JOHN HENRY v. *CHARLES BURLEIGH'S DRILL*

Doreen Chaky

THE LEGENDARY JOHN HENRY was supposed to have been a black laborer working at the Big Bend Tunnel (although that tunnel was hand-driven)[1] but he might just as well have been a composite of the miners and laborers who worked with the first Burleigh drills in tunnels and mines and quarries throughout America after the middle of the 19th century.

In any case, the competition between man and machine was, almost from the outset, unsporting.

The Burleigh drill, which soon became the mine owner's indispensable tool, was not the first percussive rock drill ever invented, but it was the first one that worked effectively. Charles Burleigh, its inventor, while a machinist at Fitchburn, Massachusetts, helped Jonathan J. Couch and Joseph W. Fowle build their rock drills which were tried out on the nearly five-mile-long railroad tunnel through Hoosac Mountain.

Neither Couch's nor Fowle's drill proved economical at the Hoosac because they were constantly in repair.

Europeans patented 86 rock drills between 1850 and 1875; Americans patented 110. But it was the Burleigh drill that was to advance tunnelling, quarrying, and mining technology in the United States, and it was Burleigh's name that, like Zerox with all copiers, was to become synonymous with machine drills, no matter who made them.[2]

The Brooks, Gates and Burleigh Drill, patented March 6, 1866, was tried in the east heading of the Hoosac in mid-June of that year. Like Couch's tool, this one had a hollow piston, but where Couch's drill was "thrown" at the rock face rather like a spear, the Brooks, Gates and Burleigh drill was attached to the piston rod and worked like Fowle's drill.

The results were disappointing; it, too, was in the repair shop far too often.

Meanwhile, Charles Burleigh purchased Fowle's patent and, abandoning Couch's hollow piston, built a machine in which the drill was attached directly to a rotating piston rod. Steam-powered machine drills had already failed in practical application at the Hoosac, so Burleigh built an air compressor and sprayed water into the cylinders to cool the air during compression.

The State of Massachusetts tried other modifications to Couch's and Fowles' drills in the Hoosac: S. Gwynn's hollow piston drill of the Couch type in 1864; and the next year, Herman Haupt's drill that was exhibited at the 1867 Paris Exposition. (Haupt had been the tunnel contractor until 1861.) These, too, spent too much time in the repair shop.[3]

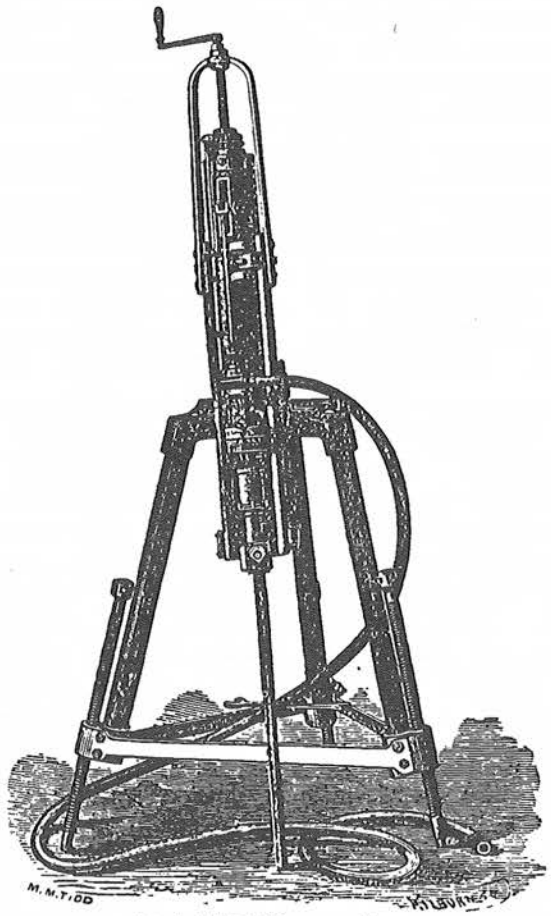
Late in 1866, Thomas Doane, chief engineer of the project, reported to the Massachusetts legislature that several of Charles Burleigh's new machines had been tested in the east heading of the tunnel since November 1 of that year. Among their other features, these drills, at 371 pounds each, weighed less than the Brooks, Gates and Burleigh drill. "[O]f all the reciprocation machines brought to your notice," Doane told the legislature, "that of Mr. Burleigh seems to me most promising."[4]

Machine drills, to this point, had not even outdone hand drilling. John Henry seemed to be winning the competition, but only temporarily. When Benjamin H. Latrobe resigned from his job as consulting engineer in 1868, he told the Hoosac commissioners that he thought "difficulties which have attended this great enterprise may be considered practically at an end."

He was right.

A Canadian consulting firm, Shanly Brothers, took

DOREEN CHAKY, a journalist and descendant of Nevada and California miners, has recently completed the first of a series of historical novels set in the Mining West.



Burleigh Drilling-machine.

From Raymond, Mines and Mining, 1871, *507.*

over the contract in 1869 and the *North Adams Transcript* of July 1, 1869, reported that at the west shaft of the tunnel "four air compressors are being put in, each of which runs 10 drills, making a 2-inch hole and capable of sinking a foot a minute. The power on each of the drills is 60 pounds to the square inch. The drill holes are sunk seven feet, are then charged with nitroglycerine, a pound to each hole, and then fired by electricity."

By 1870, with nitroglycerine in general use throughout the tunnel, Walter Shanly reported that the improved Burleigh drills were giving good results: "The use of the Burleigh drill saved about two thirds of the expense of drilling. The expense of labor would have been...fully three times the cost of machine-drilling. To have done this work by hand-drilling would have taken..., not less than twelve years."[5]

The Burleigh continued to be used throughout the excavation of the Hoosac Tunnel.[6]

Charles Burleigh had made a verbal agreement with Alvah Crocker of the tunnel commission that he "should receive no payment whatever at the time, but the State should have the full use of the machine, and when it could be determined of how much value the invention was to the State, he should be fairly and fully rewarded."

Putnam Machine Company provided sixteen of Burleigh's new drills at cost to the state, which turned them over to the Shanlys in 1869. The Shanlys bought sixty more drills at $625 each. But Charles Burleigh had to hope the Massachusetts legislature would pass a bill allocating him just compensation. He told lawmakers he would be satisfied with $100,000, but he did remind them that the state had saved millions of dollars by using his drill. What they gave him was praise and a check for $10,000, exactly the amount he had paid for clear rights to Fowle's patent back when he began designing his new model.[7]

The Burleigh in Mining

Rossiter W. Raymond, while United States commissioner of mining statistics, wrote in 1871 that by then "besides being in operation at the Hoosac Tunnel, (the Burleigh drills) are or have been in successful working operation in New York, Chicago, Jersey City, Hell Gate, Scranton, Lake Superior, Colorado, Nova Scotia, Union Pacific railroad, Boston and Hartford railroad, &c., and in deepening the beds of the Illinois and Michigan Canals at the Des Moines Rapids."[8]

Charles Burleigh took a personal interest in the Georgetown, Colorado, project, where a tunnel to intersect "several lodes at a considerable depth" had to be enlarged to eight feet high by nine wide to accommodate his machines.

"A double track is laid with iron rails as the work advances," Raymond wrote. "Two inside shifts of men, four in each, are worked regularly; and with the drilling machines the progress in a hard crystalline rock has been, of late, as great as 60 feet per month."

By the time the tunnel had penetrated 415 feet, the average monthly rate of progress was 40 feet, which Raymond noted was "at least four times as great as could be accomplished by hand labor."

The average cost of $62 per running foot of driving the tunnel up to March, 1870, was, according to Raymond, "much less than it would have cost by hand labor alone."

At Georgetown and elsewhere, when introducing machine drills, mine owners and bosses reassured their workmen that the drills were actually increasing their safety. They stressed, for example, that for underground operations, compressed air used to power the Burleigh drills had the "accidental benefit," as Raymond put it, of providing "a constant supply of fresh, pure air, promoting the health and comfort of the miners."

But when two explosions that might have been

caused by a spark from one of the air compressors occurred six weeks apart at the Georgetown project and resulted in fatalities, miners must have had their doubts about how safe the Burleigh machines were.

In fact, it wasn't long before miners, tunnelers and quarrymen would be dying young, in droves, of a disease they called miner's consumption. This deadly disease, silicosis, was caused by the razor-sharp particles of dust kicked up by machine drills that they breathed into their lungs. There were those who took the attitude that the miners worked willingly in the mines with the drills they were beginning to call "widowmakers." It wasn't as if they didn't know that the work was dangerous.

A Challenge to the Burleigh

The Comstock Lode hadn't yet yielded up her biggest bonanza when the *Gold Hill* (Nevada) *News* published one would-be John Henry's challenge to the Burleigh drill in its April 30, 1872, edition:

"I, John Baker, do challenge the Burleigh drilling machine to strike down a hole three feet and a half in solid rock, for the sum of one hundred dollars, and the contest to take place in the hottest place in the Jacket mine. In case this challenge is not accepted, I do hereby challenge the Fremont or Burleigh machine, or any other man. As I mean business I hope to be accomodated."

John Baker's challenge seems to have been ignored, but that it was issued indicated that, whether or not in use yet, these machines were available on the Comstock by April of 1872. However, it was apparently not until 1874 that Burleighs actually were operational there.

From the *Virginia* (City, Nevada) *Evening Chronicle* of March 20, 1874: "The new Burleigh rock drill for the Gould & Curry mine will be started up some day next week..."

On July 28, 1874, the *Chronicle* reported that the "new air compressor and Burleigh rock drills, at the Consolidated Virginia mine, were started in operation yesterday. Four-inch iron pipe extends from the surface, and conducts the compressed air down into the mine, where it passes into the engines, which work the drills, through flexible gutta percha tubes one inch in diameter in the clear. The compressor above furnishes the air, which can be utilized in running a number of drills in different parts of the mine at the same time. This additional supply of air will also be of great relief to the miners, and improve ventilation. The air heretofore used was brought from the 1,200-foot level of the Gould & Curry. The new air pipe of the Consolidated Virginia will be extended to the 1,500-foot level of the mine."

Notice that Consolidated Virginia had been using

Grass Valley Union, 19 June 1874.

recycled air from the Gould and Curry. Elsewhere, some mine owners used the ventilating capacity of the drills as an excuse to avoid installing proper ventilating equipment in their mines. In neither instance did the mine owners demonstrate much concern for the miner's safety or health.[9]

But on the Comstock, as elsewhere, the Burleigh proved to be successful and there was no going back to the old ways. On August 5, 1874, the *Chronicle* reported that the "Burleigh drill which is in operation at the Gould & Curry mine, makes a hole six feet deep, and a inch and a half in diameter, through solid rock in twenty minutes."

It was in 1874 when the gold mines of Grass Valley, California, first used Burleighs, too. This is from the *Grass Valley Union*, April 15, 1874:

"We understand that Mr. Edward Coleman, Superintendent, and Mr. John Polglase, Foreman of the Idaho mine, visited Gold Run a few days ago to examine the Burleigh Rock Drill at work in that place. These gentlemen were so well satisfied that the drill named is an economical machine that four of them have been ordered for use in the Idaho mine. One of these will be used in the shaft and the other three in the levels of the mine. They will be driven by compressed air, and thus the mine will be well ventilated by the power which runs the drills. The air will be compressed by the steam engine on the surface. If the Idaho's experiment proves successful, and there can scarcely be a doubt on that point, these drills will be used in several mines of the district. There is nothing like keeping up with the improvements of the times...."

Of course, with the Burleigh's success, it was inevitable that there would be competition. Sometime in 1873, the Milton Company of French Corral [Califor-

nia] had "made arrangements with the agent of the Ingersoll Drill Co., of New York, to experiment with their machine, in the Company's bed-rock tunnel." The company was apparently satisfied enough with the drill itself to order one. A letter to the editor of the *Grass Valley Union* published August 28, 1874, said that it had installed "ample machinery to drive the air compressor up to any power required by means of a Hurdy[10] wheel. The drill is now working successfully under the management of C.S. Davis, Esq...."

Even after only a couple of weeks, the Ingersoll drill was "making...twenty-four feet of drill hole in a shift of eight hours, with two drills..." Davis was "highly pleased with its work, even though he "has had everything to contend with to make it perplexing, in the way of inexperienced help, and help too that did not want to see the machine take the place of single-hand drills. He is determined to make it a success, if it is at the discomfiture of some of the old confidential hands of the Company, by giving them their time to be carried to the Superintendent's office. It is certainly a great oversight in workingmen to 'buck against' modern improvements and machinery."

The Burleigh's Successors

Just as the Burleigh was an improvement on Fowle's and Couch's drills, Simon Ingersoll's percussive drill was an improvement on the Burleigh.[11]

The types of drills first made by Ingersoll, and by Sergeant, and by Rand, as well, were similar in construction, and they also shared a drawback: their heavy attached bits. In 1890, C.H. Shaw of Denver corrected this in his stoper drill meant for overhead work, by mounting the steel bit independent of a shuttling piston and having the piston strike hammer blows to the bit.[12]

John George Leyner made his first piston-type drill in 1893. This one wasn't much different from the Ingersoll, Sergeant, or Rand drills, either, but he worked six more years on it and then on June 13, 1899, patented a model that used a reciprocating piston to deliver a series of hammer blows. His drill was light and efficient, but it, too, had a serious drawback. Compressed air ran down the center of his drill through a tube and came out through a hole in the drill bit, blowing out the dust and debris which collected in the hole during drilling. This created so much air-borne dust that miners refused to use it.

Leyner substituted water for air, but this vast improvement came too late for him to reclaim credibility with the operators. However, when the Ingersoll and Rand companies joined in 1905 to become Ingersoll-Rand, the new company began negotiating to buy Lyner's business. By 1911, they owned it and his patents as well, and in 1912, Ingersoll-Rand's first 'jackhammer' drills were at work in New Jersey.[13]

By then, descendants of Burleigh's early machine drills were used in all but the smallest of the West's hard-rock mines. As early as 1880, the federal census showed that there were 189 machine drills operating at 30 Nevada mines, and 250 of them were being used at 65 deep mines throughout the mining West. By 1892, the Anaconda mine in Butte, Montana, by itself was using 138 machine drills.[14]

It wasn't long before hand drilling was relegated to the smallest of mines and to contests held at picnics on Miner's Union Day and the Fourth of July. Machine drills were even included in some of these games. Men skilled with drilling machines practiced at the Bull Cliffs for the 1897 Fourth of July contest in Colorado's Cripple Creek District. Miners began to take pride in demonstrating their skill at hammering with the drill "at all angles and in all conditions."

Even so, there were still a few die-hard John Henrys who claimed they could beat a machine with their bare hands. Walter Bradshaw and his partner Joe Freethy of Butte, Montana, won the 1901 world double-jack championship in Spokane by drilling fifty-five inches in hard rock (though not the Gunnison, Colorado, granite that was considered by drillers to be the hardest) in fifteen minutes.[15]

When a salesman challenged Bradshaw and his partner to a contest with his coal drilling machine, then saw the hunk of rock that he would have to work with, he hastily withdrew the challenge. Years later, Bradshaw said that he and his partner might have won that contest even against a hard-rock drill if it had only lasted for fifteen minutes, but not if it lasted longer. "That's where the machine is better than the man. It can drill twenty-four hours a day, seven days a week, if necessary, without tiring."[16]

John Henry had conceded to Charles Burleigh and his kin.

ENDNOTES

[1]Brett Williams, *John Henry, A Bio-Bibliography* (Westport, CN: Greenwood, 1983), 8.
[2]Williams, *John Henry*, 10.
[3]Barbara Stack, *Handbook of Mining and Tunnelling Machinery* (Chichester, NY: Wiley, 1982), 17-18.
[4]Massachusetts Legislative Reports, House, No. 30. "Annual Report of the Commissioners on the Troy & Greenfield R.R. and Hoosac Tunnel," (Boston: 1867), 35.
[5]Henry S. Drinker, E.M., *Tunneling, Explosive Compounds, and Rock Drills* (New York: Wiley, 1893), 328.
[6]Stack, 17.
[7]Gary S. Brierley, "Construction of the Hoosac Tunnel 1855 to 1876," a paper for the Boston Society of Civil Engineers Section, ASCE. (Vol. 63, No. 3, October 1976), 205.
[8]Rossiter W. Raymond, *Mines and Mining of the Rocky Mountains, the Inland Basin, and the Pacific Slope.* (New York: Ford, 1871), 507.
[9]Otis E. Young, Jr., *Western Mining* (Norman: University of Oklahoma Press, 1970), 207-9.
[10]Hurdy gurdy wheel; a wheel turned by water.
[11]Stack, 26
[12]Stack, 29
[13]Stack, 30-31.
[14]Mark Wyman, *Hard Rock Epic, Western Miners and the Industrial Revolution, 1860-1910* (University of California Press, 1979), 89-90.
[15]Writers' Project of Montana, *Copper Camp* (New York: Hastings, 6th printing, 1976), 223.
[16]Wyman, 89.

Colonial Steel Advertisement, Salt Lake Mining Review, *15 June 1922, p. 10.*