Patent Watch: The Deep Roots of Fracking

BY KIRK TESKA

Fracking is a timely topic. The idea is to fracture the rock adjacent to a well to increase the extraction of oil and natural gas. Advocates see it as a means for the U.S. to produce more of its own energy. Critics fear it threatens local water supplies.

It's timely, but not new. Fracking has been with us at least since the 1860s. Patent No. 59,936 dated Nov. 20, 1866, names Edward Roberts as an inventor. The patent states: "In my improved method of increasing the capacity of oil-wells, I fracture the rock containing the oil to some distance around the wells, thus creating artificial seams, and enabling me to connect the well thereby with seams containing the oil that would not have been otherwise reached...." The key to the method was to "sink a flask containing gunpowder, or other powerful explosive material or gas, down the well." A column of water above the charge directed the explosion downward. Explosive fracking later used nitroglycerin.

Roberts obtained a royalty not only on the procedure but also on the increased flow of oil—a move that made him wealthy. Infringers worked at night to escape detection and came to be called "moonlighters." The validity of Roberts's patent was litigated at least twice and was upheld.

Today, hydraulic fracturing is the common practice. By some accounts, the Stanolind Oil and Gas Co. introduced hydrofracking early in the 20th century.

I'm not sure that's true. Patent No. 199,488, dated Jan. 22, 1878, is the first I could find for using pressurized water to fracture the rock. Packing (a bag filled with seed) is disposed partway down a well. Water above the packing is pumped out and a ram is placed in the well: "The ram is allowed to fall, striking the seed bag first, thus preventing the water from escaping upward on account of the great pressure of the ram and causing the water, under the heavy pressure applied to it, to be forced out through the openings in the well-tubing and thus opening the crevices in the well."

Stanolind's earliest fracking patent—No. 2,667,224, dated June 29, 1949—is for a fluid used in hydraulic fracturing. The '224 patent itself admits that various hydraulic fracturing techniques and fluids precede Stanolind's invention.

Modern fracking techniques include a "proppant," which must be strong enough to keep the fissures open and also allow the gas or oil to flow. Sand was the proppant of choice through the 1950s. Union Oil Co.'s patent of that era, No. 7,274,431, describes solids that are carried by the penetrating fluid and left behind to keep the fissures open. "Ottawa silica sand of about 20-30 mesh particle size is most widely used," the patent reads.

Patents for proppant materials include Nos. 3,399,727 (ceramics), 4,068,718 (sintered bauxite), and 3,245,866 (vitreous spheres of slag).

But how do you know the process worked? In general, once a crack forms, the pressure of the "frack pump" drops. But there are more sophisticated techniques for mapping the fractures to predict yield: ultrasonic systems, seeding the proppant with radioactive tracers and using gamma ray technology, and using seismic hydrophone arrays. Columbia University has a patent, No. 4,832,121, which provides a good overview of the different mapping and monitoring techniques.

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