A HALF CENTURY OF MINING.

Some fifty years ago one James Wilson Marshall, a carpenter, was at work deepening the tail race of Sutter's mill, in El Dorado County, California, when he noticed the glitter of gold in the gravel which he had thrown up in his excavation of the night before. That was on the morning of January 19, 1848. When Marshall picked up the yellow fragments, he little dreamed that he was holding in his hand the key to one of the richest natural treasure vaults that has yet unlocked its wealth for the enriching of a nation.

At the time of the discovery of gold in California the mineral industry of the United States was in its very infancy, as may be judged from the fact that the annual output of coal, which in 1895 reached the enormous total of 196,442,451 tons, in 1848 amounted only to 5,000,000 tons, and that the total output of pig iron was but a quarter of a million tons, as against nine and a half million tons in 1895. Lead was mined to the modest extent of 10,000 tons, and it was but two years previous to the discovery of gold, or in 1846, that copper mining had its small beginning with a total output of 150 tons.

The effect of the Sutter's mill discovery was simply magical. Its announcement was received with unbounded enthusiasm, and it drew a vast and motley army of adventurers to the Pacific coast in search of the precious metal. When we consider how crude were the methods of recovery, the yield of gold was truly phenomenal. In the first year about $10,000,000 worth was taken out; this rose to $40,000,000 in 1849; $50,000,000 in 1850; $55,000,000 in 1851; $60,000,000 in 1852; and it reached its highest point in 1853, when a total value of $65,000,000 was recovered.

During these first six years the methods of extracting the gold were very crude, and therefore very wasteful. The mining was carried on in what were known as placer deposits and the favorite apparatus of the "forty-niner" consisted of the pan, the rocker, the Long Tom and the sluice box.

In the course of time, as the rich alluvial deposits became worked out, the miner turned his attention to the gold-bearing rock, and the recovery of the gold became a more difficult and costly matter. There was a call for science, skill, and capital, and the gold mining industry passed into the hands of the engineer and the capitalist. The pan, the rocker, and the sluice gave place to the highly organized stamp mill, with its costly plant consisting of stamp batteries, amalgamating pans and concentrating tables. Chemistry was called in to determine the composition of the various ores, and the expert metallurgist became an indispensable member of the staff of the mine. In due time the rebellious ores came to be treated by roasting, and last, and most brilliant feat of all, was the introduction of the various leaching processes, by which in some cases practically the last trace of the gold has been recovered from the tailings.

Mention should also be made of the remarkable development of hydraulic mining, whereby enormous deposits of gravel, which contain only a few cents' worth of gold to the cubic yard, can be worked at a profit. As its name indicates, the mining is done by the action of water, which is discharged under enormous pressure against the wall of gravel and bowlders, tearing it down and thoroughly segregating the material which is then carried through sluices, where the gold is deposited.

It was natural that, in the first rush for gold, the less valuable metal, silver, should have received but little attention. There were about two and a half million ounces of gold taken out in 1850, whereas the total output of silver for that year was only between thirty-eight and thirty-nine thousand ounces. It rose to 12,375,360 ounces in 1870, and reached the maximum in 1890, when it amounted to 54,517,440 ounces. Last year there was a decline of about eight million ounces, the total being 46,331,235 ounces.

There is no country in the world where the mining and metallurgy of gold and silver has been subjected to such searching and successful experimental work as in the United States. To have graduated from an American School of Mines, and to have gained his experience in the practical routine of American mining, opens up the way to responsible and highly lucrative positions in any of the great mining centers of the world.

The development of copper mining in the United States has been no less remarkable than that of gold. It had its commencement a year or two previous to the discovery of gold, and the progress of this industry, especially in the last decade and a half, has been without a parallel. From a small beginning of 150 tons in 1848 the output grew steadily to 27,000 tons in 1880, when it began to increase at an astonishing rate, reaching a total of 119,000 tons in 1890, and 172,522 tons in 1895—an amount which is greater than the total production of all the other countries of the world combined. This rapid increase in production has taken place in spite of the fact that the market price of copper has been steadily declining. Although it is worth to-day only one-half what it was twenty-five years ago, the output is over thirteen times as great, and the copper mines of Michigan and Montana are reckoned as among the best paying investments of the day.

This success has been achieved by the introduction of improved machinery, and by the administration of the mines with a strict regard to economy of labor. Some idea of what skillful engineering, combined with well directed economy, can do may be gathered from the fact that the great Calumet and Hecla mine in Michigan is paying a yearly dividend of 150 per cent on a paid-up capital of $1,250,000, and this, although the value of copper has decreased 50 per cent in the past twenty-five years. The above figures are a tribute to machinery and good management, which, in the last twenty years, have reduced the cost of labor in getting out the ore more than 400 per cent.

TOTAL OUTPUT OF LEADING MINERALS IN THE UNITED STATES, 1895.

		Value.
Pig iron, long tons	9,446,308	$108,632,542
Gold, ounces	2,265,612	46,830,200
Copper, pounds	386,453,850	36,944,988
Silver, ounces	46,331,235	30,254,296
Lead, short tons	156,854	10,132,768
Zinc short tons	81,858	5,942,890
Quicksilver, flasks	33,978	1,313,589
Aluminum, pounds	900,000	495,000
Antimony, short tons	433	68,847
Bituminous coal, short tons	138,079,466	125,489,488
Anthracite coal, short tons	58,362,985	89,948,699
Crude petroleum, barrels, 42 gallons	50,652,025	42,547,701
Building stone		33,000,000
Lime, barrels, 200 pounds	60,000,000	30,000,000
Iron ore, long tons	16,950,000	29,662,500
Coke, short tons	9,927,348	15,258,935
Natural gas		12,000,000
White lead paint, short tons	92,000	8,740,000
Salt, barrels, 280 pounds	12,521,498	5,844,348
Hydraulic cement, barrels, 300 pounds	7,694,053	4,597,285
Clay, refractory, short tons	3,750,000	4,500,000
Marble, cubic feet	6,942,533	4,086,261
Phosphate rock, long tons	831,498	2,577,643
Alum, short tons	75,000	2,225,000
Roofing slate, squares	645,361	2,062,239
Portland cement, barrels, 400 pounds	749,059	1,430,089
Value of total mineral output		$673,881,505

More extensive, and bringing even a greater increment of wealth to the nation than the production of gold, silver, and copper combined, has been the development of our vast natural resources of coal and iron.

We have shown that the past half century practically includes the history of the development of coal and iron mining on a scale of any magnitude. Five million tons of coal and less than half a million tons of pig iron will cover the output in 1846; and although the earliest records of the iron industry take us back to the early years of the seventeenth century, when iron ore was shipped from Virginia to England, the commencement of the era of its modern growth may justly be assigned to the decade 1840 to 1850. This period saw the rapid development of the two great means of transportation—the locomotive and the steamship—whose manufacture and propulsion created an immediate and growing demand for iron and coal. Increased facilities of transportation extended the market for manufactured articles; and, as the factories multiplied, the demand for iron machinery and coal fuel increased rapidly. The industrial development of the country thus necessarily involved a corresponding increase in the output of coal and iron; and the story of our commercial prosperity is faithfully chronicled in the tables of our production of these minerals. This has risen in 50 years from 5,000,000 tons of coal to 196,442,451 tons; and from 500,000 tons of iron to 9,446,300 tons in 1895.

The European mine owner is puzzled to understand how we can sell our coal for 30 to 40 per cent less per ton than he can afford to do, when we are paying the miner over twice as high a wage.

The answer is simple, and with it we will close this brief review: Better paid labor produces a more intelligent workman and a larger output of work; it stimulates the introduction of labor-saving machinery, and renders economy of administration an imperative necessity.

GREAT SEAL FORMERLY ISSUED WITH BRITISH PATENTS.

THE GREAT SEAL ON BRITISH PATENTS.

The letters patent formerly issued by the British government were very formidable affairs, and in the accompanying illustrations we publish a reproduction of the great seal which was affixed to each document. The patent itself was a large folio in size and printed only on one side upon heavy parchment. The seal was affixed by means of a red cord to the lower border. This was a very beautiful affair, and measured 6½ inches in diameter. On one side of the seal is a representation of Queen Victoria in coronation robes, supported on either side by female figures, presumably Justice and Science. On the obverse side her Majesty appears mounted on a charger led by an esquire, who casts his eyes over his shoulder at his royal mistress.

The joy and pride of the inventor upon receiving this imposing document must have been very great. The seal usually was protected by a tin box, which, together with the patent papers, were inclosed in an outer case of leather, the whole weighing about four pounds. The practice of affixing the seal to patents continued until 1877, when the old act was repealed. The government fees alone, at this time, were £25—$125. These fees remained in force until 1883, when the act was again amended. Although the old seal added dignity to the papers, the public parted with it without regret, and the paper seal used now on British patents is found to be cheaper, more durable and less likely to get out of order.

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(Illustrated articles are marked with an asterisk.)