

bursting strength. Second, that the steel used welds so thoroughly that the pipe as a whole gets the benefit of the fact that the steel of which it is made is much stronger than wrought iron. This inference agrees with other facts, of which I will refer to two: First, of the twenty-three steel pipes which burst at all, 17·4 per cent. burst elsewhere than at the weld, showing that in these cases the weld was not the weakest place in the pipe. Second, in a German investigation into the strength of nineteen welded boiler-flues made of soft steel like yours it was found that the weld was practically as strong as the solid metal. Here the strength of the weld was on an average 99·3 per cent. of the strength of the solid unwelded metal, the weakest weld being 91·9 per cent. as strong, and the strongest 109·3 per cent. as strong, as the solid metal."

ORE-TREATMENT IN BOULDER COUNTY, COLORADO.

The following paper, written for the *Engineering and Mining Journal* by C. C. Burgher, may be of interest now that attention is being directed to telluride-ores in the Australian Colonies:—

The ores of this county may be conveniently divided into two classes—tellurium and sulphide. The districts producing them are in general quite distinct and separated by a porphyry dyke. The sulphide-ores, containing iron and copper sulphides, are mostly confined to the Ward district, and their treatment comprises the usual methods of stamping and concentration. Here and there through the county some lead-silver ore is obtained, which goes direct to the sampling-works and smelters.

The tellurium-ores consist of the various tellurium minerals, marcasite and some pyrite disseminated through a calcareous and magnesia gangue. Sylvanite and petzite are the principal tellurium minerals found, though calaverite, hessite, lead telluride, nickel telluride, bismuth telluride, and iron tellurate are frequently met with. Little or no silver is found in the lower grades of this class of ore. In the early days of the county, when nothing less than 4 oz. or 5 oz. ore was looked for or shipped, the question of treatment was not considered; but, as in other localities, of late years the question of economic milling of the ore at the mine has arisen. The outcome of this feeling was the erection of over twenty mills scattered throughout the county, most of which are now lying idle from various causes. Some of them are closed owing to differences between the owners, but the great majority of them were ill-advised ventures, resulting in a plant unsuited to the ore, or so badly constructed as to be an economic failure. Concentration and cyanidation seem to have been the most favoured methods of treatment. As is well known, it is not possible to satisfactorily concentrate tellurium-ores; when such material is crushed through a 20- to 40-mesh screen the values will float off any vanner or concentrating-machine ever devised. The cyanide-mills have met with very poor success in Boulder County, with one or two exceptions, where the ore was decomposed and the gold entirely free. The ores must be crushed finely for cyanide treatment, and the lime, magnesium, and aluminium compounds render leaching nearly if not quite impossible. As most of the ores carry sulphur and tellurium an efficient roasting is absolutely required before even a fair extraction can be obtained with potassium-cyanide solution.

The Delano Mining and Milling Company, when seeking to find a process thoroughly suitable to the ores in question, after carefully examining most of the different mills in Colorado, in particular those of the Cripple Creek district, decided to erect a 50-ton chlorination plant. The mill* has now been in operation six months, and has demonstrated that it is a metallurgical and economic success, and that chlorination is a process well adapted to the treatment of tellurium-ores. The general arrangement and operation of the mill is as follows: The crushing, roasting, and chlorination houses are erected on level ground, the ore being handled by elevator-belts and belt and screw conveyors. The advantage of having a compact mill all on one floor is obvious. The different elevators and conveyors have worked very satisfactorily, and have cost little or nothing for repairs as yet.

The ore is delivered to a 9 in. by 15 in. Blake crusher, elevated to a set of coarse rolls 16 in. by 36 in., set to $\frac{1}{4}$ in. The ore leaving the rolls slides along a chute in which a horizontally moving plate is set, provided with a slot one-tenth of the width of the chute. As the ore passes over the plate one-tenth of it is delivered on the floor as a sample, the balance going to the bedding-floor. The sample thus obtained is split, shovelled, recrushed, and again cut down to a suitable size for the sample-room. Here it is ground in a coffee-mill, finishing on a bucking-board, until all of it will pass a 120-mesh sieve. On most of the ores this degree of fineness seems necessary in order to get results that will closely check. The bedding-floor used at present is simply a utilisation of unoccupied floor-space in the crusher-house. The writer, on taking charge of the mill, soon found a bedding-floor to be indispensable, there being no method as practical and convenient for mixing widely different ores. The bedded ore is elevated to storage-bins, thence allowed to pass through a cylindrical dryer divided by longitudinal partitions into four compartments so as to obtain as much heating surface as possible. The dried ore is elevated to the screens, 16-mesh, the over-size being returned to two sets of fine crushing-rolls, size 14 in. by 30 in., the discharge from the rolls falling into the same elevator as the dried ore, thence to screens. The latter, conical in shape and set horizontally, are placed over bins of 25 tons capacity each. All bins are made of heavy sheet iron supported by substantial framework. The rolls used in the crushing and sampling department are known as the Rogers roll. Their distinguishing features are great strength and general compactness, one shell being placed above the other, not vertically, but at such an angle as to throw all the weight possible of the upper roll on to the ore. The upper roll works in a guide against a powerful spring. The speed of the coarse rolls is seventeen revolutions per minute; that of

* The mill and its chlorinating machinery which the article describes were designed and successfully run by Mr. John E. Rothwell, of Denver, Colorado, the well-known authority on chlorination of gold-ores.