The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Something new, something old

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There was a comment the other day asking about the technology of oilwell drilling. So I thought that it might be helpful to post the occasional piece that gives some background to different parts of the process. Nothing really intense, but perhaps useful to some, and a fair amount will be left out (pictures for example can be seen at the web sites cited).

Tomorrow is the start of the next Solar Car Race , the American Solar Challenge from Austin to Calgary, a distance of 2500 miles. The photo at the official site shows last time's winners, but not that the cars now go over 70 mph and there were at least two of them that had two people on board during the last race. (Race progress may show up on the occasional post.)

So with that evidence of modern technology on one hand, let's go back and talk about drilling holes for the other extreme. To start one can go back to the mining industry (can we call it one of the older professions) where holes were drilled, until about a hundred years ago, by taking a chisel in one hand and holding a hammer in the other with which one whacked the upper end of the chisel as it was held against the rock. This is called **hand steeling** and if you want to try it or see it, there are old Mining Days and student competitions at various places. A skilled miner can drill a 1-inch hole at the rate of about 8 inches in five minutes, using a 4-lb hammer.

Now what he does is to hit the chisel, turn it about a quarter turn between blows, and then hit it again. The turning is the critical bit. Because when you hit the chisel it crushes the rock directly underneath it, but the wedge head pushes sideways against the rock on either side. So if the driller turns the chisel between blows he will not only crush the rock, but will also chip out the thin layer between the second blow and where the first hit. This removes a lot more rock for the same amount of energy. In fact it is the skill of the driller that will make bigger chips, for less muscle power, by turning the bit, rather than using brute force to crush the rock just under the chisel into powder.

When it came time to drill the first oil wells this was the technique that they used. Except that they made the chisel much larger and heavier, so that, by lifting it and dropping it, it's own weight would act as the hammer. Normally a larger **spudding bit** was used first to make a larger diameter hole from 4 â€“ 22 inches in diameter, and down for 50 ft or more. Once this starting hole had been drilled (using a cable over the derrick to a crank to raise and drop the bit) a steel pipe was lowered into the hole and cemented in place. This pipe provided a base for the deeper hole, and provided a case around it. Thus it became known as **casing**, and it protected the hole as it went through the top soil and weakest of the upper layers of the ground.

Once the hole had been spudded-in, and this initial **conductor pipe** installed, then the normal sections of steel tubes could be strung together to form a pipe (hence the name **drill string**), and the drilling bit (in those days around 4 â€“ 5 inches) would be raised and dropped by a walking

beam engine. As the hole was drilled they would stop, perhaps every couple of feet, to pull the bit out, and sharpen it, and to bail the crushed rock or cuttings, out of the hole.

Progress was, as you can imagine, slow, and this tool is very difficult to steer, particularly as the drill goes down several hundred feet. And so the industry was ripe for a better way of drilling.

This was invented by the older Howard Hughes who realized that if very small chisel shapes could be set around a roller they would do the same thing as the dropping bit, but could be moved around by rolling, and pushed into the rock by the weight of the connecting rods to the surface. To spread the load over the face of the hole, and to balance the bit, he used 2 rollers which tapered towards the center of the bit.

> Hughes, along with his partner Walter B. Sharp, formed the Sharp-Hughes Tool Co. and produced a model of his new bit. Rather than sell his bits to oil drillers, Hughes and Sharp opted to lease the bits on a job basis, charging U.S. $30,000 per well. With no competitors to duplicate their drilling technology, they soon garnered the lion's share of the market. Flush with their success, the partners built a factory on 70 acres east of downtown Houston, where they turned out the roller-cone bits that quickly revolutionized the drilling process.2

This later evolved into a 3-cone assembly and what is now known as a **tri-cone bit**. There is a picture of one here under the oilwell drill bit section.

This bit has a number of problems under different conditions (it is harder to control in directional drilling since if the pushing force varies too much it can wander off in odd directions) and there has to be a way of getting the rock out of the hole. These have led to other drilling ideas, and we will deal with those another day.

But as you watch the movie "The Aviator" remember that all those shenanigans were paid for with the money that came from that drilling bit, and that Hughes (the company) is still reported to have 40% of the world market share of oilwell drill bits.

Technorati Tags: peak oil, oil
