the corners, sides, and the center. The printing is done on the top floor, so that the oilcloth can hang for a distance of fifty feet to dry. Each printer has a table with eight pads, on which he smears his colors. Pressing a block to the pad containing the required color, he transfers it to the surface of the cloth, using hand pressure only. Having done this with every block, as each transfers but one color, and consequently but a small portion of the complete design, he has finished about four feet square of printing, and goes about repeating the operation on another portion of cloth, and so on. Two men generally work at a table, and can turn out from 100 to 150 square yards of oilcloth a day, when printing seven or eight color patterns. The paint used is similar to the ordinary house paint. When the printing is completed, another block is pressed on, which gives the embossed surface, of which there are two kinds, pin and line finish. The wet cloth then hangs from the loft for a week, when by an ingenious mechanism it is transferred to the drying room, where for another week it remains in a temperature of 130 degrees. The door to this dry room is fifty feet high, allowing that length of oilcloth to be passed through without rolling or bending. Coming out, it is varnished, three men, with the aid of a machine, varnishing 6,000 yards a day. Next it is trimmed and the cloth is ready to be shipped.—*American Analyst.*

Cautions for Young Men.

Mr. Andrew Carnegie gives the following advice, intended for young men, but which older men may heed to their advantage:

"There are three great rocks ahead of the practical young man who has his feet upon the ladder and is beginning to rise. First, drunkenness, which, of course, is fatal. There is no use in wasting time upon any young man who drinks liquor, no matter how exceptional his talent. Indeed, the greater his talents are, the greater the disappointment must be. I do not mean by drinking liquor, the taking of a glass of beer or wine at meals. It is not necessary for a man to be a total abstainer in order to be temperate. The rule should be: Never enter a barroom and never drink liquor except at meals.

"The second rock ahead is speculation. The business of a speculator and that of a manufacturer or man of affairs are not only distinct, but incompatible. To be successful in the business world, the manufacturer's and the merchant's profits only should be sought. The manufacturer should go forward steadily, meeting the market price. When there are goods to sell, sell them; when supplies are needed, purchase them, without regard to the market price in either case. I have never known a speculative manufacturer or business man who scored a permanent success. He is rich one day, bankrupt the next. Besides this, the manufacturer aims to produce articles, and in so doing to employ labor. This furnishes a laudable career. A man in this avocation is useful to his kind. The merchant is usefully occupied distributing commodities; the banker in providing capital.

"The third rock is akin to speculation—indorsing. Business men require irregular supplies of money, at some times little, at others enormous sums. Others being in the same condition, there is strong temptation to indorse mutually. This rock should be avoided. There are emergencies, no doubt, in which men should help their friends, but there is a rule that will keep one safe. No man should place his name upon the obligation of another if he has not sufficient to pay it without detriment to his own business. It is dishonest to do so. Men are trustees for those who have trusted them, and the creditor is entitled to all his capital and credit. For one's own firm, 'your name, your fortune, your sacred honor;' but for others, no matter under what circumstance, only such aid as you can render without danger to your trust. It is a safe rule, therefore, to give the cash direct that you have to spare for others, and never your indorsement or guarantee."

Progress of American Steel.

An interesting feature of the recently published statistical report of the American Iron and Steel Association is the increasing percentage of steel in the total production. About one-third of the bar "iron" now manufactured in the United States is steel, so is nearly half of the plate and sheet iron, and 40 per cent of the cut nails and spikes. The rolled iron product, other than nails, only increased 7½ per cent last year, while the rolled steel product, apart from rails, increased 32 per cent. It needs not to say that steel rails are now replacing those of iron on all the railroads which are efficiently managed. After that change is completed, what then? Will the next reform in order be wholesale substitution of aluminum for the ferric material, crowding that out of the way as the latter is displacing wood for many structural purposes? It is not improbable. Clay is much more plentiful than iron ore, and recent experiments at least indicate it as possible that the new metal will ere long be produced as cheaply per unit of volume, if not of weight, as its elder brother. Such a change would revolutionize not a few of our manufacturing processes, and perhaps some of the habits of the civilized human being.—*Metall und Eisen Zeitung.*