

Angelico—he mentioned all of them as he sat on his low bench and pulled pieces of leather out of a bucket in which they had been soaking. A shoe, he said, when made by hand,—and though he could n't express himself clearly in English, I understood,—reflected the character of the maker, and, according to the strength or weakness of that character, was good or bad, and in such measure was art. The same article made by machinery—a shrug of his small shoulders.

OUR winding lane through the slums of the mining town ends, and we are upon the hill in the rear of the shanties. About us are scattered stockaded inclosures suggestive of frontier forts, minus the blockhouses. These are the gardens of the miners, and in season produce potatoes and other vegetables; but the work of tillage must be heavy,

for the ground is exceedingly stony. Down below us, we see the valley of the shadow, lurid and depressing. Coal-breakers rear their great tops at intervals as far as one can see. Sinister and ominous, these giant structures of men suggest great behemoths of the waters under the earth which have forced themselves through the black openings visible in the strippings, and are sniffing inquiringly for the cause of the disturbance which has led to their unleashing.

Ten yards from where we stand is the crest of the hill, and from it, toward the north, a fertile valley reaches forth, and is bounded only by the horizon. It is one of the most beautiful and productive vales in all the great State of Pennsylvania. Behind us, despair, ignorance, strife, and struggle for mere existence; before us, the beautiful valley seems a land of infinite promise.

COAL IS KING.

I.—THE ADVANTAGE OF ENGLAND AND THE UNITED STATES IN THE WORLD'S COMMERCE.

BY EDWARD ATKINSON.

IT will be remarked that the deposits of anthracite are found in very mountainous regions. The difference between this hard and what are called the soft coals was explained to me by the late Professor William B. Rogers. When the contraction of the earth's surface took place by which the mountain regions of Pennsylvania and a few other parts of the Carboniferous series were formed, these mountains were thrown up, turned over and twisted in such a manner as to cause the materials of vegetable origin of which coal is formed to become coked, or partly coked, under extreme pressure. It is due to that pressure and accompanying heat that the anthracite coals are hard and virtually free from bitumen; while, under other conditions, the bituminous or semibituminous coals are soft and more friable, containing more bituminous element. In some other parts of the earth's surface where coal is found, the so-called brown coals and lignites have not been subjected to the measure of heat under pressure sufficient to convert them into true coal.

It will be remarked that the use of coal in the production of iron and steel displaced charcoal, except for special products, about

a century ago. The blast-furnace was first applied to the conversion of ore into iron in Great Britain, where the bituminous coals were worked. It was held for a very long period that the anthracite or hard coals could not be applied in this art. The late Mr. Thomas of the Thomas Iron Company, a Welshman who came to this country many years ago, was the first to apply anthracite coal successfully to the production of iron. For a long period iron made with anthracite coal exceeded all other kinds in quantity. Then followed the coking process, and the conversion of ore into iron with raw coal, and iron into steel with coke, the latter being necessary in the finer forms of steel production.

It may here be remarked that the Bessemer process of making steel has created a revolution in the railway service almost equal to that which ensued from the invention of the locomotive engine. This process was long held by Great Britain, resulting in an excess of production above that of all other countries. That first place is now lost, first on account of the approximate exhaustion of the ores near Bilbao in Spain, which are the only ores near British furnaces suitable for

this product; and, second, on account of the rapidly increasing cost of mining the types of bituminous coals which can be converted into coke. The English mines are now being worked at a depth of over two thousand feet, the coal lying in horizontal veins from two to three feet thick, where the work must be done at a temperature exceeding 100° F. On the other hand, the rapid development of high-grade ores suitable for the production of Bessemer metal, and the opening of very extensive mines of the best coking coal lying in a region above the necessity of drainage, and capable of being worked at high wages and yet at the lowest possible cost, has transferred what may be called the dominion of iron and steel from Europe to this country. Hence it happened that the portentous event of this decade is the future and probable permanent control of the production of iron and steel by this country.

The power of Great Britain in mechanism, manufacturing, and the mechanic arts, giving to her the control of commerce for nearly a century, has rested mainly upon her supremacy in the production of iron and steel. It has now passed to the greater branch of the English-speaking people dwelling in the United States. Thus it has come about that the two great branches of the English-speaking people, politically separated by the misconceptions of a small faction which governed England during the latter part of the last century, are becoming more and more reunited through their interdependence. Their wants and their supplies are the complement of each other. The people of the British Empire are our chief customers for the excess of our food, and for our fibers, and may presently become our chief customers for our excess of iron and steel; while, on the other hand, their advantages of position, and their freedom of commerce with every part of the world, enable them to supply us with many goods which we want. It may presently fall to the English-speaking people of the two great branches and the lesser members throughout the world to make this commercial reunion one of such a nature that, while their commerce may increase to the benefit of every branch, their power will become such that, in the face of their competition, other nations must disarm or starve.

The power of manufacturing nations to supply the increasing wants of non-machine-using countries is in ratio to their possession of iron ores and coal of easy access, workable at high rates of wages and low cost of

production. These advantages are possessed in paramount measure by the United States. The power of working crude metals into finished forms is possessed in greatest measure by the United States and Great Britain combined. The possession of anthracite coal in the United States has been an important factor for a long period; but, under existing conditions, the saving of the secondary products from coke-ovens and iron-furnaces in which bituminous coal is used is rapidly giving the advantage to the so-called soft coals as compared with the hard for anything but domestic purposes.

The next advantage in the competition of the manufacturing nations is the relative proportion of national taxation. In this matter the United States bears the least burden on the largest relative product. Great Britain comes next. The competing nations of the European continent, notwithstanding the development of their coal and iron in Belgium, Luxemburg, and Germany, will soon become incapable of competition in almost every branch of useful fabrics, under the increasing burden of taxation for the support of the military system, and the destructive influence of militarism and class or dynastic rule. The time is not far distant when the control of commerce, passing more completely than ever to the English-speaking people of the world, will bring them into closer commercial union, each branch maintaining its own form and system of government, but all working together, to the benefit of all who share in the abundance of their products.

We know not what inventions are in store for converting the power of wind and water into heat. We have reason to believe that the conversion of the carbon of coal into power, without waste of light or heat, is close at hand. We have reason to believe that even greater progress will soon be made in the development of energy than any yet applied to the use of mankind. Any one of these great inventions now impending may again alter the conditions of nations; but at present the most potent influence is the control of great supplies of coal, lying near the surface, and subject to ready application to the production of iron and steel. This has given a predominance to this country which nothing but one of the revolutionary inventions hinted at can alter. It should be remembered that the power of Great Britain in the latter part of the last and the early part of the present century, through-

out the great Napoleonic contest, did not consist so much in her ability to put great armed forces into action on land as it did in her control of commerce and the development of her naval power. That development of commerce rested on her paramount control of the production of goods, at the foundation of which are the imperial metals iron and steel. It was through this commerce that Great Britain was enabled to subsidize the forces which in the end prevailed, herself supplying the lesser number of men upon land, but the greater navy.

Bearing these facts in mind, one who possesses the least power of imagination, which

is the prime factor in all the large affairs of life, will readily comprehend the position in which this nation has been placed by its predominance in coal, iron, and steel. It is to the end that, whenever the legal obstructions which close or impede the ways of trade are removed, we shall hold the paramount position in the commerce of the world, by means of which we may carry our abundance to the service of all nations, to their benefit, while realizing, on our own part, the greater benefits of high wages, large earnings, low prices, and adequate profits, in all the products of the field, the forest, the factory, and the mine.

II—THE SUPPLY OF ANTHRACITE COAL IN PENNSYLVANIA.

BY EDWARD W. PARKER, STATISTICIAN, UNITED STATES GEOLOGICAL SURVEY.

AT the close of 1896 the total shipments from the anthracite fields had aggregated 995,702,345 «long» tons of 2240 pounds each. It is estimated that the amount usually designated as «colliery consumption,» together with that consumed locally, averages about ten per cent. of the shipments, so that the production of anthracite coal since 1820, when the first shipments were reported, amounts approximately to 1,100,000,000 long tons. The Coal Waste Commission of Pennsylvania, in its report on the waste in anthracite mining, estimates that for every ton of coal mined for consumption one and one half tons are lost. This loss includes the culm thrown on the dump, and the amount of coal necessarily left in the mine, in the form of pillars for the support of the roof, etc. From this we can estimate the inroads made upon the original coal deposits at 2,750,000,000 long tons.

From careful computations it has been assumed that the original deposits in Pennsylvania contained 19,200,000,000 tons of coal. The rate of production, including colliery consumption, for the last ten years has been at the rate of about 45,000,000 tons per year. It follows, therefore, that the amount of coal now left in the hills is about 16,500,000,000 long tons, which, at the present rate of consumption, and allowing $1\frac{1}{2}$ tons wasted for each ton sold, would last ap-

proximately between 140 and 150 years. The utilization of the smaller sizes of anthracite, and improvements in mining methods, are steadily reducing the percentage of waste, and it is probable that the waste to-day is not more than equal to that of the available tonnage; so that the life of the Pennsylvania anthracite fields, at the present rate of consumption, may be estimated at about 200 years.

In passing upon such a question as this, there are many contingencies that must be considered, and which may upset calculations, no matter how carefully made. Among these are the possible increase in consumption, the development of heating by electricity, through the conversion of power into heat, and the fact that the exhaustion of the mines will be gradual. The probability is that the burning of anthracite coal will not entirely cease inside of 300 years.

In addition to the Pennsylvania anthracite, there are small deposits of hard coal in Colorado and New Mexico, but they are comparatively insignificant. The production from these deposits has not reached 100,000 tons in any year. As to the exhaustion of the boundless bituminous fields in the United States, it may be broadly stated that, before the contingency arrives, the necessity of generating heat by fuel will, in all probability, have passed.

