'Cold soaking' in autos explained

When it is very cold, have you ever wondered why a car left sitting outside for a week seems disproportionately harder to start than one left outside only overnight? Does the cold really "soak in" over long periods of time? Intuition and experience lead us to believe that something like that actually occurs, but it is a physical absurdity that a piece of iron could actually soak up and store "cold" over long periods of time. This has not prevented the term "cold soaking" from creeping into the vocabulary of those who live and work in an arctic environment.

Ed Gauss wrote an article about the phenomenon in a 1974 issue of the *The Northern Engineer*, a Geophysical Institute publication. As a search pilot for the Civil Air Patrol, Gauss had a special interest in starting engines when they had been "cold soaked." In addition to reviewing the literature on the subject. Gauss instrumented the engine of an eight-cylinder International Scout on which to perform his own experiments.

Basically, he found that there are two mechanisms responsible for the stubborness displayed by engines that have been cold soaked, and that the length of the cold exposure dictates which one causes the trouble.

The first, as might be surmised, is simply that the viscosity of the engine oil increases, reaching a maximum after about a day in -40 degree temperatures. This process is reversible, and the engine need be only partially warmed (that is, "plugged in") before it can be started.

The second, and more serious, problem is that waxes and tars in paraffin-based and asphalt-based engine oils precipitate out after a week or so of very cold temperatures. When they do, the viscosity of the engine oil rises almost exponentially. (Arctic oils have been further refined to remove more of these precipitating substances. This explains why they are so special—and expensive.)

When prolonged cold soaking takes place, it is not a matter of merely plugging in the ciculating heater that is needed to reduce the viscosity and start the engine. Once the Paticulates have formed, the engine block must be warmed to well above the temperature at which they began to preciptate out (about -10° F). Even worse, if the engine is forcibly turned over after it has been sitting for a week in -4° temperatures (by towing, jump-starting, or whatever means), the mechanical motion will even *increase* the rate at which the precipitates form.

Therefore, if you are going to leave an engine exposed to extreme cold for long periods of time, you have several options by which you can get it started again. You can tow the car into a heated garage to dissolve the paraffin in the oil pan. You can provide a heater for the oil pan. You can drain thesoakin oil and replace it when you're ready to go. Or you can buy one of th special brands of arctic oil with the paraffin and tar removed.