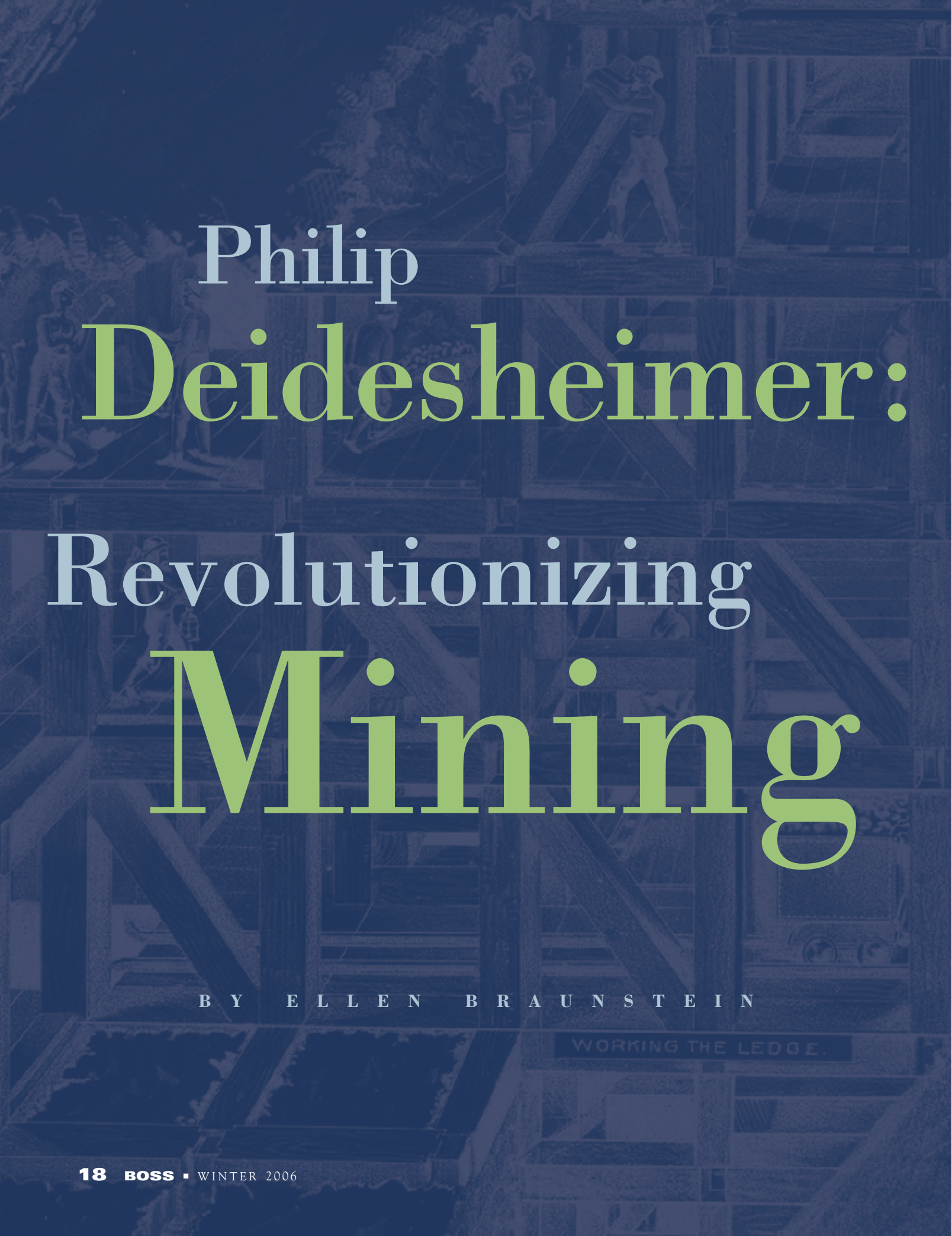
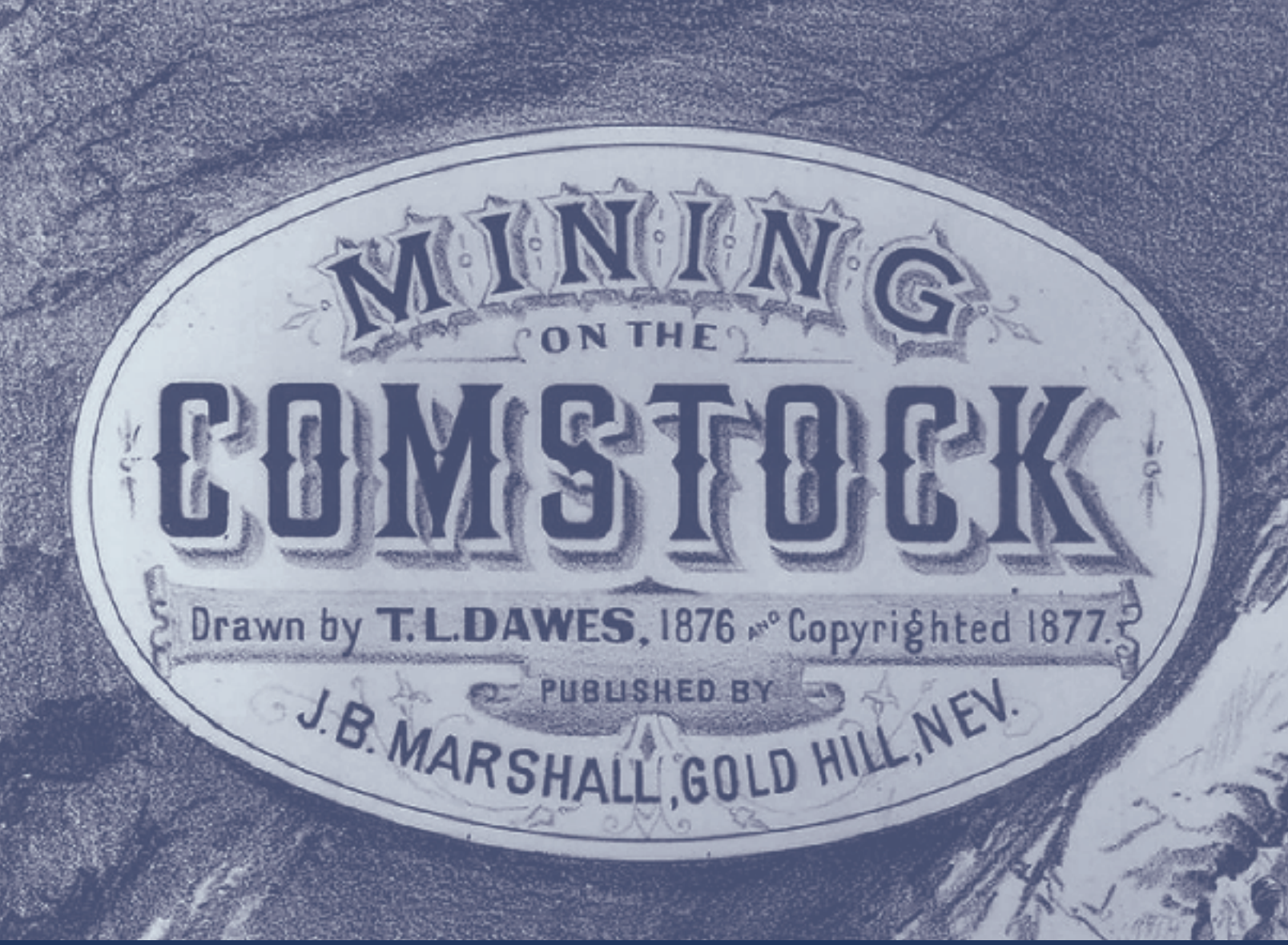


Philip Deidesheimer: Revolutionizing Mining

BY ELLEN BRAUNSTEIN



The Comstock Lode in northwestern Nevada was the most important mine in the world from 1860 to 1880. The huge geological formation yielded silver and gold worth $400 million in the 1800s (equivalent to $9.4 billion in 2005) and influenced mining methods into the 20th century.

But the ore was deep and difficult to mine. Blistering heat, flood water and cave-ins killed or injured miners. When miners broke through rock, underground water flooded the tunnels, often with deadly consequences. As mines went deeper in the Comstock, the flood water steamed and scalded the miners, who already suffered from blistering heat. Many quit. The Comstock would have shut down were it not for the innovative techniques developed by a handful of engineers.

Phillip Deidesheimer, a German engineer, could be counted among those innovators. The Comstock is where Deidesheimer made one of the most valuable contributions in history to mining safety and efficiency, historians say.

His invention, a revolutionary timber-framing system known as the square set, allowed Comstock miners to keep soft walls of fractured rock and clay supported while they extracted large bodies of ore from deep below the surface.

"All the mines were unsafe. Square-set timbering made them safer," said Jack McCoy of Philipsburg, co-author of a book on ghost towns of Granite County, Montana. Philipsburg, the county seat, was named after Philip Deidesheimer, a mining and mill superintendent there from 1866 to 1868.

Deidesheimer was born to Jewish parents in Darmstadt Hess, Germany in 1832. At the age of 20, he graduated from the prestigious Freiberg School of Mining in Germany. He was one of an elite group of European engineers sought by mining companies in the American West in the 1840s and 1850s.

That was mining's romantic era, said Daniel Meschter, a Philipsburg newspaper columnist, geologist and mining historian, who can enchant a listener with legendary stories of miners from that period. The feverish mining for gold and silver brought on by the 1949 California Gold Rush could, though rarely, make a man enormously wealthy overnight, he said.

"It was a time when mining engineers could make a big contribution," he said. "Nowadays, they are civil engineers. The romance has left."

Deidesheimer sailed to America around Cape Horn, no doubt in response to this opportunity, Meschter writes in *Flint Chips: Tales of Flint Creek Valley*. Meschter's collection of 177 history columns originally appeared in the *Philipsburg Mail* from 1985 to 1989.

Arriving in 1851, Deidesheimer spent the next nine years in Eldorado County, California, working as an assayer. Assaying is the technical skill of determining how much gold is in a piece of ore. Deidesheimer also supervised the opening of underground gold mines and built and managed stone and silver amalgamation mills in Montana.

Most important, Deidesheimer worked with other engineers to mechanize placer mining of gold and silver veins that were exposed by erosion. Placer miners, namely the '49ers, extracted tiny pieces of ore from masses of sand, grit and gravel. They hand sluiced or panned for gold in streams. Engineers of the day developed sophisticated machinery that would process huge quantities of gravel, taking advantage of the high specific gravity of gold, Meschter said. Ultimately, floating dredges would sort the material, sending huge amounts of silt and sand downstream. Laws enacted in the 1860s and 1870s attempted to limit the environmental harm caused by large-scale placer mining.

On July 1, 1859, miners struck a bonanza of silver and gold in northwestern Nevada. Hundreds of gold miners abandoned their spent claims and rushed eastward across the Sierra Nevadas to Silver City, Virginia City and other boomtowns.

Henry Comstock, a miner with a reputation for swindling, stumbled into the initial discovery. He tricked two Irishmen into getting a cut of their claim by saying they were trespassing on his ranch. He became one of the most conspicuous claim holders, and the ore deposits came to be known as the Comstock. Mr. Comstock sold out for too little. He subsequently went insane and committed suicide.

Silver miners at the Comstock were having trouble holding the ground. No one there had ever seen such wide ore veins in deep mines—up to 60 feet across, said David Davis, a spokesman for the Nevada Bureau of Mines and Geology.

To extract ore from narrow veins, miners supported tunnels with a basic post and cap method of timbering—a stick along here, a stick along there.

For the wide veins of the Comstock, timbers were neither long enough nor strong enough to support caverns cleared of ore. The ground pressure felled the pine columns like pick-up sticks. Miners were dying or quitting from the heat and cave-ins. "Not many mines were in the condition the Comstock was. The surrounding rock would cave in as fast as the miners could get the ore out," said Joseph V. Tingly, research geologist emeritus at the Mackay School of Mines in University of Nevada in Reno.

William F. Babcock of the Ophir Company asked Deidesheimer to come to Virginia City in November 1860 to look into the problem of timbering wide veins. "They had to have an engineer create something to fill the void after creating the void," said Ronald James, Nevada State Historic Preservation Officer and author of a history of Virginia City and the Comstock Lode.

According to Meschter, "Deidesheimer freely gave his invention to the world without applying for the patents that might have assured him financial security."

Meschter writes that Deidesheimer is said to have told a

Photo this and previous page courtesy of the Montana Historical Society.

Square Set Mining

The ore discovered in 1859 at the Comstock Lode was so crumbly it could easily be excavated by a shovel.

That was the upside of mining the largest silver find in U.S. history. The downside was cave-ins, among other deadly conditions.

Ore deposits, typically narrow, often run a few inches to several feet wide along a tunnel. That is why they are called veins. No one had ever seen such wide ore veins before the Comstock. However, the ore rock could easily be braced with simple shoring and beams.

But by late 1860, Ophir mine workers had sunk a shaft 180 feet deep to mine a vein 45 feet wide. The ore rocks were in large masses of quartz surrounded by a wet, clay-rich material that became unstable when exposed to air.

As the ore was removed, the clay began to swell. The pressure would bend and break the most carefully laid timbers. The walls and roofs would collapse with amazing speed and crush the miners instantly under tons of rock.

The Comstock mines would have closed were it not for the development of a timber-framing method known as the square set.

German engineer Phillip Deidesheimer designed a system of intricate interlocking cubes that provided more stability than traditional timbering. He had the cubes assembled with strong massive timbers, four to six feet wide on a side. The timber framing, set in steps, could wander wherever the miners wanted to excavate and still maintain strength and support. The cubes gave the miners a working surface from which to take out the next layer of ore.

Deidesheimer told people that a honeycomb inspired the design of his square set. He noticed that the cubes were remarkably light yet provided substantial support.

Often the cubes were refilled and strengthened with waste rock from other diggings after the ore removal was complete.

The square sets allowed the mine shafts in this huge geological formation to be sunk to great depths, up to 3,000 feet. Square sets were quickly applied throughout the west and worldwide.

But square sets were expensive and slow to build. They required lumber, transportation and highly skilled laborers and supervisors to construct the frames. Huge lumbering operations stripped the forests around Lake Tahoe.

At the time, there was no alternative.

The square set would be the standard for international mining until the turn of the century. By the 1900s, steel replaced the need for wood, and earth-moving machinery paved the way to open pit mining. More efficient and safer methods such as rock bolting, steel mesh and steel plates, made the square set timbering system passé.

Above photo: Square set timbers, 1897.
Illustration: Men working in the Comstock Lode, a silver and gold mine in Virginia City, Nevada, the first industrial city in the west.

friend, "If all goes well and these square sets protect the lives of the miners, what more could a man ask for?"

Deidesheimer's concern for safety saved lives at a time when some owners valued more his contribution to the bottom line, Meschter said.

Deidesheimer became the superintendent of the Ophir Mine. In a few years, he fell out of favor with management because he sided with miners in labor disputes, Meschter wrote.

He left for Montana in mid-1866 and accepted a similar position with the St. Louis and Montana Mining Company. He again displeased management with his favorable treatment of workers, Meschter wrote. He also presided over a mill in that area that came to be known as Granite County. A community of 200 miners and families named their town Philipsburg after the man with a German mouthful of a name.

When Deidesheimer returned to Virginia City in 1868, he found easy employment with mining companies whose owners exploited his reputation to boost stock prices. "They would have him on the masthead to approach potential stock investors," James said.

Ultimately, Deidesheimer went broke. He lost heavily in the stock market crash of 1875 and declared personal bankruptcy.

He resurfaced in San Francisco at age 43 and started anew as a surveyor. He completed the engineering survey for an innovative project that brought water from Lake Tahoe to San Francisco.

Well into his 70s, and dealing in real estate, Deidesheimer lost everything in the San Francisco earthquake of 1906. Meschter wrote that he was reported destitute and ailing in 1912 in a cheap hotel room. He died on July 21, 1916.

"In the end, Deidesheimer was a lonely and forgotten man, Meschter said. "He received from life less than he deserved."