TECHNOLOGY

Return of the steam locomotive?

The dirty, smelly steam locomotives of yesteryear weren't all bad. They were reliable, produced vast quantities of power almost instantaneously, required little overhauling, lasted a long time and ran on almost anything that burned — coal, oil, wood, gas, peat, even sugar beets. A team of mechanical engineers at Queen Mary College, University of London, are trying to redesign the steam locomotive to capitalize on these features while eliminating the pollution and increasing the formerly poor thermal efficiency.

Preliminary results from their computer models of advanced steam cycles point to fluidized-bed combustion (SN: 8/27/77, p. 134) as the boiler of choice. M. W. Thring, J. E. Sharpe and P. K. Le Sueur describe the design of their proposed system in SPECTRUM (no. 153), published by the British News Service.

The 3,350 horsepower express freight and "semi-fast" passenger locomotive they envision could burn coal of any size to 25 millimeters in diameter, and "with only simple adjustments, could be made to burn any other fuel." Combustion efficiency would be "better than 98 percent," they say, and the bed could be started from cold within 30 minutes by initially pumping propane gas through the bed and igniting it with a spark.

The cycle's overall thermal efficiency was calculated at 24.5 percent — roughly equivalent to the peak efficiency of a diesel locomotive, but more efficient than the diesel over most of the range of operating speeds, they say. (In comparison, traditional coal-stoked locomotives had efficiencies of only about eight percent, they say.)

It would cost less than a diesel or electric engine and use "off-the-shelf" components. And, unlike soot-billowing antecedents, it would produce "virtually no pollution," they say.

Faster water

Water can be such a drag. The friction between it and pipes in closed heating and cooling systems slows its passage and increases the energy needed to keep it circulating. Now Wilbert F. Stoecker, professor of mechanical and industrial engineering at the University of Illinois in Champaign-Urbana has added a polymer in the polyacrylamide family to cut drag. It works well, but degrades with use after about 6 to 10 hours, he says. The solution may be to use it occasionally, such as during periods of peak water demand.

Burn sonar

Knowing how deep a burn is can determine how and when treatment begins; but until now most physicians had only their eyes, experience and scalpel to diagnose damage. The ultrasound burn sensor should change that.

The device sends a pulsed current across a transducer, producing ultrasonic waves (too high pitched to hear). Applied to the skin, it acts like a submarine sonar, listening for reflected signals to return. Any discontinuity, such as the boundary between irreparably burned tissue and tissue that can be saved, will send back an echo, says Ronald Goans of Oak Ridge National Laboratory. The device measures the time it takes the echo to return and converts it into a distance indicating burn depth. It's accurate to 0.1 or 0.2 millimeters, Goans says in the spring OAK RIDGE NATIONAL LABORATORY REVIEW.

Working with Goans on the sensor's development were H. D. Stambaugh of Norton Children's Hospital Burn Unit in Louisville, Ky., John Cantrell of NASA's Langley Research Center in Virginia, and Brad Meyers at Vanderbilt University. Goans and Stambaugh will refine the sensor during clinical tests at the Norton Children's Hospital this year.

EARTH SCIENCES

Recyclable earthquakes

Several years ago, a Massachusetts Institute of Technology researcher realized that aggregate, an ingredient such as gravel which is mixed with cement to make concrete, is in short supply in some parts of the country, including the area around Los Angeles. Civil engineering professor Stamatia A. Frondistou-Yannas and colleagues also noted that what such areas have in large supply are earthquakes and debris from quake-wrecked buildings and highways. Why not use that rubble to rebuild? Recycling earthquake-produced concrete debris as aggregate is economically feasible, the researchers found. They estimate a 19 percent return on investment, provided there is at least one million tons of debris, and a higher return with more debris. A million tons shouldn't be too hard to come by, they say. The researchers estimate that quakes yield about 100 million tons of debris yearly.

Besides solving the problem of waste disposal and saving the cost of hauling new aggregate, the recycled concrete is at least 71 percent as strong as natural aggregate concrete, and can be made as strong by adding more cement. Also, recycled aggregate should sell for $1.67 a ton, compared with $3.30 a ton for natural aggregate. One problem in using concrete debris is ridding it of strength-sapping contaminants such as gypsum and glass. Frondistou-Yannas noted that about 15 concrete recycling plants exist, but that they use only uncontaminated debris from highway demolition. The MIT study includes designs for centers with sorting systems to remove contaminants. Besides quake-produced debris, Frondistou-Yannas said the steady supply of demolition debris from construction could be used. Just using rubble from highway and building demolition, an urban area greater than one million people could benefit significantly, she said.

Watching the glacier flow

Glacier watching is not an occupation for the fast paced. But it is one of the duties of the U.S. Geological Survey in Tacoma, Wash. They are watching the Columbia Glacier, which juts into the Columbia Bay off the Gulf of Alaska near Valdez, Alaska. It is, according to Mark F. Meier, head of the glaciology project, the only glacier in North America that hasn't thrown in the towel and retreated from the southern position it staked thousands of years ago. And this is just what worries Meier and his colleagues: When will their stubborn ward give in and begin breaking up? And what will the rate of iceberg production be? It's not an esoteric problem. Valdez is at the southern end of the trans-Alaska pipeline. Since last summer, the waters adjacent to Columbia Bay have become major shipping lanes for huge oil tankers. But those waters are also populated with the glacier's seasonal offspring — icebergs, flung off at an annual rate of about 730 million tons. Last August, such "calving" episodes were severe enough to halt nighttime tanker traffic part of the month, Meier said. If the rate of ice flow toward the tip of the glacier falls below the rate of iceberg production, the glacier will begin retreating. As it retreats, more and bigger bergs will break off at a rate of anywhere from two to 50 times current production, Meier said.

In a recent progress report based on their observations since 1974, the USGS researchers state there is no evidence yet that the 425-square mile glacier is unstable, but Meier said it thinned as much as 32 feet at its tip from 1976 to 1977. "This may mean a drastic retreat is imminent," he said. In anticipation of worsening berg barrages, the Coast Guard has issued a feasibility study on containing icebergs with ropes. The USGS hopes computer modeling studies based on this season's fieldwork will give more definite answers by early 1979 about the possible break-up. "We hope nothing will happen by then," he said.