drawn from the system of cultivation adopted on large farms and that which the land-tax estimate assumes as the peasant's return, lies the whole secret of the slow accumulation of capital in Germany.

THE END.

INDUSTRY OF THE RHINE.

SERIES II.

MANUFACTURES:

EMBRACING A VIEW OF

THE SOCIAL CONDITION OF THE MANUFACTURING POPULATION OF THAT DISTRICT.

BY T. C. BANFIELD.

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CONTENTS.

venturer obtains a warrant to explore in a certain district. If he finds a seam he applies for a certificate, naming him as the finder, with reservation of the crown royalty, and giving him a claim on the mine, to be held in fief if he seriously works at it within six months. If no competitor appears this claim can be renewed, and he obtains a fresh "Muthschein." As soon as the vein is found to promise tribute, application is made for infeoffment, and the vein or seam is granted under condition of constantly working it, and paying the dues to the crown. In the coal-district the grant is of the surface in measures of 1200 square fathoms, which can be several times repeated, so as to give a large field. In the hills custom prescribes a fixed distance from each side of the vein. The most onerous condition is that of perpetually working; for if any suspension takes place that is not sanctioned by the mining-board, the mine becomes forfeited, and whatever capital has been expended on it. The Prussian law acknowledges no tenant's right in a mine. If the adventurer does not pay his rent, he is ejected without ceremony on the application of a third party.

Sites are marked out between Mühlheim and Essen for the construction of blast-furnaces on a large scale by two companies. One is a French company that has purchased mines in the valley of the Wied near Neuwied, and the firm of which is the "Société des Mines." This company has recently negociated with the government of Nassau for large and regular supplies of ore of the kind that is used at Sterkerade. It is the red hematite, a mineral sufficiently known to the miners in our secondary formations in England, and here is found to yield an excellent iron, although demanding care in the

smelting. The furnaces are expected to be built on an extensive scale and on the most improved principle. A rolling-mill forms part of the plan. A company equally rich and enterprising is said also to have been formed at Cologne, under the guidance of some leading bankers of that city. Their plan is similar to that of the French company, and embraces numerous blast-furnaces to be supplied with ore from the Upper Rhine and Lahn, to mix with the bog iron-ore of the Ruhr district. Of course during our visit in 1846 these projects were only talked of, and their extension may have been deferred by the recent monetary crisis. The inducement to carry them out is, however, as strong as ever, since numerous railroad schemes have yet to be executed in Germany, and 14*l.* per ton is a remunerating price for rails, when coals are to be had at 7*s.* per ton, which is here the case.

At Essen there is a cast-steel work belonging to Messrs. Krupp & Co., who enjoy the reputation of making good steel; and, it is said, sell a great deal as English. Another near Bochum has not been successful, and an application has been made to Government for assistance, in order that the second complete works of the kind in this district may be kept up.

At the Horst, not far from Essen, on the bank of the Ruhr, is one of the largest smalt-factories in Germany. It is very well managed by resident partners, and belongs to Messrs. Horstmann and Niemann, who are owners of considerable cobalt-mines near Siegen. This manufacture is very considerable, being estimated at 20,000 kilogrammes annually. We shall speak more of this branch of manufacture when taking the traveller through the Siegen district.

Between Essen and Dortmund the railroad traverses the heart of the Westphalian coal-field. At Witten the Ruhr ceases to be navigable, and here a separation has hitherto been made between the coals intended to be sent into the interior by land-carriage, and such as went down in the Ruhr boats. This separation coincides also with a distinction in the quality of the coals; those from the pits above Witten being of a more bituminous nature than the coals of the lower part of the field. The price is also higher, although the tremendous cost of land-carriage has hitherto depressed it. These coal-pits have a very great advantage in not being subject to explosions of inflammable gases that are so common in England and in Belgium. Perhaps this is in some degree owing to the good ventilation, which is insured by their being worked according to plans drawn, or at least approved, by the mining officers of the Government. Their depth is, too, but trifling, not exceeding in general 100 fathoms. The heavy work is done by contract, the payment being by the Prussian ton of four cwt., at rates agreed upon between the owners and themselves, but which must be sanctioned by the "Bergamt." The pay usually amounts to a rate of wages equal to 1*s.* or 1*s.* 2*d.* per diem. The captain is a salaried foreman, who directs the workings, and is responsible both to the owners and to Government. Since mining and manufacturing have spread in this neighbourhood, and the population has become dense, living has also become more costly. Bread is much dearer than on the Upper Rhine, and meat is an expensive luxury on wages like those we have named. In these respects the railroad to Hanover will operate a wonderful change; for while it will increase the demand

for coal, and consequently raise wages, it will pour in supplies of provisions from remote and productive districts that will be glad to supply a steady market on the cheapest terms.

We may remark that this railroad (the Cologne-Minden) unites with the great line of North Germany, which is now finished to near Cracow. As Cracow lies quite as near the chief corn-producing provinces of Poland as Odessa, this line of carriage will in times of great demand in Western Europe prove to have advantages over the roundabout navigation through the Dardanelles. We can draw through this railroad large supplies even in the winter season, when the Black Sea and the Baltic are both shut up. But it is evident that on their way to us the supplies drawn through this channel will pass through all the manufacturing districts of Germany. Austrian and Prussian Silesia, Saxony, Brandenburg, and the Rhine lie on the track, and have the best and first chance of taking care of themselves. Indeed so great is the change that railroads have made in Germany, that, were our restrictions on the importation of corn kept up, we might give up all hope of competing with our neighbours in manufacturing. As it is, the chances are now very even wherever coals are abundant.

The traveller passes the Ruhr at Herdecke at a very romantic point. A long bridge and viaduct show the projected junction of the "Berg and Mark" line with the "Cologne-Minden." The former will pass from Dusseldorf through Elberfeld, and open a direct communication between the upper portion of the coal-field and the Rhine. Some of the works on this line are stupen-

dous, especially the tunnel between the Wupper Valley to that of the Enneper, which latter is traversed by a viaduct 80 feet high. This viaduct will be memorable in the annals of railroad construction, being perhaps the only one of such magnitude that has been erected with wheelbarrows only. It was a curious sight when the men in myriads used to swarm about the great mound they had raised, looking like so many white ants in the summer sun. Were the cost of foreign railroads estimated in labour instead of money, they would prove to be dear enough. But whatever their cost, they are invaluable boons to all classes, and will produce changes that without them were unattainable. At Hagen on the Ruhr the traveller will find good accommodation and intelligent society. Baron Vincke, the conspicuous champion of the rights of his countrymen at the recent diet held at Berlin, and son to the late president of Westphalia, is "Landrath" of Hagen, a situation corresponding to the "Préfet" in France, but which in Prussia is elective. His retiring, modest character in private life contrasts curiously with the promptitude with which he threw himself into the post of danger in the hour of need. The townsmen of Hagen are naturally not a little proud of their magistrate.

We should recommend following the Lenna from its junction with the Ruhr to its source, both as offering a tour through a highly picturesque country, and one that is easily accomplished. Conveyances leave Hagen daily; but it would be well to proceed to Iserlohn, at no great distance, and from thence to cross to Altena. At these two places the traveller obtains the best idea of the manner in which the subdivision of industry has grown

up in this country. As long as the forest supplied fuel for smelting, forging, and casting, the stream afforded mechanical power sufficient for working up the metal. Nothing can be more curious than the neighbourhood both of Iserlohn and Altena, from the great number of small works of wire-drawers, coppersmiths, steel-hammers, nailmakers, and countless other trades, which have clustered together on the brooks, like their rivals in the streets of Sheffield. On one stream that falls rather suddenly into Iserlohn twenty-four little works are placed. Twenty are counted on another falling into the Lenna, near Altena. The little river Volme is occupied wherever its fall measures but a few feet. In this manner the whole district between the Ruhr, Lenna, Sieg, and Rhine, or the old duchy of Berg, and part of Mark, is peopled. The hills are still wooded, and managed according to the system described as prevailing near Siegen in the first volume of this work, and called the "Hauberg" system. A rotation of coppice or underwood, cut down every sixteen years, affords both bark for the numerous tanners and charcoal for the metallurgists; and both occupations alternate with the care of small farms belonging to these small manufacturers, as the rye is admitted into the forest rotation the year after the underwood is cut down. For the scale of industry prevailing generally in the last century the arrangements of this country were superior of their kind. But since production on a large scale, directed by the association of large capitals, with numerous bodies of workmen, in the manner in which steam-power makes it practicable to unite them, has become general, the owners of these little works, with cheap power and metals on the spot, are surprised to find themselves everywhere under-

sold, and that the markets are taken from them. As a natural consequence amongst an industrious and intelligent people, where so much is done to spread information amongst all classes, the transition is daily progressing to large establishments. But it has been slow, owing to the vast number of privileges that the old-fashioned system of government created, and which the more modern practice of the "Bergämter" has too much respected. Licences that had been granted for the erection of blast-furnaces and puddling-hammers were supposed to represent a value which was regarded by the shareholders as a capital that they had a right to draw from any new speculator in the same business. According to the value they set upon their little falls and licences would they hold out, even under the greatest suffering, for the chance of getting their price. There are at this moment numerous sites, with little mills that have stood idle for years, but which are regarded as good investments by the owners, notwithstanding the scarcity of capital requisite to fit up works suited to the present scale of manufacture. The attempt to keep up their small factories is like the benevolent but assuredly mistaken endeavours to help the people in other parts by the establishment of spinning-schools. It is in either case questionable education to encourage people to contend with hand-labour against machinery. Machines may be made subservient to the wants and the welfare of all classes, and what is wanted is to teach their utility and the best modes of getting and of employing them.

The transition to larger machinery is observable within a certain distance of the river Ruhr, being the limit to which coal can be conveyed by land-carriage. Iserlohn lies within this limit, and at Hattingen and Wetter on the

Ruhr large establishments may be seen for forging instruments of cutlery and the construction of machinery. Olpe, on the summit of the watershed between Sieg and Ruhr, is the first and last point of iron-smelting with coke in this neighbourhood, the nature of the ore being such as to make it advisable, when practicable, to smelt it with charcoal.

The iron-ore found in this highland district, and which is most abundant near the Sieg and in the valleys of the tributary streams which feed that river, is the sparry iron-ore, a carburetted protoxide of iron. From the steely nature of the metal run from this ore, the mineral is called "steelstone" by the country-people, and when puddled with charcoal, according to the custom of the country, steel is at once made from it without any cementing process. The same ore, if smelted with coke, gives a good white iron, but one of a less steely nature. Near Altena the Messrs. Hundsdecker have long been famous for their raw and refined steel. It is the process of refining that occupies so many small hammers in this neighbourhood, and the method is the same that is known by the appellation of shearing at Sheffield. Strips of the raw steel are welded together with alternate strips of iron until the whole is beaten into a homogeneous mass, in the course of which process the carbon contained in superabundance in the raw steel is imparted to the strips of bar-iron that contain none, until the spread of the carbon is equalised. The mystery of steel-making is amusingly kept up in England, where technical skill is so great as to defy all rivalry. In both Germany and France, where capital is not abundant, the theory is chiefly studied, although the practical skill is deficient. It is, however, a race between

routine on the one side and intelligence on the other, for the mastery. For some years experiments abroad have taken a direction quite opposed to the system that has been found so successful in England.

Steel being a combination of iron and carbon in certain proportions, there are two ways of getting at the combination. As cast-iron is more highly charged with carbon than steel, it may be possible to arrive at steel by extracting so much of the carbon as will leave the proportion desired. On the other hand, bar-iron, having lost all the mixture of carbon contained in pig-iron by the processes of puddling and rolling which it goes through, must be recharged if it is to become steel. This is done by what is called cementing at Sheffield. Bar-iron, mostly Swedish, is there charged with carbon until it becomes steel, and is, by hammering and rolling, refined and brought to a state of perfection. But in this way there appear to be two superfluous processes resorted to, that of quite decarbonizing to make bar-iron, and that of recharging, or cementing, to put the carbon back again. The blister-steel, as it is called when so highly charged as to make the bars that have been cemented porous and blistering, stands something on a par with the "raw steel" of the Rhenish districts. We shall elsewhere describe the process of making the raw steel, and here merely remark that when slit into strips and alternated in certain proportions with bar or decarbonized iron, it makes shear-steel, as the blister-steel of Sheffield does when treated in the same manner.

The superior quality of the steel made from Swedish iron shows, however, that there are qualities of iron which, independently of the admixture of carbon,. make

better steel than others. The Dannemora iron is mostly made from magnetic iron-ore, and is free from many deteriorating additions, such as sulphur, copper, &c., which render it difficult to make good steel. The proportion of sulphur that is imbibed by all iron that is smelted with coke is what makes English bar-iron inferior to Swedish. On the other hand, the British empire doubtless contains, especially in India, all the materials required, and of the best description. When that country is thrown open to commercial enterprise by a change in its fiscal government all European speculations may be expected to dwindle into insignificance. But with such an event, India would also present a new market, and the field for industry would be so much the more extended.

To return to the Rhine. A great variety of experiments have been made by scientific men and manufacturers to find a shorter and cheaper mode than the ordinary one for turning the iron of this country into steel. For some uses it is unsurpassed. For instance, the foils of Solingen are sent all over the world as combining toughness with elasticity in the highest degree known. But for fine cutlery the high-priced steel of Sheffield is imported into Germany, and it has been found hitherto impossible to make a chisel of the German steel that will cut iron like an English chisel. Files are in the same manner imported from Sheffield, while sugar-knives and woodcutters' implements for the back settlements in America are in great demand at Solingen.

Mr. Vörster, of Eilpe, near Hagen, has a method of decarbonising cast-iron to any extent he pleases, and has given repeated proofs that he has the process quite at his command. Some specimens which he sent to the exhi-

bition at Berlin in 1845, and which were afterwards shown at Liverpool, excited much surprise. It is said that the Prussian government wished to buy the secret of him, but offered a very low sum for it, which the inventor declined. At the cast-steel factory of Burg, near Solingen, scissors and other implements of low quality are cast and turned out malleable by the simple process of uniting the pig with bar iron in the crucible in due proportions. This experiment was tried some time back at Sheffield with German charcoal-iron, when a good kind of steel to all appearance was produced, but it was not followed up. In all probability, however, many of the cheap wares sold as steel are made in this manner; their quality depends altogether on the kind of iron used in the casting.

We have noticed a cast-steel manufactory at Essen, belonging to Mr. Krupp, in which the English method of cementing bar-iron is retained. The steel of this factory is in great demand, and is often sold for English. There are few markets susceptible of so much extension as that of steel.

CHAPTER IV.

If we follow the Lenna to its source, it brings us to the valleys that fall into the Upper Sieg, at about 80 miles from Hagen. The new Lenna road, a beautiful piece of work, passes in the valley of the Ferndorf, very near a remarkable mine of the steelstone, of whose qualities we have spoken. The "Stahlberg" of "Müsen" is the show mine of the district, and was long a source of great wealth both to the inhabitants of the neighbourhood and to the Counts of Nassau, to whom the district of Siegen originally belonged. The oldest documents in the archives take us back as far as the fourteenth century, but tradition goes far beyond that date. It is even asserted that it was the possession of this iron-producing district which enabled the Saxon chief Witikind to carry on the thirty years' contest with Charlemagne which history records. There is nothing about the Stahlberg to justify such an assumption, but the mine is in other respects curious enough.

Permission is obtained to see the mine from the government mining officer residing at Müsen, and a small fee is taken for the benefit of the widows' fund. It was Saturday afternoon when we arrived there, and a small building near the entrance was occupied as a school-room by such of the miners as desired to improve themselves in plan-drawing and mensuration. This apartment is where the miners assemble daily at prayer

before going into the mine. The entrance is by an adit cut from the lowest point in the valley, and carried 660 fathoms on end into the hill. It is 7 feet high by 4 broad, according to the custom of the country, and is vaulted, being built up with brick where the sides were not formed by the solid rock. The rock, or country, as it is called in Cornwall, is grauwacke-slate, in which the lode, or rather bed, of steelstone, 12 fathoms in breadth and 20 to 23 fathoms long, runs in a direction of N.E. and S.W., inclining at an angle of 80° to 85° E. to the horizon. At the south end the lode is cut off by a fault, beyond which it has not yet been possible to find the vein. At the north end it splits into several small veins, which lose themselves after an inconsiderable length. The large central mass formed one of those workings which old miners were particularly fond of, and in which their ingenuity displayed itself by cutting out chambers of irregular dimensions, supported by great pillars left standing at intervals, and communicating with each other by staircases that led from one story to another. As the solid mass of ore rises nearly to the summit of the hill, it might almost as well have been quarried out, as is the case in Styria and at Dannemora; and the plan now pursued is, after clearing away all the ore left in the upper chambers, to remove the pillars, and let the surface over the cavity fall in; the miners working continually downward, and the hill following them as they proceed, until they reach the bottom. The height from the adit by which we entered to the highest point excavated is 60 fathoms, and is divided into 10 stories, the first and second of which are now worked out.

This mine contains the history and affords the most striking illustration of the mining theories that for centuries have been acted upon in this district. The ruling wish is to look upon the veins of metal in which nature has been liberal as a treasure belonging to the land, which must be slowly and economically worked out, that the people may not be impoverished. On such a theory all the calculations of modern mining break down. It discourages all concentration of power and rapidity of work, because the task set to the miner is one that must last for centuries if possible. Accordingly, in all descriptions of the mine which the stranger meets with, it is gravely asserted, "that at the present rate of working, the streak of ore in the Müsen mine will furnish employment to the miners for centuries." Of course the error in this reasoning lies in overlooking the fact that if the contents of the mine were turned into money, or into capital in any other shape, employment would be just as well found by it, and of a more profitable description than that which old-fashioned mining affords. The error is, however, too common in all countries of looking on mining-produce as revenue, and not as capital, to be very wonderful here. Besides this notion, others peculiar to the district have much influenced the management of the mine. At present there are but 60 to 70 miners, and 30 to 36 washers and pickers of the ore are employed in the Stahlberg and the contiguous lead-mine named "Schwabengrube."

The adit by which we entered cuts a vein of lead 70 fathoms before reaching the iron-mine that we have described; and on turning to the left at this point the stranger finds himself in the "Schwabengrube." This mine gives a good idea of the lead-mining of the district,

as the Stahlberg does of the iron-mining. It is singular that in a great many veins sparry iron-ore leads to lead below. Hence they have here a proverb that—

"A lead vein to be good*
Must have an iron hood."

Welsh miners, we believe, have no great faith in lead veins that show near the surface. The Schwabengrube has several lodes of irregular breadth, varying from two and three feet to several fathoms. In one of the richest workings that we visited the lode presented a perfect wall of compact lead-ore, that sparkled brilliantly to our little lamps; and our curiosity was not a little excited to know why the works were not pushed with more vigour than seemed to be the case.

The whole scene was as different as possible from an English mine. In consequence of their being no winze, or cutting below the level of the great adit, all water has its discharge by the drain that passes under the sole of that entrance. The mine was, therefore, as dry as a drawing-room, and ladies lightly shod might (and indeed constantly do) walk over every part of it with perfect impunity. The workings, being all planned by rule, and without much regard to expense, are roomy and convenient for hand-labour; but notwithstanding the length of the adit (three-quarters of an English mile), there is no provision for applying horse-power, a sufficient proof of the nature of the theory which here prevails in mining. Some of the iron-ore used to be raised by a shaft at the upper end of the Stahlberg, but this mode has been

* Es ist kein Blei so gut,
Denn er hat einen eisernen Hut.

abandoned, and the shaft converted to the uses of a shot-tower. The miner's dress, too, in consequence of the absence of damp, and equal temperature all the year round, is a black linen jacket, cut full in the round and compressed by a broad leather strap at the waist, to which is appended a short leather apron, which the miner wears behind, the band clasping before with brass studs, on which the pick and hammer, crossed in the German fashion, serve as a coat of arms or masonic symbol. The same ornament "in little," generally of silver, decorates the caps of the miners on state occasions, and some care is taken to keep up an "esprit du corps" amongst them, although from the low wages the means at the disposal of government are not great. The miners of the Siegen district, to which Müsen belongs, are nearly all householders, who unite mining with their other occupations. Few besides the captains make it an exclusive occupation. But all are enrolled on the miners' roll of the district, which imposes the obligation to be obedient to the mining authorities, and to pay a small deduction from their wages towards a widows', sick, and superannuation funds. The burials and other ceremonials are solemnized with processions of miners on the roll in their best dresses, and have a picturesque effect amidst the wild scenery of this mountain-district. But there is no miners' band at Siegen, as in Saxony, Silesia, and Bohemia; and, strange as the assertion may seem, the Slavonians appear more instinctively musical than the Germans, who, even in mountainous parts, with the exception of Tyrol, have no national songs of any antiquity. There is a friendly manner about the Siegen miner, united with all the shrewdness of a man eternally

speculating and the activity of frame which manual exertion and mountain walking engender. Poor as the wages are (here not above 1*s.* per diem, although corn is brought by land-carriage from the Rhine, and is dear), yet there is nothing of that gloom and despondency in the looks of these miners that is so often met with in England. The fact is, that while their wants are few, they are intelligent enough to perceive that the demand for labour is not great enough to allow them any influence in industrial calculations. Besides, as mining is here quite free, not being a right of the land or manorial lord, but dispensed by the crown, every man has the chance of discovering something of value that may suddenly enrich him. We shall see presently the effect which this notion, and the system that gives birth to it, has on the country. From whatever cause, it is pleasant to be surrounded with good-natured if not smiling faces, and to meet with civility within the bowels of the earth, as on its surface, as an habitual feature of society. The miners' greeting, "Glück auf," which, literally translated, is "Luck up," is the masonic key to that general information which a traveller can demand without intrusion.

The absence of foul air in these workings in the old slate formations makes it unnecessary to use the precaution of Davy's lamp, or the variations common on the Continent. A small iron-lamp, with the wick projecting in front, as out of a Roman chamber-lamp, is suspended to a hook that is carried on the thumb, or balanced on some ledge of stone where the miner is working. An allowance of a penny per diem is made to the miner if he finds himself in oil. On these lamps every man cuts

his own mark, sometimes the initials of his name, but more frequently some heraldic cognizance, which evinces a taste for pictured alphabets as still prevalent in this class. The lamp hangs by the same hook into his belt when he is walking, into which he also sticks his hammer, and the equipment is usually completed by a small coffee-kettle, in which pottery is often most ingeniously united with copper mountings, and a bag with the bread, buttered or larded, which ekes out his frugal meal. The hours of work are from six to six, with two half-hour and one hour's interval. When the works are manned for day and night labour, the captains and men change from one to the other every week, working one week by day and the other by night. No allowance is made for the time spent on the road from their homes to the mine, which is often a walk of some miles, up hill and down, through brake and briar. The treading a snow-path in winter is a matter of no small importance where the fall is so heavy as in these hills; and custom has established that the captain shall go first on these occasions, the others following in a single file.

The holes for blasting are bored generally single-handed. Double-handed boring is only occasionally resorted to; and we were told that the average of work gave in hard slate a fathom of 7 feet high and 3½ broad as what two men could do in a month. In soft slate a fathom and a half of the same dimensions is good work, and in quartz or crystallised rock half a fathom is the utmost. The contracts vary in proportions similar to these quantities, and range from 10 dollars or 30*s.* to 30 dollars or 4*l.* 10*s.* per fathom of 80 inches. In these contracts time only enters as an accidental element, the

whole system excluding it from mining calculations in these parts. We were told of a visit paid by some Cornish miners to this mine, who had come over from the English company's establishment at Dillenburg. They set about valuing the work in the English fashion, and so frightened the captains and officials, that they were requested to desist, in order that the miners might not be set astray by their calculations.

The arrangements on the "Halde," at the mouth of the adit, testify to the severity of the climate, large erections having been made for the children employed in picking and sorting the ore, in which they work in winter in rooms heated with stoves. The usual ages of sorters are from 13 to 15 or 16, when they go into the mine as "lehrhauer" or learners. This being treated as a model-mine, is in fact a mining-school for the whole country; and it is usual when new mines are opened to look for a captain amongst the men. They are thus induced to submit to strict discipline and learn their business well, that they may deserve recommendation on these occasions. The mine is almost daily visited by some of the numerous officials of the district, and the men have every access to them and to all the information they can impart.

The brook which drains the valley passes near the opening of the adit, and its stream drives the blasts of two lead-foundries upon the scale that is common in this district. One of these is private property, the other is a part of the mining establishment of Müsen, and the assays of all metals are made there which come to the monthly auctions. The following table of the assays for one of these auctions will give the best notion of

the nature of the ores and of the system of mining followed:—

Assay of Ores sold, September, 1846.

Name of Mine.	Quantity	Silver to the cwt. of ore	Lead to the cwt. of ore.	Silver in the ton of lead.	Price per cwt.	
	cwts.	Loth = half oz.	lbs.	oz.	*s.*	*d.*
Wilhelmstrost. . .	95	..	50	35	5	7
Hoffnungstern . .	194	..	60	36	5	10
Brudershaft . . .	268	..	53	36	5	8
Heinrichsglück . .	38	$5\frac{1}{2}$	58	$787\frac{7}{10}$	16	7
	28	$4\frac{1}{2}$	50			
Ende	140					
	44					
	—		Copper.			
	184	..	$13\frac{8}{10}$	..	3	11
			Lead.			
Stahlberg	193	$2\frac{1}{2}$	62	$53\frac{5}{10}$	9	$9\frac{1}{2}$
Jungermann . . .	158	2	58	$50\frac{1}{5}$	9	0
Landescrone . . .	260	2	45	$44\frac{4}{10}$	7	9
Jungfer—						
Copper ore . . .	$2\frac{9}{11}$	$12\frac{3}{4}$	..	$294\frac{4}{10}$	4	6
Lead ore	42	$2\frac{1}{2}$	40			
	117	..				
Heinrichsseegen—						
Copper ore . . .	$8\frac{1}{3}$	$19\frac{3}{4}$	..	$66\frac{8}{10}$	13	9
Lead	$67\frac{8}{10}$	$8\frac{3}{4}$	..			
	297	..	20			
Oberster Glücks-			Copper.			
stern	$44\frac{1}{3}$	..	$24\frac{3}{10}$	..	9	1
			Lead.			
Silberard.	$40\frac{2}{3}$	..	..	$75\frac{5}{10}$	15	8
Neue Hoffnung . .	92	$\frac{1}{2}$	28	$19\frac{9}{10}$	2	10
Schlüssel	51	4	66	$73\frac{7}{10}$	15	6
Ludwigseck . . .	142	$\frac{3}{4}$	66	$43\frac{5}{10}$	7	1
M. Kreutzbach . .	44	$\frac{3}{4}$	20	$39\frac{3}{10}$	7	0

The auctions are public, and the assay lists are open to the inspection of all. This publicity, which always ac-

companies the interference of the authorities in Germany, is a remarkable feature in this mining district, and appears strange to an Englishman accustomed to the rigid secrecy of private accounts. Nobody here seems to think it an inconvenience.

The total sales of lead and copper ores at these auctions amount in an average year to about 2000 tons of the former and some hundred tons of the latter. The richest ores are copper, with a mixture of lead and sulphur, but containing from 5 to 40 per cent. of silver. They occur in small nests, and the German technical term for this ore is "Fahlerz." Crystals of a light ruby colour, transparent, and bearing a beautiful polish, containing 60 per cent. of silver, are occasionally found, but of course as curiosities. We were shown some at Siegen.

But the flattering assays that are here given are not as easily realised as might be supposed. The lead-ore of this country has an enemy that sticks to it in nearly every shape, and renders smelting difficult: this is the antimony, which is sure to be either chemically or mechanically combined with it. At the stamps near the Stahlberg mine large quantities of ore, in which antimony is the principal ingredient, may be seen lying perfectly worthless, from the inability of the smelters to deal with it. The antimony makes the lead too hard to be used by plumbers or for making colours. An English house built works near the Rhine some years back, in the expectation of being able to treat this ore, but, from whatever cause, does not seem to have made it answer.

Another mixture of copper, silver, lead, and nickel,

presents here a problem to the scientific smelter. Such ores are usually handed over to the enterprising owner of the upper foundry at Müsen, M. Schmidts.

The inn at Müsen and all the accommodations are marvellously wretched, notwithstanding the regular attendance of strangers at these auctions and the periodical inspections of the mines, which bring mining officers of high rank frequently into the neighbourhood. The traveller, who will in other respects find Müsen well worth visiting, must make his account to put up with every annoyance that bad ventilation and fare of the very coarsest kind subject him to, or must try to combine his trip with lodging at some neighbouring inn, such as Creutzthal, about 5 miles distant.

The Müsen brook falls into the Ferndorf, a tributary of the Sieg. On this stream a government foundry is established, about two miles from Müsen, and serves as a model for the neighbourhood, as the Stahlberg is a model-mine. The road thither lies past the stamps and inclined planes for washing the refuse ore; but the greater part is obtained in so rich a state from the mine, as to need no other preparation than breaking up into small pieces with a hand-hammer. The stamps and tables are worked by a large water-wheel, and are not calculated to finish more than one or two hundredweights per day, as much time is lost in sorting the qualities that are rich in silver, however small their quantities may be. At the end of the Müsen valley is an iron-foundry after the fashion of the country, which we shall describe elsewhere, and near it is a small machinery-factory, conducted ably by Messrs. Klein, who inhabit two handsome houses immediately adjoining. The

planing and boring in this work are done with steam-power.

Nearly each of the steep valleys into which the central mountain-summit of the Martinshardt divides, has some small establishment: stamps, furnaces, or hammers, all worked by water-power, and on a diminutive scale. Were it not for the very indifferent tavern accommodation and absolute scarcity of sporting opportunities (with the exception of a few trout in the streams), a ramble through these glens would prove amusing. But the leading features of the mining and metallurgy of these parts are accessible in many places to the traveller without much sacrifice of time or labour. At Loh the stranger is sure of a hospitable reception by the director, M. Stengel, the patriarch of scientific iron-founders, if he be interested in metallurgical operations. The foundry is on a small scale, but embraces much that is worthy of study, and no better guide can be found than its director. In the iron-furnace, which has a cylinder-blast with air warmed by gas taken from the top, the ore of the Müsen mine which falls to the government share is smelted. In this district generally the "Stahlstein," or sparry iron-ore, is not roasted, but is put in a state of nature into the furnace, with its sulphur and all its imperfections on its head. At Loh the ore is first roasted, and then allowed to lie for a long period in heaps, that the air and rain may work upon the copper combined with the iron, and disengage it. In consequence of the care thus taken, and which might be carried further with advantage, the iron smelted at Loh bears a higher price than the generality of the iron produced in the district. When smelted with charcoal and chilled

as it runs out of the furnace, it assumes a highly crystallized appearance, brilliantly white when freshly broken, and so hard that a file will not touch it. Analyses have shown the ore to contain—

Carbonic acid	30 per cent.
Manganese	10 „
Oxide of iron	59 „
Earthy particles	1 „
	— 100

The iron in the first stage, or "Spiegeleisen," contains—

Manganese	4 per cent.
Carbon	5½ „
Iron	90½ „
	— 100

It is supposed that the manganese contained in the ore facilitates in some manner the regulation of the proportion of carbon in the iron. However this may be, the ores that are found to contain most manganese are sought by the founders who desire to make "Spiegeleisen," or the material that it is perhaps allowable to denominate steelpig. It is a peculiarity both of the steelstone and of the steelpig made from it, to be very ductile, and this allows of its being smelted in the country furnaces, not only without roasting, but without any addition of limestone; the common run of ore does not, however, contain more than 40 to 45 per cent. of iron.

Loh is the proper place to see the working up of this valuable material to the second stage of "raw-steel," a process to which M. Stengel has devoted special attention. The large flat slabs which are run from the blast-furnace are broken up into pieces, and a lump of about

8 cwt. is heated by lying on the coals of the furnace used for puddling or decarbonising. This is a low open furnace, containing a bed of charcoal about 2½ feet in depth and 4 feet square. The blast is introduced at the side, about the middle of the bed, into which the lump is plunged and exposed to its action until it comes to a melting state. The steel-puddler's art consists in detecting the precise moment for checking the fusion of the metal, and in regulating the blast so that no more carbon shall be extracted from the mass than is necessary. The lump is frequently brought under a heavy hammer, which, with considerable loss of material, shapes it to the figure of a pine-apple, then with its front (which is sloped to a wedge) cuts it into four pieces. Each of these, after several re-heatings, is brought down into a bar an inch and a half square, to try the temper of which an end is broken off by striking it on a horizontal bar. If it breaks short off, and the core is perfect, it is reckoned to be a good article. But frequently a black core is engendered either from burnt metal or from extraneous matter that has not been discharged under the hammer. If this appears, it is thrown aside as inferior quality, although still valuable. The analysis of the raw-steel bars shows them to contain about 2 per cent. of carbon, which is nearly double the quantity that enters into the composition of English cast-steel. Hence, by the process of shearing or welding together strips of this steel with strips of bar-iron under heavy hammers, or by means of casting with a proportion of malleable iron, the proper infusion of carbon is obtained, and fine steel produced.

We have already said that steel can be obtained by casting from the steelpig mixed with a proportion of

bar-iron, for which purpose the charcoal-iron of this district appears to be especially suited. Whether it derives this quality from any natural affinity to carbon, a tendency which is pointed out as distinguishable even in the ore of various mines that are said to be more steely than others, or merely from its being free from impurities in consequence of the care bestowed upon the smelting, has not been satisfactorily ascertained.

Lead and copper are also smelted at Loh, where the processes usual in this country may be seen. They are adapted to production on a small scale, and to the use of wood and charcoal for fuel. Consequently, while they leave the smelter very little profit, he cannot afford to pay more for the raw material than is shown in the preceding table. His wages are also at the lowest point that will support life, not being more than 1*s.* per diem for adults, in a country where black rye-bread sells at 1*d.* and 1½*d.* per lb. The advantage that lies in having the ore on the spot, and water-power to work the blast, added to the enormous cost of land-carriage from the heart of this mountain-district to the Rhine, the Ruhr, or the Lahn, ensures the smelter a monopoly of the ores. But under these circumstances mining is carried on in a very lax fashion, and the supplies are small. Projects are afloat for two tram-roads, one from the Ruhr at Hagen to the Lahn, traversing the mining district of Siegen and Dillenburg. Another is projected, and the measurements are now making for it, from Dillenburg to the Rhine near Coblenz. Either plan would operate a great change in these parts, and would be much in favour of the mining population. At present coals brought by land-carriage from the Ruhr cost 30*s.* per

ton, delivered at works recently erected at Creutzthal and at Geisweid, which the traveller passes on his way from Loh to Siegen. The former is for rolling sheet-iron, and has considerable water-power, but is not vigorously worked. The latter is a rolling-mill, belonging to Messrs. Dresler, a large mining and smelting firm at Siegen, and makes iron of all sizes. Both works, although respectable, are on a small scale, being rather suited to the high price of coals than to the capabilities either of the mines or markets of the neighbourhood. Some interesting experiments on the puddling of the steel iron, so as to obtain steel bars on a scale equal to the manufacturing iron bars, are now progressing at Messrs. Dresler's work, under the direction of M. Zintgraf, the chief inspector of furnaces at Siegen. This gentleman, who is member of the mining-board, has also an ingenious plan of using the gas of furnaces for reheating in rolling-mills under trial.

Along his whole route throughout this district, which is crossed by the high-roads leading to Cologne, Elberfeld, and Westphalia, the traveller sees the sides of the hills bored, and many indications of pits on their summits, forming the points of access to the numerous mines which are everywhere working. He is here in that division of the clay and greywacke slates which, lying to the eastward of the old limestone ridge that forms the watershed between the rivers Ruhr and Sieg, sends all the streams into the latter river. This district is geologically isolated, lying between the comparatively recent formations that are found on the slopes towards the north and west, and the trap formations of the neighbourhood of Dillenburg, which are connected with the

huge basaltic heavings of the Westerwald. The district contains some imposing summits, such as the Martinshardt, near Müsen, 1700 feet; the Rothenberg and Gilsberg, near Siegen; the Ederkopf, where the rivers Sieg, Lahn, and Eder have their sources; and the Höheberg, between the Sieg and the Heller, varying from 1200 to 1500 feet above the level of the sea. The Siegen district is, as has been remarked, also mineralogically distinguished, chiefly by the occurrence of the sparry iron-ore or steelstone. The valleys in which it is found are those of the Rothenbach near Müsen, the Ferndorf, the Crombach, the Sieg, the Weiss, the Eisern, the Agger, the Gosenbach, Fishbach, and Wildbach, the Heller, and the Great and Little Nister.

The sparry iron-ore is generally found accompanied with a little copper, occasionally with lead, cobalt, nickel, antimony, and arsenic, with pyrites or sulphates of all descriptions. It occurs in veins, sometimes large enough to be quarried like beds, as at Müsen, but more generally in veins that run deep, but are not of long continuance, being frequently cut off by faults and throws, after which it requires both skill and capital to recover the lode. These characteristics have had great influence both on the customs and laws that regulate mining operations; but certain economical notions that have been pertinaciously worked out have influenced them still more. We adjourn an account of them until we have taken the traveller to Siegen, the chief town of the district. On his route he will pass several ironworks and steel-hammers standing idle and in a state of ruin, together with new erections upon modern plans, but indicative of timidity on the part of the owners.

CHAPTER V.

The town of Siegen is, far more picturesquely than conveniently, situated on a steep eminence, which it is difficult to ascend in summer, and dangerous to climb in winter. During our stay there a loaded waggon descending on one side actually overran the horses, and crushed six valuable animals to death. But it is characteristic of the place and of the notions prevailing in the district, that this inconvenience is supposed to contribute to the prosperity of the town, because a few wretched horses are kept to eke out the teams of waggons. A projected road at the foot of the hill, which would avoid this ascent, but also, it is true, the principal street of the town, has long been retarded in consequence. There is scarcely a town in Europe that presents so extraordinary and antiquated an appearance as Siegen: between two large castles that are picturesquely relieved with fantastic towers, the diminutive houses of the citizens, with gables turned to the streets, and fronts that are familiar in England only to the readers of Mr. Knight's 'Antiquities of London,' are lost in a maze of narrow, ill-paved streets, which are half choked up with dunghills. It is scarcely possible to conceive that this is the chief town of a district inhabited by the most intelligent and industrious population of the continent. But sharp and active as the inhabitants of these mountains and picturesque valleys are, their notions are often as antiquated

and as fantastic as the houses of their magistrates in the good city of Siegen.

The story of this district is peculiarly interesting, as it involves the working out of the problem of protection from beginning to end. There never was a better opportunity of making the experiment, nor has clearer evidence of the unavoidable results to which monopolies lead anywhere been obtained than can here be shown. The object sought to be monopolised was the manufacture of steel, for which we have said that the iron made from the sparry iron-ore is peculiarly fitted. Smelted with charcoal, which also abounded here, the steel of Siegen was long prized as equal to any obtained in Europe. It probably formed an important item in the exports of the Easterlings or Hanseatic traders to London, and in deciding between the conflicting etymologies that have been offered for the Steelyard near London Bridge, this circumstance ought to be allowed its due weight.

It appears not unlikely that some prince of the house of Nassau, perhaps the same who favoured the introduction of the beautiful irrigation described in our first volume, also brought the improved steel-manufacture from the other side of the Alps. The Nassau princes were proud of their mines, which at an early period furnished them with large revenues: one, in the neighbourhood of Siegen, that produces rich silver lead, has documentary testimonials of its antiquity that reach to the epoch when Adolph of Nassau ascended the imperial throne. The steel monopoly seems to have been organised later, and the first enactments relating to it show that originally a larger number of furnaces existed than was afterwards tolerated. As long as smelting was per-

formed in moveable furnaces, of which there are many traces, no taxation could well be enforced upon the smelters; but when the use of water-power came to be understood, and these arts obtained fixed habitations, they became, like other property, an object of speculation both for sovereigns and subjects. The oldest document respecting furnaces and hammers is dated 1443; in another of 1444, as many as twenty-nine furnaces are enumerated in this district. By a compact between the iron smelters and workers and the counts of Nassau and Sayn in 1478, the metal-workers bind themselves not to carry their art out of those districts on pain of death and forfeiture. What the counter-advantages then granted were, we are not told; but a later treaty or confirmation of the preceding by William of Nassau, in 1555, declares, "that he and his heirs will abandon for ever the arts of smelting, casting, and hammering of iron and steel, with the exception of the work at Freudenberg, in consideration of 2100 gold florins, to be paid him by the owners of furnaces and hammers in the Siegen district." In later confirmations of the rights of the smelters they are exempted from certain taxes, and from military and other suit and service. On all occasions of renewal of their charter the smelters and hammermen were, as might be expected, duly mulcted for the benefit of the crown. Two noble families, the owners of the castles of Burgholdingham and Loh, had each a furnace, a steel-hammer, and an iron-hammer; but although they seem to have kept aloof from the commonalty by not subscribing to their compacts, yet the authority of the ruling house was sufficient to oblige them to submit to the regulations that were promulgated as law.

Their prosperity seems to have soon suffered from the evils common to all monopolising attempts.

Security probably induced neglect; the forests were not proof against constant thinning, for which there was then no proper provision of renewal, and soon after the establishment of the monopoly it was again found necessary to prohibit the exportation of charcoal. From 1563 to 1616 this prohibition was enforced, and yet it was found necessary to reduce the number of furnaces. They were gradually reduced from 34 to 17, at which number they remained stationary, viz., 10 iron, 7 steel furnaces; with 18 iron-hammers, 13 steel-hammers, and 4 copper, lead, and silver smelting-houses. The establishment of the counts of Nassau near Freudenberg was afterwards bought up, which reduced the blast-furnaces to 16.

The next step taken was to limit the number of days which each of those furnaces was allowed to work; and, after many changes, the Siegen furnaces settled down as follows:—

Furnace at	Eiserfeld	125 days.
,,	Eisern	186
,,	Hayn	91
,,	Marienborn . . .	128
,,	Sieghütte	121
,,	Haardt	62
,,	Tiefenbach . . .	62
,,	Gosenbach	90
,,	Birlenbach	92
		957

Thus nine furnaces were to perform the work of three that should be kept at constant work. The furnaces are all the property of numerous shareholders, whose portions are estimated in days. One man has perhaps twenty

or more days, another five, another one, or even half a day. These days they can let to others if they do not choose to use them; and, from the rent obtained, each day s assumed to be the equivalent of a certain sum in fixed capital, that varies according to the locality and the standing of the furnace. This sum varies from 450 dollars (67*l.* 10*s.*) to 240 dollars (36*l.*); and a valuation of the whole in 1836 gave a sum equal to 299,150 dollars, or 44,877*l.* 10*s.*

An arrangement like that we have described rested too much upon chance to be of great duration; and yet chance favoured it singularly. One great object of Napoleon was to secure this district, and monopolise the supply of arms which it could furnish. He therefore incorporated it into the French empire, with the adjacent district of Dillenburg. But although he knew the value of the people, and formed his sappers and miners and practical engineers out of the drafts levied here, yet the French emperor was singularly blind as to the mode of making the country itself productive. This is the only part of his empire of any importance where Napoleon made no roads. As a natural consequence, the differential duty imposed by the carriage to and from a highland capital protected the produce to the extent of the home market, and raised the price of such goods as were fine enough to be sought abroad. The monopoly therefore still bore up within continually narrowing limits until roads came, which has been only within a few years. It then broke down in the most natural manner possible.

When the district at the peace became a portion of the kingdom of Prussia, this monopoly was of course found to be quite anomalous, and even contrary to the spirit of

the laws of that kingdom. But it rested on the faith of compacts with the sovereign, and, what was more in its favour, seemed only to threaten injury to those who adhered to it. Things were therefore left as the Prussians had found them, as regarded the hammers and furnaces, and the government agreed not to interfere by granting licenses to erect new ones. No sufficient claim, however, could be made out to the monopoly of ore and charcoal, and these were declared to be free. In consequence of this, furnaces situated on the outskirts of the Siegen district became valuable, because, as they could work all the year round, the proportion of fixed capital which they took up was small. Then came the opening of the coal-pits on the Ruhr, which cheapened fuel for the furnaces lying on the western boundary. Olpe, which lies on the new road that was soon after begun by the Prussians, has reaped the benefit of all these changes, and has since become a centre of roads crossing in all directions. The new roads carried off the pig-steel to puddlers and hammer-works in the coal-districts; and the people of Siegen have their monopolising "Hütten und Hammerordnung" still, without anybody's being hurt by it but themselves.

A new license was granted in 1846 for a furnace to be heated with coke; but public opinion has so much changed on the subject, that a proposal for throwing open the trade would probably be well received by the majority, especially as scarcely one of all the privileged hammers can work at present prices.

The highly intelligent members of the "Bergamt," or mining-board of Siegen, although obliged in their official position to remain neutral respecting this question so deeply affecting the interests of many of the townsmen,

have contributed not a little to show the monopoly in its true light, as the real cause why more is not produced at cheaper rates in the district. There, as at Dortmund, the scientific or commercial traveller may reckon upon meeting a hospitable reception, and can gratify his curiosity by consulting underground mappings of a district as large and nearly as rich as Cornwall. The mining-board possesses a highly valuable geological and mineralogical cabinet, that has been enriched by contributions from all parts of the world which Siegen miners have visited, and they are not few. Some of them, by economising their salaries and making judicious ventures, returned home from the early Mexican expeditions, between 1820 and 1830, with small capitals, that make them men of consequence in these parts.

In the room that contains this collection and the models, a school is held in winter for miners, at which some of the officers occasionally lecture; and instruction in drawing is given at a very low charge. The castle in which the Bergamt is located was formerly the seat of the Catholic branch of the family of Nassau-Siegen, the Protestant branch living in the castle at the top of the hill above the town. A huge round tower adjoining the principal building of the former castle contains the mapping department, the officers of which are bound to survey and lay down plans of mines and workings, on the requisition of the owners, for very moderate fees. The lower part of the same building is devoted to the laboratory, where any one, for an equally moderate fee, can obtain an analysis of any mineral he chooses to bring. It is curious that within twenty paces of this tower a building stands that has been appropriated to the use of a high

school; and there the professor of chemistry, a man of scientific eminence, is equally ready to satisfy the doubts or the curiosity of the miners. The mining-board has a valuable library of works relating to its department. The assays for the monthly auctions we mentioned are made at Müsen, which is twelve miles distant, and at Dillenburg, twelve miles in another direction there are all the necessary facilities for testing minerals and obtaining chemical instruction provided by the government of Nassau. The pleasant feature in these arrangements is, that the smallness of the fees taken on all occasions makes them equally accessible to the poor and to the rich. These are all encouragements to people to engage in mining in this district. If anybody applies for advice or directions how to proceed, there are always officers at his disposal, whose knowledge of the country, and indeed of the leading features of most of the mines, is remarkable. The young men who devote themselves to the mining-department are all highly educated. They usually pass from the grammar-school to one of the large mining-academies in Saxony, or to the university; and after that they commence practically as miners in the district they expect to be employed in. Beginning with the pickaxe and shovel, they are required to draw up memoirs on geological or mineralogical subjects, or on modes of treating knotty points in mining. They then usually go to some of the model-furnaces, when they put on the leather skin that distinguishes the German furnace-man. The next step is that of a volunteer attached to a district mining-officer or jurat, who is sworn to protect the interests of the revenue while he guides and assists the miners. In this position the candidate acquires a know-

ledge of the district, and when a vacancy occurs is prepared to occupy it. This branch of service is equally important with the forest department described in our first volume. Both present a body of highly-trained scientific officers, such as is scarcely to be found out of the Germanic territories in the civilised world. The district officer has the superintendence of from one to two hundred mines, which keep him fully employed. Several districts are under the inspection of a "Bergmeister," and the furnaces under a "Hütten-inspector." The four bergmeisters, with the furnace-inspector, the head of the engineering department, under the presidency of a chief counsellor of mines, "Oberbergrath," form the mining-board of Siegen. Its jurisdiction extends from the Lenna to the Rhine, which bounds it on the west from Düsseldorf to Ehrenbreitstein. On the south it is bounded by the duchy of Nassau.

Siegen is a place of some commercial importance, as the residence of numerous owners of mines, furnaces, and forests, and the seat of most of the commercial transactions of the district. But its monopoly has driven some of the largest adventurers to a distance, and Kirchen, with Olpe, already mentioned, are centres of great activity on a sounder footing. But the country about is more interesting than the town; and it is now happily accessible by some of the finest roads in Prussia.

The valley of the Upper Sieg was described in our last volume as the school for meadow irrigation in Germany. The beautiful manner in which these meadows are laid down not only causes them to produce abundant crops, but allows the floods that are frequent in spring and autumn to roll over the ground without damaging anything.

A little below the town the valley grows very picturesque, and the wooded heights on both sides close it in majestically. The road runs along the left bank, having been cut along the rocks at a level little above that of the floods, so that the slates are laid open sometimes to a height of thirty or forty feet, and best show the nature of the ground. Traces of mining are to be seen on all sides; but at a short distance from the town stands a house at the mouth of an adit, leading to one of the most profitable mines of the district, "the Philipshoffnung." It is an iron and cobalt mine, yielding the last-named precious mineral in great abundance. The washing-works belonging to this mine, and which until lately washed for the whole district, lie about two miles distant. This establishment, which is said in 1845 to have yielded a clear profit of 20,000 dollars upon a comparatively small outlay of capital, belongs to M. Graf of Siegen, and Niemann and Horstmann of the Horst on the Ruhr, with some few shareholders. The whole of the adjacent hill shows symptoms of cobalt; but it is rarely found in large quantities, and the poorer ores are not well managed: otherwise, at the high price of 4*s.* to 6*s.* per pound when concentrated by washing, more ought to be made of it. At the first village, about three miles from Siegen, a valley runs into the heart of the mountain-chain that divides the Heller from the Sieg. The little river Eisern runs out of it; and the village itself is called Eiserfeld, or the Field of Iron, so that the traveller is at no loss to know what here most occupies the people's thoughts. In fact, every man is a miner and furnace-owner; and the white furnace-skin (usually a calf's hide, dressed white and left uncut) is constantly worn by the

villagers when haymaking or working in their meadows. The mining district officer resides at Eiserfeld, and can give permission to strangers to visit any mine in the neighbourhood.

Perhaps the most remarkable iron-mine, after that of Müsen, is the "Eisenzeche," the entrance to which is in a side valley opening into that of the Eisern. It is one of the oldest workings of the neighbourhood; and its adit, which runs upon the vein, is about an English mile in length. Here too there is no provision for horse-power, but a tram road, as at Müsen and the Philipshoffnung, is used to run out the stuff. Around the entrance heaps of ore, of two tons each, lie nicely piled, each with a wooden cross stuck in it, marked with some sign like those mentioned as frequent in the miner's heraldry,—a ship, or a tree, or occasionally the initials of a name, to indicate its being appropriated in the general division to one of the shareholders. This mine belongs altogether to small miners, and has been worked by themselves from first to last under the direction of the mining-officers. The vein is occasionally of great breadth, and the stone is of good quality; but under the present system, where no concentrated work is undertaken, the profits do not more than afford the proprietors moderate wages. Not far from this mine, which is surrounded by other mines that occur at intervals of a few feet for miles in all directions, the visitor can see the arrangements for smelting common in the country.

The furnace of Eiserfeld stands about a mile up the valley, on a site to which water has been led to drive the blast. The wheel is twenty-four feet high, and the furnace itself not much higher; but the latter stands in

the centre of a large casting-house, which affords shelter in the inclement season to the numerous smelters and their gossiping neighbours. We have mentioned that each furnace is limited to a number of days. It is common for every man to manage his smelting during his own days in person. He has therefore two sheds, one for his ore, and another for his charcoal; and the curious appearance of all these irregular wooden constructions, huddled round the furnace and blackened by its smoke, forms an object perfectly suited to the mysterious gloom of old mining-legends. Here, then, through the long winter, unless frozen out by the intense cold of the season, the villagers sit breaking up their ore with hand-hammers, the never-failing pipe in their mouths, to light which frequent trips to the furnace below are necessary, and give an opportunity of relieving the tedium of their task with gossip. As each man's turn comes, he wheels his ore to the furnace-mouth under the superintendence of the "Hüttenmeister," an official elected by the shareholders, of whom the majority are usually villagers. The whole establishment becomes in some measure a portion of the village property; and the labourers, women, and all required beyond the actual shareholders, are taken from the inhabitants. The richer shareholders do the drudgery work through their men; but the furnace matters are important enough to call for frequent visits and lengthy discoursings even on the part of the notables. To this must be added the pleasure—acknowledged, though not yet defined by metaphysicians—which all the Saxon race seem to find in watching the glow and flame of a well made-up fire, whether in a furnace or a grate.

The cold, which is so intense as occasionally to freeze

the rivers to the bottom, seems to have no power upon the water which drains from the mines; and thus, when a supply of mine-water can be obtained, the adjacent fall is of proportionate value. The grant of the right of mining does not include the disposal of the water, unless specially applied for. Thus a third party, desirous of establishing foundry or washing works, can obtain the water of any mines that may suit his purpose on application to the mining-department. Land is also unhesitatingly appropriated, when required for metallurgical purposes, although the amount to be paid in compensation of its use is left open to agreement or litigation, as the parties best like.

The reader has by this time probably come to the conclusion that mining and smelting, on the scale described, very much resemble the farming system contained in our first volume:—an immense sacrifice of labour, for so small a hope of profit that little more than daily wages, and those very poor indeed, can be the result even for proprietors. Such is strictly the case. The ten iron-furnaces of the district are worked mainly by the proprietors; some few capitalists of Siegen having a few of the shares. The peasant owners are also shareholders in mines, and in the forests around which supply the charcoal consumed. They manage to divide their time between the mine, the forest, the furnace, and their land, in such a manner as to be unceasingly employed, and they calculate closely enough in isolated speculations. But the grand calculation of all, the benefit conferred by division of labour, is unknown to this community. There has throughout Germany been decided hostility to all concentration of capital in few hands, with the exception

of the fundholders. The laws which on one side appear to protect and encourage mining and manufacturing, are in a great measure counteracted by others which invest a prior right in water and other necessaries in the agriculturist. As long as the villager is both agriculturist and iron-master, this collision is concealed, but it becomes revealed as soon as the capitalist steps in to concentrate and economise the scattered forces. Yet so low has the estimation of mining and smelting properly been brought in the Siegen district, that nearly all the furnaces, and all hammers without exception, might have been bought up at moderate prices in the year 1845 while the price of English iron was low. The period of depression was favourable for some progress to improvement. Amongst other projects, it is currently reported that the Government contemplates reforming its exaction of the tithe which is now levied on the gross produce. Probably the French system of a tax on the profits of mining adventures, such as now subsists on the left bank of the Rhine, will be substituted, and both the crown and the miner will assuredly be gainers by the change.

But more would be gained by promoting the concentration of the numerous small industrial undertakings in matters that ought to be conducted on a large scale. Iron ought beyond all doubt to be everywhere produced at the lowest possible cost, that we may be able to dispose of the greatest possible quantity for the manufacture of machinery, upon which the refinement of labour depends. This can only be effected with the aid of large establishments. In such, the extent of the operations produces a large amount of profit, even if the *rate* of the profit be small. The deductions from the amount of profit to pay

wages and to purchase materials can, under such circumstances, be greater that when the total profit is small, whatever be its rate. But if it be a difficult thing to convince small landowners and miners of this truth, it ought not to be so difficult to inculcate the same truth to governments. The change said to be projected in the levying of the royalty would be from a mode only practicable amongst numerous small proprietors, to the mode which alone is practicable when capital is concentrated. For no capitalist will embark in a speculation liable to a rigid tax that does not vary with the changes in his rate of profit.

M. Schenck's valuable 'Statistics of Siegen' give an interesting survey of the state of mining in this district. We find in 1834 :

District.	No. of Mines.	No. of Miners.	Value Raised.
Eisern	229 ..	491 ..	57,750 dols.
Gosenbach . . .	57 ..	185 ..	9,837 ,,
Müsen	97 ..	317 ..	55,026 ,,
	383	993	122,613 ,,

The quantity and value of the ores raised stand in an inverse proportion to the number of small mines, but in a direct one to the number of large ventures. The mines of Müsen employ on an average 100 hands. We are told in another table that the mines returned as follows : in

District.	Profit on Paying Mines.	Loss on Losing Mines.
Eisern . . .	12,948 dols. ..	10,022 dols.
Müsen . . .	15,979 ,, ..	3,620 ,,
Gosenbach . .	142 ,, ..	5,156 ,,
	29,069 ,, ..	18,798 ,,

There was thus a serious loss on mining generally in the

Gosenbach district, where there is the greatest number of small mines. In Eisern the small mines, with heavy losses, almost eat up the profits of the two large ones. In Müsen, where there is a majority of large mines, the profit and loss account stands better. But assuming, as M. Schenck does, that 70,000 dollars went in wages, yet this is only 70 dollars, or about 10*l.* 10*s.* per head, for the miners; while about 10,000 dollars, or nearly 1500*l.*, was the result as gain to the owners of 383 mines, for which a monopoly had been kept up during two hundred and fifty years.

One unfortunate result of the small-mine system has been to prevent its being ascertained whether the nature of the country of Siegen, and the run of the veins in those old slate formations, favours concentrated mining or not. That such was the case seems to have been the opinion of a very sound miner, whom we shall further on our tour find in the management of large and well-managed works in Baden. M. Daub, while in the mining department of this district, had commenced a statistical survey of the mines, intending to show the loss entailed by the repetition of shafts, adits, and other workings, that would be useless where the works were more concentrated, and a greater extent of ground would be opened by one shaft or adit than is now attained.

Some large mines in the Eisern district afford proofs of the truth of this calculation. The Philipshoffnung that has been mentioned has three veins opened by one adit. Another mine, named the Glücksstern, purchased a few years back by the Mudersbach mining company, founded by an eminent Frankfort banking firm, and which also yields cobalt and iron, opens three parallel veins with one

shaft. There seems no reason, from the information kindly supplied by the mining officers, why the whole of those mountains, with their rich veins of silver, lead, sparry iron-ore, with cobalt and copper pyrites, should not divide off into lots, that with little labour would yield good profits to shareholders. Perhaps speculation now only waits the decision of the Prussian government on the tithing question to start.

The tithe, as it is now taken, falls heavily on copper, lead, and cobalt mines, as it is taken from those ores after they are washed, that is to say, have become a half-manufactured article. This mode of rating checks the erection of stamps and washing establishments. As far as cobalt is concerned, it has hitherto only been paid under protest, as the washing of this valuable mineral is the nicest, and at the same time the most expensive purely mechanical process that the miner performs. The process may be seen either at the works of Messrs. Horstmann and Niemann, at Gosenbach and Schelden, or at those of the Mudersbach mining company, which wash for all the Siegen cobalt-mines.

When cobalt is found in quarry, it becomes a mere question of the cost of carriage whether it ought to be washed or not. Its destiny is to be combined with glass, when the grey steely-looking mineral turns into a beautiful deep blue. The glass, when minutely powdered, makes *smalts* that are used in paper-making and in dressing linen. For both these purposes they cannot be replaced by any other blues, whether mineral or vegetable, although many are substituted. Paper blued with other colour than genuine smalts loses its colour and becomes spotted; and, although useful for momentary purposes,

cannot be used where it is intended to be kept for a while. Linen or cotton articles, blued with the genuine cobalt, improve in whiteness when kept, whereas all other cloths get yellow, and are especially marked at the folds. Thus ladies and lawyers are interested in no small degree in Siegen mining. But to return to the works. Those of the Mudersbach company are built on the site of an old high-blast furnace, that had become defunct as to profits under the monopoly we have described. Still, when the shareholders, sixty-five in number, had an opportunity of selling the site and its excellent waterfall, they clung to the *days*, and carried them off to a neighbouring village, where, under a good regulation of the mining board, they were allowed to smelt to the length of their privilege upon paying a sum to the furnace-owners. The fall and site at Mudersbach, where the whole water of the Sieg is carried round to the works, was sold for 1000*l*. The people had to pay 750*l*. for the share they acquired at the neighbouring furnace of Brachbach, to which they carried their ninety-six days. We could not but think that if they had given up smelting altogether, and had kept their money, taking chance for selling their ores and charcoal in the market, they would have been better off. But they acted quite in the spirit of the country.

This little village affords a very pretty interest of the public spirit which the village corporation system tends to foster. Situated in the most beautiful part of the romantic valley of the Sieg, it may have been said to be inaccessible to other vehicles than the mountain-car dragged by the ox of the husbandman, who is, like his master, pressed periodically into the service of the mines

and furnaces. The new road from Siegen to the Rhine was carried along the right bank of the river for some space, and passed through Mudersbach. This improved means of transport having given value to property, the village by the sole means of its inhabitants first purchased out its church dependence on the town of Kirchen, five miles distant, by indemnifying the rich pastor for his loss. They then built a church of very handsome dimensions. The school was the next thing emancipated ; and having shown their ability to maintain a schoolmaster, they were allowed to do so, and to build a school, which they accomplished in 1846. Great part of the cost of those two undertakings was defrayed by a judicious change made with the lands, by which the arable lots near the Sieg were converted into beautiful irrigated meadows, while a strip of forest cleared furnished timber for building, and also ready money for general purposes. The result of all these transformations has been to make a place, that was wretchedly poor and altogether insignificant, a thriving and creditable village.

The cobalt-works are on a small scale, as the company has adopted the wise plan in mining speculations of beginning cautiously. The stamps and washing-tables are moved by the same wheel, which turns two axles, one above the other. The poorer quartz ores, and those in which cobalt is combined with the slate, are very finely powdered by the stamps, the pulverised stuff being carried off by a stream through troughs, in which it settles according to its specific gravity. The richer part is raised with shovels, and spread through the agency of very pretty machinery over inclined planes, which are lifted and fall so as to give a number of shocks in the minute.

This facilitates the settling of the metal while the lighter portions of the ore are carried away. The great value of the metal (6*s*. per lb.) makes it desirable to avoid waste, and the captain of the works is required to be a man of great nicety of observation and unremitting assiduity. This work, with four tables, washes half a cwt. daily out of two and a half tons of sorted ore. This is a very good yield ; and many fair ores of the district give only one half per cent. The washing is carried on day and night, and is managed by two men and two youths under the captain. The most minute accounts are kept of receipts and yield at this work, as the tithe is royal property, and the inspection of the mining board is proportionately strict.

Close to the works is an iron-mine belonging to the same company, which promises to go over into lead in the manner common in this country. The vein occurs in an immense mass of quartz, called on the Rhine a " Ley." The Ley of Mudersbach is at least 600 feet above the level of the river, and has shown symptoms of metallic wealth at various parts. A path through the forest beside it leads over the watershed that separates the Heller from the Sieg. The walk over into the adjacent valley will in summer be an agreeable diversion for the tourist. From several points the eye ranges over a beautifully varied highland prospect. As far as it can reach, summit seems to follow summit, and one green carpet of forest and underwood to be spread over all. To the south-east, from some spots the sugar-loaf shaped seven hills near the Rhine may be seen ; but the great charm is imparted to the landscape by the deeply-cut and winding valley of the Sieg studded with successive villages, without which the wanderer on the lone mountain-top would seem to have bid adieu to habitable haunts.

On one of the highest points of a hill, at the foot of which the large mine already mentioned, the Eisenzeche, is opened, stand the pit and entrance to the principal cobalt-mine of the Mudersbach Company. The shaft is fourteen fathoms in depth, but the mine is not incommoded by water, which is carried off into the fissures of the rock. With this one shaft three veins are opened that are rich in steel, stone, copper, and cobalt. The history of this mine is curiously illustrative of the progress of mining. At some former period, of which there is no longer a trace, miners excavated to a depth of twelve fathoms on the copper lode, which is on the hanging side of the iron. The operation has been performed very neatly, and the adventurers were probably stopped by water, for the removal of which no proper precautions had been taken. The excavation seems to have been practised without the regular sinking of a shaft, and is a curiosity in its way. Some villagers of Eiserfeld afterwards took the mine for the sake of the steelstone, which was found to be easily reduced in the furnace, as is supposed, from its being combined with a great deal of manganese. But the vein was upwards of two fathoms in breadth, being in great part filled up with quartz of a bluish colour. At a later period the discovery was made that this quartz contained cobalt, and the villagers sold their shares to the Mudersbach Company, who are now working it.

All mines in Germany are worked on what in England is called the cost-book system; and this is not mere matter of choice, but is prescribed by the mining trade of Prussia. The registries, which are as exact for mining property as for land, recognise no firm. All must be entered to specific names, and all bills must be liquidated

once a month. The purser, like the captain, is sworn to the state as well as to the proprietors, and is not removeable, except on grounds in which the mining board concurs. Proprietors are bound to keep a mine at work on penalty of losing their right to it; but the extent of the workings is left to themselves, and one or two men preserve the claim as well as one hundred.

We are enabled to give the cost of working this mine from the accounts passed by the mining officer, and they will serve as a fair specimen of the charges attending working mines in the Siegen district. During the year 1846, when from 30 to 40 miners, and as many pickers, sorters, and over-ground hands were employed, the total cost of working out and making available 100 fathoms on two lodes, with 40 fathoms of cross-cutting, was—

Miners	3308 dollars.	
Sorters, &c.	1061 ,,	
Cost of a winze . . .	647 ,,	
	5016 ,,	or £758

The returns were in iron, cobalt, and copper ore, and were stated at

500 tons, or 250 wagens of iron, at 5 dollars	1250 dols.
10,000 cwts. of cobalt-ore and slate, averaging ½ per cent., at 100 dols.	5000 ,,
	6250 ,,

As it was the first year of working, the cost of buildings which are erected by the miners, of tools, &c., which is included in the above estimate, has to be deducted. The profit is here clearly on the cobalt, to which the workings are proportioned, the washing-works

not having in that year sufficed to work up more. But it is evident that there is scope enough for speculation in these parts, when the means of communication allow the ore to be taken off to distant markets.

The buildings at this mine are, as is here the fashion, simple, but well suited to the work. A large room for the sorters, heated in winter by day, and in summer at meal-times, by an economical stove, on which the men place their coffee-kettles, stood at a short distance from a second of still more simple construction, erected over the mouth of the pit, and adjoining which the miners had an apartment of their own. The exposed position makes it necessary to provide against snow and storms, which, as the elevation is nearly 1500 feet above the level of the sea, sweep over it with unrestrained power. The appearance of the miners was that of hardy, healthy men, although the change of temperature, especially in winter, from the mine, where it is often warm when the thermometer without is below the freezing-point, exposes them to pulmonary complaints. Throughout the day, coffee, with bread and butter, is the chief refreshment taken. But the principal meal is supper, which is at a fashionable dinner-hour after work. The constant use of coffee without sugar or milk would appear to excite the nerves, and in the winter of 1846 especially, when food of all kinds was dear, and the general diet was perhaps lower than usual, nervous fevers were very frequent in this neighbourhood.

In traversing these hills, which are bored and torn up by the old workings that are more or less abandoned, it is necessary to know the ground well; and even the natives do not like to cross them after dusk, as fatal

accidents sometimes occur. The path from the Glücksstern leads by many entrances to adits, the cobalt, lead, or iron extracted from which is piled in heaps ready to be carted down, a work of no slight labour and expense. The roads are marvellously primitive, and can only be traversed by carts having the exact breadth of the deep ruts ploughed into them, and yet until very recently there were no others in the vicinity. The ore constantly sells for nearly 50 per cent. more from a mine that is entered from the Sieg road, than for the produce of the mountain-tops. The descent on the other side of the hill into the Heller valley is highly picturesque. Before us lay the highest summits of the Westerwald, which form the boundary between Prussia and Nassau at this point. One, the highest, is crowned by a large church, that is conspicuous as a landmark far and near, and perhaps preserves the tradition of its site having served as a place of worship or of sacrifice from time immemorial. Two other cones, where the basalt has broken through the overlying mass of slate, are very conspicuous. One forms the termination of a tongue or ridge of mountain-range that projects from the central mass. Its round summit, about 1600 feet in height and at least 800 above the bed of the Heller, is said to have been the seat of a castle in the middle ages, the stronghold of the powerful family of Seelbach. Numerous and romantic are the traditions attaching to the "hoher Seelbach's kopf," mostly indicating the prominence that mining occupied as a widely-spread occupation in the country around, the wealth derived from it, and the sad end to which its owners were often doomed as a punishment for their avarice and oppression. The Heller, and streams that

fall into it, work the blasts of a number of small furnaces and puddling-hammers, which have for some time been restricted in the time of working, like those on the Sieg, although it does not seem to be clear when they joined the association of Siegen and Sayn. The Heller valley some centuries back was the seat of a number of little independent dynasts, who long made good their position against the powerful lords that surrounded them, and at one time made an effort to obtain recognition as an imperial confederation, like the knights of Suabia. Eventually they fell under the dominion of the counts of Nassau, but exemption from tithe and a few immunities, such as the right of chace and fishing that still attaches to the representatives of these families, has given to the valley the appellation of the "Freier Grund," which may be translated "the free bottom." Mining is the prevailing occupation still, and, from the causes pressing upon its prosperity, forms a lottery that absorbs more capital than is generally returned.

Exceptions are, however, here perceptible. At the upper end of the valley various rich glens branch off, one of which leads to the Landscrone silver-lead mine, which has already been mentioned as possessing charters that date as far back as the reign of Adolph of Nassau in the thirteenth century. The vein having been lost on several occasions, has been recovered by skilful mining operations; and the shares that on the last of these were actually given to the subscribers to the new venture, are now worth some thousand dollars each. The bergmeister Marenbach at Siegen was presented by the shareholders recently with a goblet made of silver extracted from the vein at the spot where he pointed out that it would be

found in a depth of 50 fathoms. Another glen, that leads up to the highest point of the Westerwald, tells a still more curious tale. Its sides have during man's memory yielded rich lead-ores; and 30 years ago a company, directed by an Englishman of the name of Bennett, established large works there. But allowing themselves to be carried away with the notion of inexhaustible wealth, they ran on wasting their borrowed capital in good living until they reached the level of the bottom, and were unable for want of means to sink pits and pursue the venture. The company broke up, and scarcely a vestige is now left of their works and habitations, when a discovery made a twelvemonth back disclosed the treasure that was just within their grasp, if their operations had been conducted with only a moderate share of prudence and management.

Some convicts were employed in the forest only a few paces from the site of their furnace in drawing a ditch, when they discovered some heavy lumps of lead-ore. The report of the discovery was bruited about, and all the adventurers in the neighbourhood started to look for the source which they rightly judged not to be far distant. Two parties—one led by an old captain, the other by one of the nobles of the valley, working himself with pickaxe and shovel—came upon the vein nearly at the same moment, one on the surface, the other some fathoms under ground. The circumstances were so happily mystified on both sides, that each showed a claim to the whole, and the result was a lawsuit, which kept the works in suspense for more than twelve months, during which time the parties were so wrapped up in the calcu-

lations of the millions to which they had an exclusive right, that all the efforts of the Bergamt to get them to consent to an arbitration, and allow the ore to be extracted, were unavailing. The discoverers at length agreed to transfer their riches very wisely to some capitalists. One half has become the property of the Frankfort house that founded the Mudersbach company, the other has fallen into the hands of parties at Cologne. This vein promises to excel in productibility all that the neighbourhood knows. It is 6 feet broad near the surface, and the lode is a mass of solid lead. Some lower workings have traced it already 10 fathoms deep, where it was broader and richer than at top. Reasoning from the experience of the English company whose mines lay in the adjoining valley at a level of 50 fathoms lower, these veins may well be expected to penetrate as far; and supposing them to go no farther, the mass of metal that can be extracted without the application of a pump, from the favourable situation of the vein, will be enormous. Public opinion immediately christened the discovery "New Mexico," and, indeed, nothing but good means of carriage to the Rhine seems wanting to fulfil the prediction which is implied in this title. The Frankfort banking-house has, we believe, obtained a concession from the Nassau government for a tram-road to be carried along the plateau of the Westerwald, passing close to the works of the Nisterdale company at Hachenburg, and falling into the valley of the Rhine at Vallendar, near Neuwied. We may, therefore, expect that mining will gradually creep into a more concentrated shape, and ultimately prove a source of wealth to

those districts which possess all the materials requisite in mineralogical advantages and a trained population fitted for any work that they may be put to.

At the same time it is very clear that the present mode of collecting the royalty on the gross produce of the mine is a tax imposed upon the capital sunk in machinery as well as on the mineral contained in the veins worked. If the good promise of the rich veins induces capitalists to overlook the injustice of this impost, the poorer veins may be expected to remain unworked while it continues.

Several of the mines which we enumerated from the auction list of Müsen, as containing rich ores of silver-lead, lie in the Heller valley. They are mostly worked upon a small scale, and are now subjected to all the disadvantages and deductions inflicted by bad, hilly roads, and consequent limitation of market. These and numerous extensive veins of iron and copper that are known in the neighbourhood will acquire considerable value from the projected tram-road to the Rhine. Amidst this prospect of increasing wealth it is not uncommon to see old people shake their heads and ask whether the concentration of profits will confer as much happiness and independence as was known in these remote valleys while each man worked for himself, and was contented with the produce which his labour extracted from the ground. The problem we see meets us everywhere, and it surely admits but of one solution. Hitherto, while labour sufficed to supply the primary wants unaided, it became the leading object of a man's life. To have secured work for his lifetime satisfied the unambitious industrious workman. But since our numbers have in-

creased too much to allow unaided labour to furnish even moderate requisites, man has been urged to apply machinery, which gives him gigantic power, and will allow of his calculating upon means and leisure with less work than before. His future lot will, therefore, mainly depend upon the way in which he makes this certainly new but not discouraging calculation.

The following comparison shows the result of the German mode of mining and smelting, as contrasted with the system of association on a large scale, aided by improved machinery, practised in England.

In Great Britain, when the annual production of iron was estimated at about 1,400,000 tons (in 1841), the census commission found 10,949 miners and 29,496 other persons engaged in the iron-manufacture; this gave for one miner 140 tons, and for one workman 47 tons.

In Prussia 117,000 tons were produced in 1842 by 9273 miners and 27,703 workmen, being 13 tons for each miner and 4 for each workman.

CHAPTER VI.

It is quite characteristic both of Germany and of the Germans, that the recent check in railway speculations in England occasioned no interruption of their plans for tracing main lines of communication between the principal cities and the sea. As soon as it appeared doubtful whether extraneous capital could be enlisted in these projects, the governments came forward with encouragements which drew together the small hoards of private individuals. These, under the management of good engineers, aided by influential men in the money market, sufficed to ripen the project formed for lines exceeding 2000 miles in length, by which the Rhine is now connected with the Baltic Sea and the German Ocean at three points, and with the Weser, Elbe, and Danube at many more. As the acquisition of powerful engines of progress is at all times a far more important consideration than the manner of obtaining them, there will be no inquiry at a future day as to what such useful engines cost, nor will those who grow rich by using them much consider whether the projectors made or lost fortunes in their construction. German railroads make no great promises of traffic from the experience of the past; but they are likely to prove so much the more profitable at a future day. The resources, for which the rapid means of communication open markets, are but half known, and that half is but badly worked.