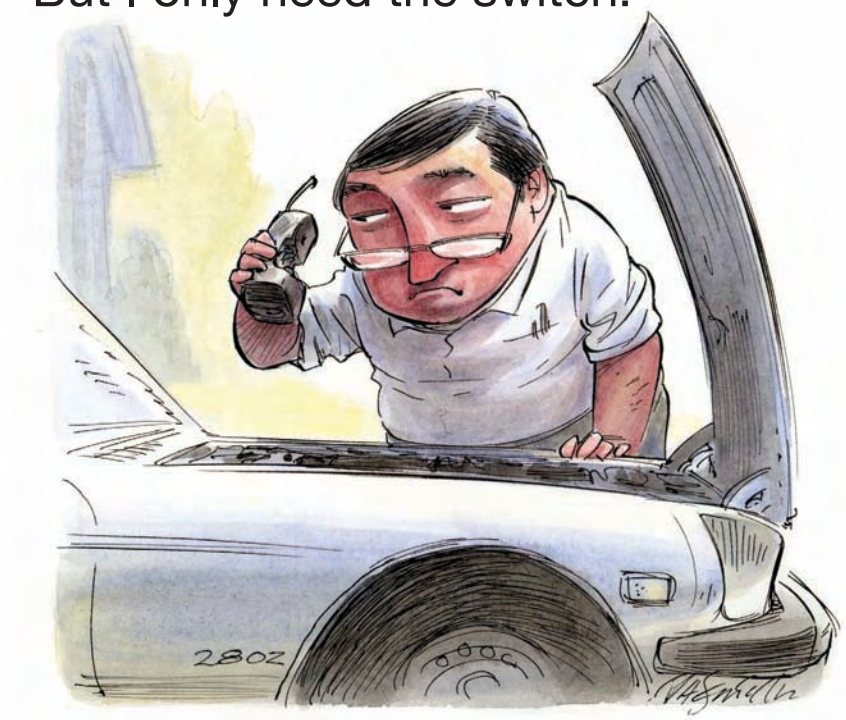
WALTER SJURSEN • BOSE CORP

But I only need the switch!



Not all engineering challenges occur at work; often, an engineer needs to bring his troubleshooting skills home with him. I learned that lesson firsthand when, during the late 1970s or the early 1980s, my wife's automobile started acting up.

The car was a Datsun (now Nissan) 280Z. It had been very reliable and well maintained, but it had started to act up intermittently—and as any engineer will tell you, intermittent problems are the hardest to diagnose.

The first time the problem occurred, the car stalled as if it had run out of gas. My wife turned the ignition switch off and then back on to restart the car; it restarted fine, and she was able to get home. I took a look at the car but couldn't find anything wrong. I thought the fuel filter might be dirty, so I changed it to eliminate that as a possible cause.

After that, my wife drove the car for many weeks without a recurrence of the problem; but then out of the blue, just as it had done the first time, the engine stopped as if it had run out of gas and then restarted just fine. Again, I checked the car but found nothing suspicious.

My wife drove the car without incident for a few more weeks before the car stalled again. It became clear that an apparently random event had a real root cause; I just hadn't found it yet.

My wife and I traded cars, and I drove hers for a few weeks before I stalled just as she had. I got out the auto manual. After studying the wiring diagram, I connected a voltmeter to some points under the dash and sat the voltmeter on the console so I could keep an eye on it.

I drove that car for months, monitoring and recording the voltages. Periodically, I would switch the voltmeter to a different point to collect more data. I drove with no problems through the winter and spring; then one hot summer day, the engine suddenly stalled, and I noticed that the voltage was only 6V on one of the relay coils. Finally, I was getting somewhere. Consulting the wiring diagram and all the data I had collected, I determined that the voltage loss was through switch contacts in an airflow meter.

The airflow meter was simply a spring-loaded flap connected to the switch contacts and mounted in the air-intake path. With the engine running and air flowing into the intake manifold, the flap is open and the switch contacts are closed; if the driver gets into an accident and the engine stalls, the airflow will stop, the spring will close the flap, and the switch contacts will open. The switch provides the voltage to a relay, which in turn controls the fuel pump. When the airflow stops, the switch will open, the relay will open, and the fuel pump will stop, causing the engine to "run out of gas." This safety feature ensures that fuel will not be sprayed onto a hot engine in the case of an accident.

The switch in our car dropped enough voltage to barely pull in the relay, and in the heat of summer the relay had an even harder time pulling in. Since all the wiring looked OK, I concluded that the switch contacts had to be dirty or corroded. I temporarily wired in an external toggle switch to bypass the airflow-meter switch; this applied the full 12V to the fuel-pump relay coil and kept the car running, and confirmed that the airflow-meter switch was the problem.

When I called the Datsun dealership to buy a replacement switch, the dealer told me I would have to replace the entire airflow-meter assembly, as it was a sealed unit and not repairable. The cost was about $500 just for the assembly. But I only needed the switch!

Never tell an engineer that something cannot be repaired. I got my utility knife, slit the cover seal, and removed the cover. There was the switch, with its dirty, pitted contacts. I cleaned the contacts, put the cover back on, and sealed the assembly with RTV. I then measured the full 12V on the relay coil. Intermittent problem solved. EDN

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