

The stability of the tungsten industry depends, of course, on the uses for the metal; and as these are not extensive and the demand is limited and variable, there is always the possibility of intermittent operation of mines and mills. It is safe to say that were it not for the large companies operating in the Boulder district the industry would have a more variable career than it now enjoys. At the present writing there is a large tonnage of unused concentrates in the Eastern market, as well as at the mills, with no immediate demand in sight. The principal use of the metal is still confined to the manufacture of tungsten steel for high-speed tools. Minor quantities are used in dyeing textiles, glazing pottery, colouring glass and paper, making bronze powder, and weighting silks. The manufacture of tungsten electric lamps creates a slight demand, but as 1 ton of high-grade concentrate will suffice for the manufacture of 15,000,000 to 18,000,000 lamps the quantity used is not important.

The reader who may be interested in other details of the Boulder County tungsten field, such as general and economic geology, mining, technology, ores, etc., is referred to the Colorado Geological Survey, which has published a complete report, from which some of the foregoing information has been abstracted.

Location of Mills.

The town of Nederland is centrally located with respect to the tungsten mills of Boulder County. It is reached by stage, 18 miles from Boulder, or by railroad to Cardinal station and thence by stage for 2 miles. At Nederland is the mill of the Wolf Tongue Mining Company. At present this company is running its mill on a custom basis, sampling and paying for the tungstic acid content according to a graduated scale of prices. On ore ranging from 1 per cent. to 30 per cent. WO_3 the price paid per ton increases with each per cent. tungstic acid contained, and above 30 per cent. WO_3 the price per pound of tungstic acid also increases with each additional per cent. This system of outright purchase of ore has superseded the former custom of milling the ore at a certain price and returning the concentrate recovered and is generally more satisfactory. It insures better work on the part of the mill and should make a better return to the miner.

At Cardinal, 2 miles west of Nederland, is the Cardinal mill of the Primos Chemical Company. This plant for the past eighteen months has been retreating the tailings made during four years' previous run, when the methods of saving were not as efficient as at present. The Lakewood mill of the Primos Chemical Company is located at Lakewood, about $2\frac{1}{2}$ miles northeast of Nederland. It is the newest and most attractive of the mills in the district. The company's own ore is treated at present, although in the past a great deal of custom ore has been treated.

Between Cardinal and Nederland is the mill of the Alton Mining & Milling Company, a small plant for company or custom work. On Beaver Creek, about 2 miles southeast of Nederland, are two small mills, one belonging to the Tungsten Mining & Milling Company, treating company ore, and the other owned by Smith & Ardourell, at present retreating the old tailings of the Wolf Tongue Mining Company. The Claras-dorf mill on lower Middle Boulder Creek is idle. In addition to the regular milling there is an effort in a small way to roughly concentrate some of the old mine dumps, either by screening and saving the fine

mineral or by hang jigging. Any material obtained in this way is sold to the mills.

Difficulties of Concentration.

The concentration of tungsten ore presents difficulties not encountered with other base minerals. This is particularly true with some of the methods now in vogue. It is believed, however, that all of these obstacles can be largely overcome by applying principles and methods that have proved successful in dressing other ores. Excessive sliming is one difficulty, the cause of which is well set forth in the report of the State Geologist, previously mentioned.

"Ferberite is a rather soft mineral with one perfect cleavage, and generally one or more prominent partings. As a result the mineral is extremely friable even in the massive and massive-granular forms. Much of the ferberite was deposited as aggregates or loosely arranged crystals and crystal grains, forming crusts over the surfaces of rock fragments. One crust succeeded another until in many places the opening was filled. In other places the cavities remained open, but the walls were lined in the same manner. The crystal grains composing these crusts average not more than $\frac{1}{8}$ -inch in length and about $\frac{1}{16}$ -inch in diameter. In much of the ore where the crust is broken the crystal grains are easily separated from one another. When to this ready crumbling of the mass is added the extreme friability of the grains and crystals themselves it is easy to understand the excessive sliming. The finer parts of the slime form an almost impalpable mass which, when stirred in water, gives it an inky appearance, and the water remains turbid for ten days to two weeks. To save these slimes is one of the difficult problems with which the tungsten millman has to contend.

"Another serious problem is the successful treatment of the highly silicious ores. In almost all the tungsten mines there is a certain amount of highly silicious ore, consisting of minute grains of ferberite in a matrix of chalcedonic quartz or hornstone. The percentage of ferberite varies widely. Outside of certain limited areas this type of ore is fortunately not very abundant and rarely amounts to 20 per cent. of the product. Various methods of treatment have been tried, but none has given entirely satisfactory results. Even very fine crushing leaves a large part of the ferberite with particles of quartz attached. In concentrating, these grains consisting of quartz and ferberite will be disposed of according to their specific gravity. Those in which quartz is largely in excess will go with the tailings and ferberite will be lost, while those in which ferberite is abundant will go with the concentrates and help make a low-grade product."

Corroborative testimony on the difficulty of treating some of the ores is given by Mr. Victor G. Hills, who was connected with the Colorado Tungsten Corporation during 1905-7. This company treated custom ores, and at that time was doing the best work in the district. Careful records were kept and improvements were made wherever possible. From a list of twenty-one tests on custom lots the following are given as showing the extremes and average in percentage saving:

Lot.	Mine.	Crude Ore, % WO_3	Concentration ratio.	Concentrates.	Saving
4	D	8.07	8.69	62.17	88.90
3	C	6.07	181.81	40.37	5.03
15	E	9.51	8.93	62.59	75.11