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The Mines and Mill of the Atacama Mineral Company, Ltd., Taltal, Chili. BY S. H. LORAM. *Trans. Am. Inst. Min. Eng.*, **29**, 488–502.—The gold occurs here in very finely divided particles in compact quartz and in fissures in the quartz in the form of spangles upon crystals of baryte and quartz. The ore averages $41.68 per ton; ores assaying under $14.00 per ton do not pay for treatment. There are about 15 per cent. concentrates; some ores contain scorodite (hydrous ferric arsenate). The method of treating is pan-amalgamation, separation of sulphurets, and cyaniding of tailings. The ore is broken in a crusher to ½-inch size and pulverized dry in a Gruson ball mill to pass an 80-mesh screen made of phosphor-bronze. A No. 4 mill is charged with 1320 lbs. of steel balls; it makes 25 revolutions per minute, requires 11 horse power, and treats 6½ tons in 24 hours. The wear of steel from plates and balls is 5.69 lbs. per ton of ore. The amalgamating pans (22 in number) are 5 feet in diameter and 3 feet deep; they are lined to within 6 inches from top and bottom with amalgamated copper plates, and have 4 discharge holes in the sides; of these the lowest is just below the bottom, (a channel in the casting leading to it), the next is 8 inches higher, and the other two are equally spaced. A pan is charged with 88 lbs. mercury, 1100 lbs. ore, and enough sea water to make a thick pulp, the charge being a little over 1 foot deep. The amalgamation lasts about three hours, the muller making 48 revolutions per minute; caustic soda is added if ores containing scorodite are treated. The pan is now filled with water and the amalgam settled for one hour. The sands are discharged through the holes in the sides and enter an agitator (a pan 5 feet in diameter and 5 feet deep, lined with copper plates) from the bottom and overflow at the top. One agitator serves 3 pans. From the agitator the sands are run into a spitzkasten which takes out the concentrates while the overflow passes over a blanket (8 feet long) into a sump whence a centrifugal pump delivers it to the tailings-heaps, where the sands settle, while most of the fine slimes run off to sea. The concentrates, assaying about $14.00 per ton, are weathered and returned to the pan. A pan is cleaned up once a week, when the copper plates are dressed, and the agitator once a month. The tailings average $5.66 per ton representing an extraction of 86.5 per cent. The bullion contains 516 parts gold and 358 parts silver in a thousand. The cyanide plant contains 6 leaching vats (18 feet in diameter, 6 feet, 6 inches deep), and 3 zinc boxes (10 feet, 9 inches long, 2 feet wide, 1 foot, 5 inches deep), having 8 compartments. A vat is charged with 45 tons tailings to which have been added 225 lbs. of lime. The ore is first washed for twelve hours with 10 tons of water containing 0.05 per cent. caustic soda and 0.01 per cent. potassium cyanide; the solution is drained off, passing through the zinc boxes. It is followed by a strong cyanide solution (0.3 per cent.) percolating for four hours, then come 10 tons of weak solution (0.1 per cent.) and lastly 5 tons of wash-water, the last of which, when drained off, contains 0.01 per cent. cyanide. The tailings are discharged by sluicing. A zinc box is charged with 70 lbs. of shavings and the solution passes through it at the rate of 3.3 gallons per minute. The solutions upon entering the boxes contain in 100,000 parts, 0.28 (caustic wash), 0.80 (strong solution), and 0.25 (weak wash) part gold, and upon leaving, they retain 0.1 part gold. The boxes are cleaned up once in ten days. The precipitate, containing about 29 per cent. mercury, is pressed and retorted; the retort gold is melted with borax soda, and sand giving ingots assaying gold 19, silver 21, copper 59, and zinc 1 per cent. The consumption of cyanide is 1 lb. per ton of tailings; the leached tailings assay $6.37 representing an extraction of 80 per cent.

The Purchase of Zinc Ores in the Joplin District. By W. G. Waring. *Eng. Min. J.*, 70, 38–39.—In the European zinc centers the ores are bought and sold upon an assay basis, the valuation being made according to certain formulae which custom has established as being fair to buyer and seller. In the Joplin district the ores have been, until about 1898, purchased exclusively by agents who, judging the blende concentrates by their general appearance, made their offers and took the risks. This one-sided arrangement became unsatisfactory to miners, and at present blende ores are bought on a fairer basis than the mere judgment of the buyer. The purchasing formula now in vogue is $V = WQ - (E + P)$ in which V = value of ore at mine, subject to deductions for lead (50 cents for each unit) and iron ($1.00

for each unit above 1 per cent.), W = 80 per cent. of the number of pounds of metallic zinc contained in a net ton of dry ore, Q = the St. Louis spelter quotation per pound at time of purchase, E = cost of treatment including freight, expense ($10.50), P = smelter profit. This is = 100 Q with ore running over 60 per cent. zinc, with under 60 per cent. it is = 100 Q + (10 Q × 60 — A), the assay in per cent. Jig concentrates contain 1–4 per cent. water when shipped, coarse buddle or sludge-headings 10–12 per cent.; when fine, 12–17 per cent. Carbonate ores are still bought and sold in the old way.—An investigation of the losses of zinc in smelting made at one plant showed that 1 part of lime in blendic ore entailed a loss of 2 parts of zinc. The author found that one part of lime present in the ore as carbonate would retain in roasting 0.4–0.7 part sulphur.

The Sadtler Process for Treating Zinc-Bearing Ores. BY THE EDITOR. *Eng. Min. J.*, **70**, 368–369.—Zinc ores containing over 5 per cent. iron cannot be satisfactorily distilled in the usual fire-clay retort, as the iron corrodes the clay, forming a slag which also scorifies zinc. In this process the retort receives a basic lining not readily attacked by iron or lead. In a trial-test with a furnace containing 30 retorts, oxidized ores were treated containing Fe, 16–30.5; Pb, 1.5–12.89; SiO_2, 2–9; Zn, 16.5–37.5 per cent; Ag, 5–17 ozs., and Au, trace. The loss in retorts was a small fraction of 1 per cent. as against 3 per cent. in Missouri, where blende concentrates with 3 per cent. iron are treated. The precious metals remained in the residue (which also retained 4.2–8.5 per cent. zinc) and served as a basic flux for the lead blast-furnace; the zinc (yield 70–84 per cent.) contained 0.52–1.12 per cent. of lead, and 0.06–0.12 per cent. of iron. It is believed that with a large furnace and regular work the yield in zinc will be 85 per cent. A carload of zinc shipped to a lead-desilverizing plant did as good work as the Missouri spelter. To the regular cost of roasting and distilling of blende there will have to be added from 8 to 12 cents for the lining of each retort, which is, however more than made up by the longer life of the lined retort.

Aluminum-Magnesium Alloys. BY R. H. THURSTON. *Science*, **11**, 783–784.—In view of the appearance in the technical literature of publications on aluminum-magnesium alloys (*e. g.*, Mach's "Magnalium"), the author calls attention to his investigation published in 1893. Magnesium has a breaking strength of 22,250 lbs. per square inch; the elastic limit is 8,870 lbs., the elongation, 2.8 per cent. and the modulus of elasticity, 1,945,000. The following table gives the data on aluminum-magnesium alloys:

Per cent. Mg.	Sp. gr.	Breaking strength lbs. per sq. in.	Elastic limit lbs. per sq. in.	Modulus of elasticity.
0	2.67	13,685	4,900	1,690,000
2	2.62	15,440	8,700	2,650,000
5	2.59	17,850	13,090	2,917,000
10	2.55	19,680	14,600	2,650,000
30	2.29	5,000	....	....

The addition of magnesium to aluminum reduces the elasticity steadily with the increase of magnesium; the alloy $\frac{1}{3}$ magnesium, $\frac{2}{3}$ aluminum is as brittle as glass. The author believes that the addition of small amounts of magnesium to aluminum will make useful alloys.

Reminiscences of the Early Anthracite Iron Industry. By S. Thomas. *Trans. Am. Inst. Min. Eng.*, **29**, 901–928.

The Relative Desulphurizing Effect of Lime and Magnesia in the Iron Blast-Furnace. By O. R. Foster. *Trans. Am. Inst. Min. Eng.*, **29**, 562–568.—The paper is a record of experiments made in brasqued crucibles heated in a furnace using illuminating gas and forced blast, the highest temperature obtained being 1,550° C., as measured by the Le Chatelier pyrometer. The materials used were Swedish wrought iron (carburized in a graphite crucible, sulphurized with iron sulphides and siliconized with carborundum), chemically pure lime, magnesia and silica. The results indicate in a general way that sometimes lime is the better desulphurizer, sometimes magnesia.

Experiments with Titaniferous Ores. By A. J. Rossi. *Eng. Min. J.*, 70, 544.—The author desires to place on record the fact that he has succeeded in producing on a working scale some 20 tons of ferro-titanium and promises details regarding the process and the product later on.

The Effect of Heat-Treatment upon the Physical Properties and the Microstructure of Steel. By R. G. Morse. *Trans. Am. Inst. Min. Eng.*, **29**, 729–751.—The basis of the experiments was a steel of the composition C, 0.343; Si, 0.027; Mn, 0.221; P, 0.0266; S, 0.0037. Bars 1 ft. long were heated to temperatures varying from 500° C. to 1300° C; they were kept more or less time at these temperatures, then allowed to cool slowly, and the critical point, α_r, determined. They were tested for tensile strength and elastic limit and finally examined microscopically. The paper is accompanied by two diagrams and twenty-six micrographs.

The Relative Corrosion of Wrought Iron, Soft Steel, and Nickel Steel. By H. M. Howe. International Congress, Methods of Testing Materials of Construction, through *Eng. Min. J.*, 70, 188.—The paper gives the loss of weight of many plates of wrought iron, soft steel, and nickel steel (3 and 25 per cent. Ni) when exposed to sea water, to river water, and to the weather for two periods of about one year each. The inferences drawn from the results are: (1) "that the difference in the rate of corrosion between wrought iron and soft steel is rarely enough to be of great moment except, perhaps, in marine boilers, and (2) that the ratio of the corrosion of given soft steel to that of given wrought iron may vary greatly with the conditions of exposure." Wrought iron consists of ferrite containing mechanically intermixed some cinder in the form of flakes; soft steel, free from scales, contains cementite. Scale and cementite, resisting oxidation, mechanically protect the ferrite, and having a different potential than ferrite, may hasten or retard the corrosion. The resultant of these two forces must vary with the nature of the attacking medium. The following is a summary of the results of the author's experiments on the relative corrosion of soft steel, wrought-iron, and nickel steel, taking wrought-iron as a standard.

	Sea water.	Fresh water.	Weather.	Average.
Wrought-iron	100	100	100	100
Soft steel	114	94	103	103
3 per cent. nickel steel	83	80	67	77
26 per cent. nickel steel	32	32	30	31

Nickel Steel: A Synopsis of Experiment and Opinion. By D. H. Browne. *Trans. Am. Inst. Min. Eng.*, **29**, 569–648.

Carbide of Silicon in Cupola Practice—A New Softener. By F. J. Tone. *Foundry*, **16**, 117–118.—Carborundum has been found to be very satisfactory in foundry work, especially when dirty or burnt scrap forms part of the cupola charge. Already 1 per cent. carborundum has a marked influence upon the castings. In practice it is customary to charge the carborundum in lump or brick form on top of the coke that the iron, when melting, may be sure to come in contact with it. The heat of the cupola-metal is not sufficiently great to permit adding the carborundum in the ladle as is done in steel castings.

Malleable Cast Iron. By a Correspondent, *Eng. Min. J.*, **70**, 275–276.—The first record of the manufacture of malleable cast iron in this country is of that at Newark, N. J., about 1820. Good malleable castings show: Graphitic C, 3.20–4.00; combined C, 0.10–0.60; Mn about 0.25; S, not over 0.07; P, not over 0.250 per cent. The physical properties are: ultimate strength, 37,000 to 45,000 lbs. per sq. inch, elongation, 3–5 per cent. in 2 inches. For melting, the cupola, and the reverberatory without and with regenerative chambers, are in use. As cupola-metal is difficult to anneal, it is restricted to fine sections. Reverberatory furnaces hold 6–12 tons of metal. It takes about one hour to charge a 10-ton furnace, and four to six hours to melt a charge. The castings, after knocking off the gates, are cleaned in tumblers, sorted, packed with iron scale in pots and annealed for four to seven days. The malleableized iron is then again tumbled, the fins are ground off, and the goods shipped either directly or after first dipping into asphaltum thinned with benzene. The author enumerates the many uses malleable castings are put to and gives the names and productions of the leading firms of the country.

Annealing Malleable Cast Iron. By G. C. Davis. *J. Am. Foundrymen's Assoc.*, **8**, 93–104, 121–124; *Foundry*, **16**, 103–106. Discussed by R. Moldenke and H. M. Howe, *Eng. Min. J.*, **69**, 382.—The object of the author was to find out experimentally how far the generally accepted statements were true that white iron when annealed, increased in weight in spite of the large loss of carbon. He found that with a $\frac{1}{8}$ inch bar (Si, 0.60; S, 0.047; total C, 3.23), the increase in bulk was 10.29 per cent. and with a $\frac{3}{4}$ inch bar, 6.17 per cent.; the increase in weight averaged 6.29 per cent. The explanation of this increase in volume given by Moldenke and Howe is that the cementite (Fe_3C) of the white iron is converted in annealing into ferrite and bulky temper-carbon, the latter expanding the metal. The increase in weight is ascribed by the author to the reduction of some of the oxide of iron in the packing by carbon or carbon monoxide, and to its welding to the casting. The experiments showed also that considerable sulphur was absorbed in annealing, the gain in sulphur occurring principally at the surface; in a $\frac{3}{4}$ inch bar the sulphur content in the center remained unchanged, while it increased 0.035 per cent. in the skin ($\frac{1}{32}$ inch thick). The sulphur, the author points out, must have come from the mill-scale used in annealing, samples of wrought-iron scale showing 0.17–0.26 per cent., and of steel scale, 0.061–0.084 per cent. of sulphur.

Shrinkage of Malleable Iron Castings. By H. O. Evans. *J. Am. Foundrymen's Assoc.*, **8**, 125; *Foundry*, **16**, 121.—In discussing Davis' article (see above), Moldenke made the statement that the contraction in chilling, of irons used for making malleable castings, was $\frac{1}{4}$ inch to the foot and the expansion in annealing $\frac{1}{8}$ inch to the foot, leaving $\frac{1}{8}$ inch, the ordinary contraction allowed for gray iron. The author attacks this general statement. He shows that while the shrinkage due to the cooling of the white iron is a pretty constant quantity, the expansion due to annealing shows considerable variety, so that no hard-and-fast rule for the design of a pattern allowing for shrinkage can be made. In fact it has happened that the same pattern sent to different foundries gave castings differing slightly in their dimensions.