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Early Days of Well Completion

by Richard Mason

Abstract: Today's well completions often involve massive formation fracturing. For more than 60 years, the same task was undertaken by a single individual, his helper, and a pick-up truck loaded with locally made explosives.

Analysis: In 1912, T.L. Mendenhall came to the north Texas oilfields. The Ohio native had spent 17 years in the oil business developing expertise in one of the most dangerous and most skilled of oilpatch occupations. T.L. Mendenhall was a well shooter and his stock-in-trade was nitroglycerine.

Like Mendenhall, hundreds of workers from Ohio, Pennsylvania, and West Virginia found employment in the oilpatch in Oklahoma and Texas during the early 20th century. They were specialized individuals with the mechanical skills to employ rope, steam power, and metal tools to hammer 12-inch holes one-half mile or more into the earth's surface. That knowledge passed to native sons who eagerly learned oilfield techniques and embraced oilfield culture. Those native sons moved on to other regions and provided yeoman's work in expanding drilling activity into West Texas in the years following World War I, a move that made the Lone Star State the nation's leading petroleum producer in 1928.

The well shooter typifies the mechanically skilled artisan of the oilpatch. Well shooters were among the most skilled technicians in the early oilfields, and certainly the most independent. It was a lonely occupation. Few companies produced standard explosives or equipment in the early days. Individual well shooters manufactured both their nitroglycerine and the tin torpedoes that ferried it into the earth.

Mr. Mendenhall located his manufacturing plant on a farm five miles north of Electra. Plants typically were built in duplicate so that if an accident destroyed a facility, the business could continue.

The well shooter learned the rudimentary techniques of explosives manufacture and safety under close supervision but developed expertise under practice in the field. It took more than three years as an assistant with ever-greater responsibilities to learn the rudiments of the business. Unfortunately, no two wells were ever alike and the well shooter had to be creative about solving problems on the fly.

T.L. Mendenhall learned to shoot wells in southeastern Ohio in 1895. He taught his skill to his son, W.H. Toby Mendenhall. Each spent 50 years in the oilfield explosives business, and both retired without injury. The father witnessed its infancy; the son its evolution and decline. In a 1985 survey, there were just eight well shooters active in the United States.

Well shooting was the earliest well stimulation device available in the oilpatch, and most wells were completed in this manner. Oilfields in the Texas Panhandle, at Burkburnett, KMA, and in the Permian Basin could not have been economically developed without explosive stimula-

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tion. The well shooter used an array of ingenious mechanical devices, many of his own design, which enabled him to vaporize underground rocks or perform operations as delicate as removing lodged drill stem or stuck casing at the pipe collar. Toby Mendenhall and other well shooters performed this feat dozens of time with surgical precision.

There were two innovations that altered the nature of well shooting. The first was development of the timed detonation charge, which became available in the mid-1920s. This evolved into the sand-tamped shot where the well shooter set his explosives, placed an umbrella bridge over the charges, and filled his hole with gravel and liquid, confining the explosion to the bottom of the well. The practice brought an end to the oil gusher, which is probably the most ubiquitous image in the early day oilpatch. The second innovation was the development of the plastic explosives, which are more stable than nitroglycerine and which are used in the oilpatch today when explosives are necessary. But what brought the well shooting occupation to an end was the rise of the engineer and mastery over fluid hydraulics after World War II.

By the time sand-fracing came of age in the 1950s, the need for well shooters had largely diminished.

Modern well drilling involves mass investment, mass machinery, and mass hydraulic power to develop an oil or gas play. This is in contrast to the well shooter and his helper who rolled onto the site in a modified pick-up truck.

In many ways the well shooter relied on finesse and innovation in an industry that prided itself on brawn. The well shooter needed imagination to envision what was taking place one mile below in a hole a few inches in diameter and often filled with liquid. And, he needed the mechanical skill to navigate tin torpedoes filled with unstable explosives to an exact depth with a wireline.

The soup, as it was called, was made in batch quantities by a relatively simple formula. Of course, the world has changed since then and there is no use repeating either the ratio or recipe. But the well shooting business was vertically integrated with practitioners purchasing raw ingredients in railroad cars, mixing them together in large batches, storing the finished product and transporting it to the site where it was used in well completion.

There are the usual adventure stories from a lifetime in the well shooting business. In the early days, team animals provided the motive power to carry product and people to the wellsite. Most shooters were fond of their livestock. Mr. Mendenhall's father was hauling a wagonload of explosives up a West Virginia mountainside when the road began to collapse after recent rains. He jumped from the wagon and had just enough time to cut his Percheron horses loose as the wagon and road slid down the embankment. And exploded.

And there was one foggy day in Illinois when a truck hauling soup for a job was hit by a train as it crossed railroad tracks. The collision tore off the front of the truck, though the rear remained intact. None of the soup exploded in the incident. Well shooters had personality. While there was a little bit of thrill seeking in their psyche, most characteristics could be summed up in a description of the elder Mr. Mendenhall. He was never impetuous, seldom showed anger or impatience, and paid very close attention to detail. The job attracted people who had ambition. The pay was good and there was a fair amount of prestige associated

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with the occupation. Generally the torpedo companies looked for young men in their 30s with some education. The well shooter worked carefully with calibration. Jobs ranged from a long string of torpedoes used for a massive formation fracture to charges small enough to sever casing or pipe at the collar. There was as much art in the work of a career man as science.

Basically the shooter determined depth, measured out the explosive in gallon allotments, set a timed fuse, and lowered the string into the well via wireline. Afterwards the well was bailed with mechanical tools.

In the 1920s, it cost \$90 to shoot a well. Mendenhall Torpedo Company employed 25 shooters at its peak in the north Texas oilfields. Work ranged from 20 to 60 wells per month but, as with all work in the oilpatch, it tended to vary in volume.

Other firms included the Texas Torpedo Company, U.S. Torpedo Company, the Illinois Torpedo Company, and a roster that changed almost by the year as personnel went into business and out of business.

While notoriety had initial charms for well shooters, the occupation could wear on someone's nerves. Oilwell shooters were known to suddenly retire after eight or ten years in the business. And those former shooters who stayed in the oilpatch in other occupations often did not want to be around the rig when the well shooter showed up.

The tools and equipment of the early oilpatch were crude and dangerous, but in the hands of the skilled, the results were astonishing. Consider the wizardry of well shooting. Nitroglycerine is an unstable liquid, which explodes instantaneously into gas with the slightest provocation. As such, it was a form of canned liquid energy awaiting release. The well shooter simply controlled the time and the place for release of this enormously powerful stored energy and utilized these skills to give life to the petroleum industry.