use nickel, in conjunction with copper and zinc, for making various articles.

"According to Proust, nickel used in certain proportions, gives a degree of *whiteness* to iron, diminishes its disposition to rust, and adds to its ductility.

"M. Richter has lately (1803) been occupied in a series of experiments upon nickel. He has found that this metal in its pure state is very malleable, nearly as brilliant as silver, and more attractable by the load-stone than iron. It is generally combined with copper; but he has found a method of freeing it from that metal. He says, that when pure, it is not liable to be altered by the atmosphere; that it is perfectly ductile, and has great tenacity. Its specific gravity, when forged, is 8,666. *Annales de Chimie*, tom. III. page 173.

"The most abundant ore of this metal is a sulphuret of nickel, called *kulfernichel*, which is generally a compound of nickel, arsenic, and sulphuret of iron.

"The valuable qualities which M. Richter has discovered in nickel, show that it might be applied to many important uses; particularly for surgeon's instruments, compass needles, and other such articles, as it is not liable to oxidize by the atmosphere. Should an easy mode of working it ever be discovered, we may possibly find this to be calculated for a greater variety of purposes than any other metal.

"It is a curious circumstance, that all the specimens of the stones which have been said to fall from the atmosphere, *contain iron alloyed with nickel*. These stones, which have at different periods been seen to fall on every quarter of the earth, are supposed by many to be cast from a volcano in the moon. Very lately a shower of them fell in Norway, which covered an extent of three-quarters of a league long, and half a league broad.

"Nickel is employed by the Chinese in making their *packfond*, or *white copper*, which is a beautiful metallic compound; but it has not been much used in Europe, although it may be had in considerable quantities."

We see now, however, that it is brought into considerable use in Europe; the Germans having employed it in many ways, and particularly in making the new musical instruments, formerly described by us, and for which it is admirably adapted; as the delicate *tongues* in them, are easily acted upon by the moisture of the breath, when they are made of steel, brass, or other oxidable metals.

On Making Saltpetre in France, and in Spain. By DON GUILLERMO BOWLES.

MR. BOWLES states, that he has evident proofs that the basis of nitre really exists in the earth, and in plants, in different provinces of Spain, the same as in the *soda* of Alicante; and that any one may convince themselves of this truth, and see saltpetre with its alkaline basis, in the manufactures of Castile, Arragon, Navarre, Valencia, Murcia, and Andalusia, where it is made without the assistance of

vegetable matter; only sometimes throwing in a handful of ashes of mat-weed, merely to filtre the lie of earth; and they make excellent saltpetre by boiling the lixivium of their lands only; consequently, they have gunpowder in Spain, without being indebted for its fixed alkali, to the vegetable kingdom, there being a perfect fixed alkali in the earth.

Let us now see how saltpetre is generally made in France, and in Spain; I say nothing of England or Holland, because they make none, importing what they want from the East Indies, where it is found naturally in the earth, as in Spain, where I have seen saltpetre made with the lixivium of nitrous earth, collected in places, where perhaps there never was a tree nor a plant.

Every thing is carried on at Paris, as well as in other parts of France, according to royal ordinances, in the manner I am going to relate:—the rubbish and filth of old houses is carried to the works, and pounded with hammers; the dust is then put into casks, perforated at bottom, the aperture covered with straw, to give a free passage to the liquor. Water is then poured on this dust, which, in its passage, carries away all the saline matter. This impregnated matter is called lie, which, if they were at that period to boil, would produce saltpetre of a greasy nature; to remedy this, they purchase the ashes of all the wood fires in Paris; from which they also draw a lie that is mixed with the former, and they then boil up the whole.* In proportion as the water evaporates, the common salt, which crystallizes when hot, soon falls to the bottom of the caldron; and the saltpetre, which only crystallizes when cool, remains dissolved in the water. They draw off this water, loaded with saltpetre, into other vessels, and place it in the shade, where the nitre crystallizes. This is called saltpetre of the first boiling, having still some remains of common salt, earth, and greasy matter incorporated with it; it is conveyed to the arsenal to be properly refined, being boiled over again, and left to crystallize two or three times, or more, if found necessary; by which means it is cleared of all its impurities, and becomes perfectly adapted to the making of gunpowder, and the other uses to which it is applied in the arts.

In Spain, where a third part of all the lands, and the very dust on the roads in the eastern and southern parts of the kingdom, contain natural saltpetre, I have seen them prepare it in the following manner:—

They plough the ground two or three times in winter and spring, near the villages. In August, they pile it up in heaps of twenty and thirty feet high; they fill with this earth a range of vessels, of a conical shape, perforated at the bottom, observing to cover the bottom with mat-weed and a few ashes, two or three fingers deep, that the water may just filtre through. They then pour on the water (sometimes without putting in any ashes;) the lie that results from this

* The fact seems to be this:—the salt they obtain from the lie of the rubbish, is a nitre with an earthy basis; the fixed vegetable alkali procured from the wood ashes is then added; this alkali precipitates the earth from the nitrous acid, and taking its place, forms true saltpetre.

operation is put into a boiler. The common salt, which, as we said before, precipitates and crystallizes when warm, falls to the bottom, in the proportion of forty per cent.; the liquor is then poured into buckets placed in the shade, where it shoots, and crystallizes into saltpetre. The same earth, deprived of its nitrous quality by this process, is again carried back to the fields, and exposed to the elements; by which means, in the course of a twelvemonth, assisted by the all-powerful and invisible hand of nature, it again becomes impregnated with a fresh supply of nitre; and what is still more surprising, and cannot be observed, without admiring the wonderful works of the omnipotent Creator, the same lands have produced for time immemorial, an equal quantity of saltpetre; so that if the Supreme Power was to annihilate all the factitious saltpetre of France and Germany, Spain alone could supply the rest of the world, without the aid of a fixed alkali, ashes, or vegetables, if public economy joined hands with industry, and assisted in bringing these great points to perfection. I once asked one of these people the reason of that constant production of saltpetre; but his only answer was, "I have two fields, I sow one with corn, and have a crop; I plough the other, and it furnishes me saltpetre!"

[Tech. Rep.]

On the Spanish Iron Ore of Mondragon, in Guypuscoa; with some account of the famous Toledo Sword-blades, so greatly valued formerly in England. By DON GUILLERMO BOWLES.

"I SHALL now relate some particulars concerning the famous iron mine of Mondragon, which is about a league distant from the town of that name, in Guypuscoa. It is called by the Spanish miners, '*Hierro Elado*,' or frozen iron; is found in a red clay, and produces *natural steel*, with this remarkable circumstance, that it is not to be met with any where else in the kingdom. They even preserve a traditional story, that this ore was used for those famous swords, which Catharine of Arragon made a present of to her consort, our Henry VIIIth; some of which still remain in repute in the highlands of Scotland, being suitable to their dress, and are called *Andre Ferrara*, the name of the maker, which is marked on the blades. The famous *Toledo blades*, those also of Zaragossa, called *Del Perillo*, mentioned in Don Quixote, and others, from the figure of a little dog on the blade,* were also supposed to be made of the ore of this mine, which yields forty per cent. of metal, though rather difficult to fuse.

* Cervantes endeavours to heighten the courage of Don Quixote, when he attacked the lion in the cage, by adding, "that his sword was of the common sort, and not so sharp as those famous ones with the *Perillo* mark." The Zaragossa artists had three distinct marks on their blades, viz. *El Perillo*, a little dog; *El Morillo*, a Moor's head; and *La Loba*, a wolf. Swords with the *Loba* mark, have the name of *Andre Ferrara* on them, and are not uncommon at this day in England. They show a sword in the small armory of the tower of London, with the name of Andre Ferrara, and no other mark, which was taken in the Scotch rebellion, in 1715.