Wheels: Arlene of Vandalia has a question about gasoline. She states that she normally uses "plus" (midgrade) in her 1991 Ford Crown Victoria. When she uses regular grade, the engine "pings." She wants to know what is causing the ping and could it be due to the additive being put into gasoline to clean the air?

Halderman: The "ping" that Arlene is talking about is also called *spark knock* or *detonation* and is caused by a secondary flame front being created inside the cylinder. This second flame front is formed when the air-fuel vapors ignite before the flame front from the ignition occurs. When these two flame fronts meet, the temperature and pressure inside the combustion chamber raises and causes the piston to ring like a bell causing the "loose marbles in a coffee can" sound. Using higher octane gasoline will often prevent this from occurring, but at a cost of several dollars additional cost per tank full of gasoline. Your 1991 Ford, like most vehicles, is designed to operate correctly on regular 87 octane fuel. Because your Ford is about 10 years old, I think that the problem is not necessarily due to the additives in the gasoline, but rather a possible problem with the exhaust gas recirculation (EGR) system of your engine or the accumulation of carbon inside the cylinder. The EGR system is designed to flow from 6% to 10% of the exhaust back into the cylinder to help prevent high temperatures from being created in the cylinder to reduce oxides of nitrogen (NO_X) exhaust emissions. If the passages in the EGR system are partially clogged, it can reduce the amount of exhaust gases being recirculated and can cause spark knock as you described. This is a common problem and can be corrected by having a service technician remove the EGR valve and clean all of the passages. It is often necessary to remove the intake manifold, especially on your V-8 engine, to thoroughly clean these passages.

Wheels: Are there any other possible reasons for the spark knock or ping she is hearing during acceleration?

Halderman: Besides restricted EGR flow, other factors that can cause spark knock include:

- A cooling system fault such as a partially clogged radiator which allows the engine to operate at a higher than normal operating temperature.
- Incorrect spark plugs or ignition timing.
- Lean air-fuel mixture often caused by cracked or leaking vacuum hoses on the engine.

Even though you will have to pay a service technician to perform these checks and services, it often pays for itself from the savings at the gas pumps. When the engine is operating correctly, Arlene should be able to use regular 87 octane gasoline avoiding the extra cost of higher octane fuel. This savings lasts as long as she drives the car.

Wheels: What about Arlene's question about the gasoline. What, if anything, has been added to gasoline for clean air and could this contribute to her problem?

Halderman: While there have been many technical changes to gasoline in the last several years, most gasoline sold today does meet the octane rating posted on the pump. The use of ethanol enhanced fuels may actually help prevent rather than cause the ping concerns because ethanol has a higher octane rating than pure gasoline.