PIPELINE CONSTRUCTION: MULES TO MACHINES

by Ellen Schweppe

When natural gas pipeline construction was in its infancy, it wasn't as exact a science as it is today. Building a transmission line from a gas field through the countryside to the gas-heated homes of the early 1900s required more muscle and common sense than engineering expertise.

"In those days, experience counted for just about everything. Most of us didn't have much more education than the eighth grade," recalled the late Ed Greenwalt, who got his first pipeline construction job about the turn of the century and worked on pipelines until the late 1940s.

"Why, we never did have an engineer in my operations. When a line needed to be laid, the main office told us where it went from and to. Then we measured the land, built the pipeline and sent back maps and inventories to the office for their files."

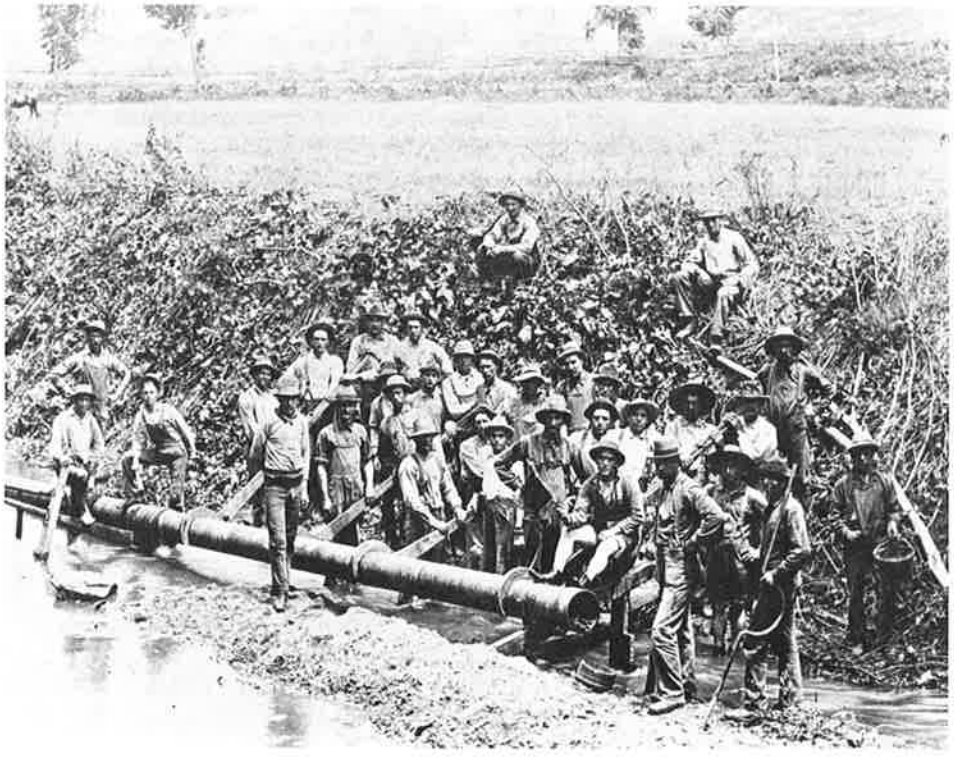
Columbia Gas and Electric Co., a predecessor of the Columbia Gas System Inc., began laying one of the first long-distance gas pipelines in the country in 1908. The line—some 180 miles from the West Virginia gas fields through northern Kentucky and across the Ohio River to Cincinnati—was built primarily with pick and shovel. That process, which had been used since the 1800s, remained much the same through the 1920s and '30s, when a few pieces of machinery started showing up on pipeline jobs.

Back in the early part of the century, before chain motels had cropped up at every interstate exit, men who worked on a rural pipeline job stayed in camps. The camp, which consisted of sleeping tents equipped with cots and a dining tent staffed with a cook and an assistant to take care of odd jobs, was packed up and moved along as the pipeline progressed so the workers would never be more than an hour's walk from supper and a night's rest. The men worked 10 hours a day, six or seven days a week, for $2 to $2.50 a day.

"Oftentimes, we didn't get home for weeks at a time," said Greenwalt.

(see Mules, pg. 26)

Ellen Schweppe *is a communications representative for Columbia Gas Transmission Corp., a unit of the Columbia Gas System Inc. She is a former reporter for the Associated Press and the Charleston, W. Va., Daily Mail and worked as public relations director for Henrico Doctors' Hospital in Richmond, Va. She received bachelor's degrees in journalism and English from West Virginia University.*



Pipeline construction crew near Springfield, Ohio, in 1900 used tongs and wooden levers to install a line.

Mules (cont. from pg. 25)

Rights of way did not present much of a problem in the early days of gas pipeline construction because a utility bought the right to lay a line across a particular piece of property without having to describe exactly where on the property that line would be laid. Instead, it relied on the shotgun survey method, which meant those laying the line chose starting and ending points and laid the line as straight as possible in between. Once the path was decided, workers cleared the right of way by hand, saving logs and tree trunks which could be used later as skids to lay the pipe on before it was lowered into the ditch.

After the right of way, which normally was just a few feet wide, was cleared, the ditchmen moved in. Each was equipped with a pick, a short-handled shovel, a long-handled shovel and a spade and was expected to complete two tricks a day. A trick equaled 10 feet, or the length of two long-handled shovels.

If a ditchman hit rock, but it wasn't solid, he attacked it with a 12-pound sledge hammer. If the rock was solid, he turned the job over to the rock crew, which pounded holes in the rock with long, pointed churn drills made of iron and weighing 50 to 75 pounds each. Two men on a churn drill could ram out a hole four inches in diameter and four to five feet deep in 30 minutes. The dynamite man then loaded each hole with explosives topped with a fuse and set off up to 200 fuses at a time to clear out the rock.

The pipe used in the early 1900s was made of thin sheets of bar iron laminated together in 20-foot sections. Pipe twenty inches in diameter was the largest available. The pipe was hauled to the construction site in wagons pulled by oxen, mules or horses.

Moving the pipe into position over the ditch was a process involving both brawn and coordination. Long wooden poles with hooks in the middle were attached to each end of each section of pipe. Workers lined up along the lifting poles on either side of the pipe section. At a signal, the men on one side jumped the ditch while the men on the other side pushed. They then carefully lowered the pipe onto the skids stretched across the ditch.

Bolting crews came along to fasten each section of pipe to the next with a coupling—a steel middle ring, two steel follower rings and two rubber gaskets all bolted together to form a flexible seal. The wrench inspector followed behind the bolting crew, checking the tension of every bolt.

The wrench inspector working on this Columbia line in 1930 made certain all 12 bolts in each coupling were tight.

Workers lowered the pipe into the ditch with an intricate system of ropes and levers and used gas to test the strength of the line. They filled in the ditch with a team and morman board, a flat wooden contraption fitted with two plow handles which dragged the excavated dirt back over the ditch.

"We were always inventing things," said Greenwalt of the early days of building Columbia pipelines. "We were always finding better ways to bend bolts, lift pipeline or do just about anything else we had to do."

Individual resourcefulness, muscle and mule-power built gas pipelines until the 1920s and early '30s, when some machinery, small by today's standards, came into use. That was about the time Columbia Gas and Electric built a 460-mile-long pipeline from Kentucky to the Washington, D.C., area and beyond. The project was started in 1930, several months ahead of schedule at the request of public officials to provide jobs in Appalachia, and used much of the so-called modern equipment available at the time.

"The equipment we had was thought adequate,"recalled V. E. Frazier, who worked on Columbia's Seaboard line. "But by today's standards, it was primitive. We had the only type of sideboom that was available."

(see Primitive, pg. 27)

One of the first major transmission arteries of the present Columbia Gas System was this 20-inch piopeline laid in 1916 between Calendenin and Cedarville, W. Va.

Primitive (cont. from pg. 26)

Bulldozers were unknown then, so the right of way still had to be cleared by hand. In level country, the trench was cut by a gasoline-powered ditching machine, which operated on a track geared to the speed of a bucket belt working on pulleys. After biting into the earth, each bucket poured its load on a conveyor, which dumped the dirt alongside the ditch. When the ditching machine hit rock, a wagon drill, a pneumatically powered version of the old churn drill, was brought in.

Pipe was made of steel instead of iron and was formed with one arc-welded seam down the side instead of laminated in layers. It was made in 40-foot sections and hauled to the construction site by truck rather than by wagon if the terrain permitted. The pipe sections were fastened together with a combination of welded joints and couplings. Small boom tractors replaced lifting poles for lowering the pipe into the ditch. Testing was done with air instead of gas because it was considered safer.

A crew working on Columbia's Seboard line in 1930 used lifting poles to move pipe into position over the ditch. Each 20-foot section of 20-inch pipe weighed 1,450 pounds.

The backfiller replaced the morman board for covering the ditch. The backfiller of the 1930s maneuvered on a track and had a boom that extended across the ditch. Cables on the boom operated a bucket in a yo-yo manner, giving the machine its nickname, dragging the dirt back over the ditch. Backfilling was a two-man operation then; one ran the machine while another walked beside it to regulate the angle of the booms as it moved across the ditch.

Although time-saving and back-saving machinery was available from the 1920s on, it could not always be used on a gas pipeline job because of the terrain. "When we were working in Kentucky in the 1940s, we still had to use churn drills because we couldn't get air compressors to run wagon drills up into the hills," said C. P. Brisley, who worked on various Columbia pipeline jobs from 1924 until 1976.

The Great Depression put a damper on gas pipeline construction, and the next big boom did not come until the period following World War II through the 1960s. That period was characterized by size—bigger machinery, bigger pipe, bigger projects, including an 841-mile long pipeline built in the 1950s to carry gas for the Columbia Gas System from southern Louisiana to Kentucky.

The right of way got wider to accommodate the larger pieces of machinery that had to move in and out of construction sites. It also had to be specifically described and the location of a pipeline on it staked before construction could begin, a change from the days when workers just laid the pipe the best way they could across a parcel of land. Government agencies also became more specific about the methods of erosion control used on rights of way and how they were restored after construction was completed.

Bulldozers came into use for clearing rights of way and ditching machines and sideboom tractors became larger and more powerful. Even the method of putting the pipeline together changed. It was welded solid, with no coupled joints to leak or break, and by the 1950s welds were checked with X-rays.

Cathodic protection, a technique devised during World War II to keep the bottoms of ships from falling out was used after the war to keep pipelines from deteriorating. At first, machines were used at the construction site to wrap layers of coal tar, fiberglass and felt around a pipe to prevent stray electrical currents from moving between the soil and the pipe and causing it to corrode. By the 1950s, mill-coated pipe was available, although the coating was still coal tar. By the 1960s, improved coatings had been invented.

Also in the '60s, a new method for checking the strength of a pipeline became widespread—hydrostatic testing, or filling a pipeline with water under pressure and then shutting it in while the pressure was monitored. Hydrostatic testing offered the advantage of saving time, because a pipeline could be filled with water and put under pressure in 30 minutes flat, compared to the days that it took to fill a line with compressed air.

Not only have the methods for building gas pipelines changed over the years so that one worker in a bulldozer can now do the work of 100 men with picks and shovels in clearing a right of way. The number of permits a utility must acquire before its workers can

(see New Rules, pg. 28)

A coating and wrapping machine used in the 1940's put a layer of Cathodic protection between the pipeline and the soil.

New Rules (cont. from pg. 23)

move on to that right of way has increased considerably.

"In the early days, you needed only one permit from the Federal Power Commission. If you had to cross a railroad or a state road, you had to get permission from the owner of the railroad or the state," said Brisley. But when Columbia built an 82-mile line in the 1970s to move gas from a liquefied natural gas terminal at Cover Point, Md., Brisley said, "We had to get 142 permits."

Even though technology has brought about changes in the way natural gas pipelines are constructed, the purpose today is the same as it was when the first lines were built in the 1800s. The work that once was done with picks and shovels and is now done with bulldozers and tractors helps provide a dependable system for moving an energy source from where it is produced to where it is needed.

Sideboom tractors have replaced lifting poles for moving the pipeline into the ditch.

FERC (cont. from pg. 23)

natural gas which it transports, the ability of municipalities to obtain natural gas service under Section 7(a) of the Natural Gas Act may be limited or non-existent. Because persons who receive certificates from the Commission may exercise eminent domain authority under the Natural Gas Act along the pipeline right-of-way, the potential inability of communities which are near the pipeline to obtain natural gas service from that pipeline appears to be a highly questionable result as a matter of policy. The result is one that may need to be remedied through the exercise of the Commission's conditioning authority.

Lately, the Commission has taken some steps to add flexibility. Not everything a government agency does requires an application filing and the command control framework and delay that that system may entail. Moreover, once you deal with projects through applications, you're limited to adding or subtracting procedural steps to the process. As an alternative to this method of regulating, you can institute programs which set up the parameters or conditions within which companies can proceed with certain projects without prior goverment approval. Also, within the application process applicants have the flexibility not to file certain information required by our regulations where the information just isn't applicable to their proposal.

Pipelines have a continuing need to construct facilities in order to connect new sources of natural gas supply into their mainline systems and they often need to do this expeditiously. Now the Commission determined, where $20,000,000 or less of these facilities are to be constructed during a given year, that the effect on rates would be minimal; and, where each single onshore project would cost $2,500,000 or less, the effect on the environment would likely be limited. So the Commission decided to issue blanket certificates to companies to construct these facilities within the $20,000,000 and $2,500,000 limits. This allows an interstate pipeline company to construct these facilities without prior government approval.

With this program, more planning and operational flexibility has been given to the company. You've specified those projects where the public interest impact is not significant. You've left to the application process those larger projects which require an application; and you've freed up your staff and the company's staff to work on these more important applications. You've reduced public and private regulatory expense. You've increased the gas supply of interstate pipelines. We simply have to inject more flexibility into the decision-making process, consider innovative alternatives to the present system, and provide incentives for good operations and management judgment. Blanket certificates and conditional exemptions are ways to do this without sacrificing the benefits of the regulatory process. In short, we are rethinking the decision-making process in government. It's going to be required of us all.

Director Bud Storm and President Dave Erickson show the 25th Anniversary cake that was enjoyed by everyone who attended Tri-State Chapter 20's festive celebration.