Coal-diesel Fuels

Since the embargoes of the early seventies oil's reputation as a "wonder fuel" has gone steadily downhill. Increasing costs and unreliable supply has sent countries scurrying to find feasible alternative energy sources. Windmills, solar power, tidal power, nuclear energy, and fusion, among others, have been looked at as possible petroleum replacements.

Work has also been done to try and find ways of squeezing energy out of abundant but so far undeveloped domestic resources. For instance, engineer Ray Billingham, at the Mechanical Engineering Division of the National Research Council in Ottawa, recently carried out tests on the implications of using a coal/diesel fuel mixture in a diesel locomotive engine. (Specifically a compression ignition engine, so called because ignition of the fuel occurs through compression rather than by a spark plug.) The purpose was twofold: decrease the amount of diesel fuel required to run the engine, and find a productive use for the mountains of coal "fines" (tiny, unusable particles of coal) discarded around mining sites.

Initially Billingham's work was designed in two phases. The first would determine if the system was able to deliver fuel to the engine, the second would examine the degree to which the fuel could be burned in the engine.

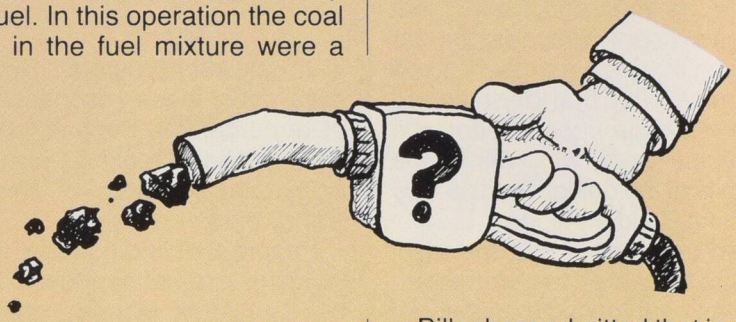
Unfortunately the results in phase one were not sufficiently encouraging to merit proceeding with phase two. It was found that the 25 per cent coal/diesel fuel mixture was too damaging to the injection components. According to Billingham, erosion of the injector orifices and wear of critical sliding components were the major problems.

Diesel injection equipment has very fine tolerances. Furthermore its sliding surfaces are lubricated by leaded fuel. In this operation the coal particles in the fuel mixture were a definite disadvantage because they acted as an abrasive, causing wear on the injection components.

For instance, in the pump, after 113 h of operation the leading edge of the plunger had worn down to the point where it was seriously affecting the rate at which the fuel was being injected. At the 200 h mark the damage was so severe that the pump ceased working completely.

In the same amount of time the valve seat on the injector stem, which controls the flow of fuel, was also showing signs of wear and this, combined with the orifice erosion, was causing an unwanted increase in the fuel injection rate.

Erosion of fuel injection components is especially critical in compression ignition engines which require an accurate and steady control of injected fuel. The coal mixture caused changes in the injection parts that rendered this fuel control impossible.



Billngham admitted that in order for a coal/diesel mixture to work in locomotive and other diesel engines extensive research would have to be done to develop injection components capable of withstanding such conditions.

Although the experiment did not result in complete success its value lies in the information it uncovered — information which will become part of an ever expanding pool of knowledge that will aid researchers in the future.

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Robot Vision

NRC engineers are working on a cure for an affliction suffered by industrial robots — poor vision. A new, three-dimensional vision system has been developed and demonstrated to Canadian industry. Combining a laser beam and a rotating mirror, the system uses triangulation (two or more bearings to determine the location of a distant point) to form the image. An accompanying computer can then "turn" the image to provide various angles of view. Smaller and more flexible than other systems available and with only a single scan needed to form an image, it is faster than its competitors.

Industrial robots have always been plagued by inadequate vision because they must rely on two-dimensional imaging methods. When you watch television (the basis for many machine vision systems) the images appear "real" to you because your brain has accumulated memories of how things should look. Properly illuminated, a cylinder looks round because we are familiar with its shape and can distinguish it from a rectangular carton. Machine vision systems cannot perform this feat — to them a box of tissues and a roll of paper towels look alike from the side; both are rectangles. Consequently, industrial robots that assemble parts (of a small motor, for example) must have the supplied parts oriented so that the vision system can recognize them. Alternatively, the machine must be programmed to recognize a limited number of possible orientations of the part — an involved and costly process. A three-dimensional vision system enables the robot to select the correct part from several alternatives, orient it correctly, and assemble it with other parts. Because of its speed of operation the new system also permits rapid, accurate inspection of parts, both before and after assembly.

Machine vision is a growing industry. Sales in the North American market reached nearly $20 million last year and that figure is expected to increase more than ten times by the end of the 1980's. Several systems are under development in various industrial nations. Canadian manufacturers can both produce and utilize these vision systems, improving productivity and entering the export market, an arena long dominated by Japan and the United States.

Cartoons by John Bianchi