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THE LARGEST ARCH BRIDGE IN THE WORLD (See page 722)

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The Story of Metals

XIV. ZINC

ZINC is next in importance to lead and copper among non-ferrous base metals, that is those other than the precious metals, such as gold and silver. It resembles copper and lead in possessing a very long history and we do not know when it was first discovered. The ancient Greeks, Romans and Arabians were familiar with alloys containing zinc, but it is not certain whether zinc was known to them in its metallic state. Various passages by early writers appear to refer to metallic zinc, but there is a good deal of doubt as to what really was meant.

So far as is known, the name zinc, or as it was then written "zinck," was first applied to the metal in its metallic form by Paracelsus, the famous Swiss physician and naturalist, who lived from 1490 to 1541. His writings show that he not only realised the metallic nature of zinc but was also familiar with some of its properties.

It is rather a curious fact that, although zinc remained practically unknown in Europe until late in the sixteenth century, it was known and extracted in various parts of the East at quite an early period. During the 17th and 18th centuries very considerable quantities of zinc were exported from India and China under various names. Among these names was the Dutch word "spiauter," from which probably was derived the present-day term "spelter," which is usually employed for commercial unworked zinc.

Zinc Ores

Zinc is very rarely found in nature in a metallic state, in which respect it differs from gold, silver, copper and many other metals. A large proportion of the zinc used at the present day is derived from a crystalline mineral known as "blende," which is sulphide of zinc and contains about 67 per cent. of the metal, together with over 30 per cent. of sulphur and small quantities of iron, lead, silver and other elements. Deposits of this ore are found in almost all parts of the world.

At the Broken Hill Mines in Australia are found

extensive deposits of blende together with galena, iron pyrites, garnets and other minerals, the galena, which is sulphide of lead, being very closely intermixed with the blende. For many years these Broken Hill deposits were worked solely for silver and lead, the zinc being neglected and passed away with the "tailings" to the ever-growing dumps. In 1905 a company was formed to work these dumps on modern methods, and by means of flotation processes, to be described later, enormous quantities of zinc have been extracted.

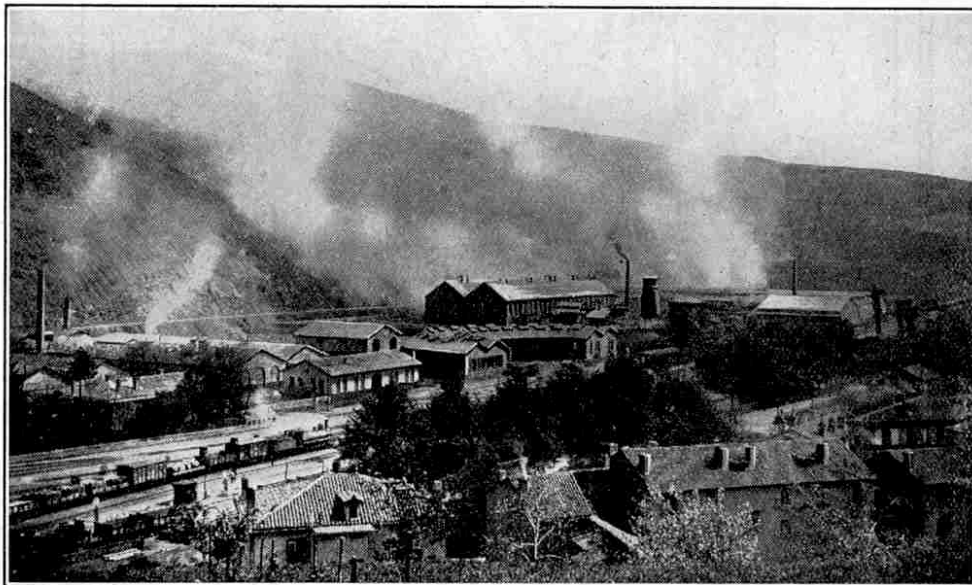
There is also another sulphide of zinc ore known as "wurtzite."

An important but diminishing source of zinc is smithsonite. At one time this ore, which is carbonate of zinc, supplied the largest quantities of the metal, but the deposits of the ore most suitable for working are to a large extent exhausted.

Early Extraction Processes

Long before zinc had acquired any importance in Europe the Hindus were extracting the metal by a process of distillation downward into a receptacle containing water. This method apparently was used also in China and it was there that, in the 18th century, an Englishman, Dr. Isaac Lawson, acquired a working knowledge of it. On his return to England Lawson supervised the erection of a smelting furnace for producing spelter by this method, at the brass-making plant of John and William Champion, near Bristol. This Bristol works flourished from 1740 to about 1865, but in its later years it suffered severely from intensive foreign competition and the setting up of a rival smelting works at Swansea by the firm of Vivian & Co.

Towards the close of the 18th century a German named Johann Christian Ruhberg came to England and acquired a knowledge of the methods of smelting then in use. He subsequently returned to Germany and experimented in zinc distillation at Wessola Glass Works near Pless, in Poland. The results did not satisfy him, however, and he set himself to devise a more efficient process. Finally he evolved a method of treatment in large horizontal furnaces called "muffles." A large plant was erected in 1799, near Myslowitz, in Upper Silesia, and Ruhberg's method was successfully



General View of Zinc Factory at Viviez

introduced. This works formed the beginning of the great Silesian zinc industry of the present day.

In Belgium, zinc smelting began with many years of patient experiment by the Abbé Don who, in 1806, discovered a distillation process somewhat different from that practised by Champion or Ruhberg. He set up works at Liege in 1806, but although his method was more efficient than its predecessors, the works failed to pay. Don reaped little or no financial benefit from his invention and died in poverty. His process was widely adopted later, however, notably by Germany, and about 1850 it was introduced into England.

In the United States zinc was first produced in 1835 by a man named John Hitz at the Arsenal in Washington, but the first commercial zinc plant in America was not established until some 15 years later.

"Dressing" the Ore

The first stage in the treatment of zinc ore is known as "dressing" and is commenced by passing the elements of ore over large iron screens inclined at an angle of 30 degrees. The smaller pieces fall through the mesh into a receiving bin underneath and are known as "undersize." The material that fails to take the screen is known as "oversize" and is passed on to rock-breakers, by which it is reduced to the necessary smallness. The rock-breakers usually consist of a steel casting containing two powerful jaws lined with lead and covered with detachable facings of manganese steel. These jaws are inclined towards one another, one being firmly fixed while the other moves pendulum fashion upon a pivot as the ore passes between the two. After this crushing the ore is led to the receiving bin containing the smalls from the first screen.

From the bin the ore is passed on to an endless belt in order to be sorted. This belt is of indiarubber and is usually about 2 ft. in width. Boys are stationed at intervals along both sides of it and as it moves along with its load of ore they pick out all useless or undesirable material that can be detected. The ore now undergoes further disintegration by being passed between slowly revolving iron crushing rollers. The crushed material is then passed to a rotating conical screen called a "trommel," which has a very coarse mesh.

All ore that falls through the trommel passes down a chute leading to a "Jig," which is a wet stamping plant comprising two, three or four compartments arranged in the manner of steps and each fitted with

a sieve of finer mesh than the one preceding it. From the chute the ore enters the top sieve or cell of the jig and is violently agitated by hydraulic action, which causes the lighter particles to be washed over the compartment edge and carried down to the finer sieve next below. The agitation is repeated in each section as floating particles are received.

The oversize from the trommel is conveyed by chute to the topmost sieve of a second jig and similarly treated. Each sieve retains "heavy" particles which sink to the floor of the compartment and are later drawn off through a discharge pipe regulated by a valve.

A "Shaking" Table

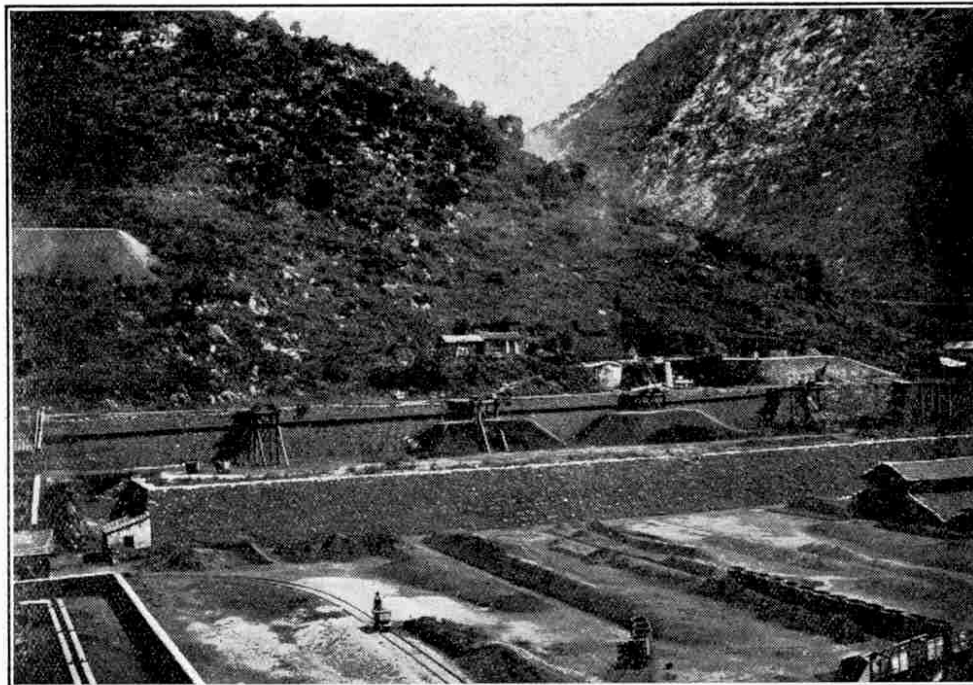
Some of the undersize from the tapered end of the trommel is too fine for treatment in a jig in the ordinary manner and is passed through a "classifier." This apparatus consists of a series of compartments through which flows a current

of water gradually diminishing in speed and its effect is very similar to, though less pronounced than, that of the jig. The lighter particles are carried on by the water and the remaining deposit of heavier particles is transferred to what is known as a "Wilfley" table.

The Wilfley table may be described as a shaking table. The table top rests upon rollers moving in a grooved iron bed and an arrangement of "toggle" levers enables a quick jerking motion to be imparted to the table, which is given on average 240 shakes per minute. The table slopes to one side, the amount of the slope being adjustable. The top is traversed by a series of parallel wooden strips or "riffles," the top strip extending half the length of the table and subsequent strips being each slightly longer than the previous one.

The ore enters a compartment overlooking the inclined table from the raised side and passes down by the aid of jets of water, each emitted at a different angle from adjoining compartments. Heavy particles are caught by the top riffles while the lighter particles are arrested after being carried a short way by the water. The mechanical agitation shakes the arrested particles from the riffles and subjects them to renewed separation by the water, and in this manner the pulp is thoroughly broken up and the light valueless matter swept away as "tailings." The deposits of blende and galena are later collected from the riffles preparatory to calcination.

The dressing of zinc ore is carried out also by various froth flotation processes, the general principle of which



Zinc Mines in Sardaigue at San Benedetto