



Repair Shop

CONFIDENTIAL

It's been a couple of years since I bailed out on wrenching and got into the detective business. You might say I traded my safety shoes for gumshoes.

It was easy money right from the start. I specialized in locating misses. Most of 'em were a piece of cake. Just round up the usual suspects and ask a few questions.

Not tough at all. In fact it got pretty boring after a while. So I added a line to my Yellow Pages ad. "Intermittents Welcome," it read. Life became a little more challenging after that.

Staking out a modern fuel delivery system isn't for everyone. Hours of sitting, just waiting for the culprit to show up. Can't break for the can 'cuz you might miss something. Can't run out for pizza and a brew. Can't tell when you're going to be done. Never know when a ten-minute job is going to stretch into hours or days.

I'm a guy who can take it. I've got a reputation as a can-do guy. I don't work cheap, but I always deliver. Let me give you an example — here's one from my files.

"The Case of the Errant Idle"

It had been one of those days. Stale donuts and yesterday's coffee were burning a hole in my gut.

The draft under the door was blowing across my already cold feet. My brain was wrestling with the question: "What sort of lunatic drew this schematic?" That's when she walked in.

I didn't notice her at first. It was her little-girl voice that got my attention. I looked up and stopped dead. This was the sort of customer that dreams are made of. Not too tall, but too much woman for a Metro. And dressed! She didn't get that suit in any of the stores I shop in. This gal was class. I figured her for a Jaguar, probably an XJS.

"Excuse me. I have a problem with my car and somebody told me you might be able to help."

"Yeah. Sure. What's the problem?"

I like to act a little aloof. Rule Number 7 in my life is: Don't take boring cases. So I always feel 'em out a bit before I commit. Act like I'm doing them a favor taking their money.

"My engine is running too fast. The car goes 40 miles an hour without my even touching the gas."

I'm thinking "dirty throttle linkage." Not exactly the most interesting of problems, but what the heck, it had to be more interesting than what I had been doing. And, besides, she didn't smell bad. Wham, bam, half a hundred. I ain't easy, and I certainly ain't cheap.

“Yeah, I’ll take a look at it. Pull up to the door and I’ll open it.”

She stepped out and a few seconds later the clatter started. The noise sounded like a cropduster taxiing for take-off. I jabbed at the opener and watched the door rise. I knew the next car I saw would buy a week’s groceries.

It wasn’t exactly the Jag I was expecting. It was a Hyundai. Maybe early-to-mid nineties. One of the medium-size ones. I know about these cars. DOHC motors, Mitsubishi-style fuel control, good TV commercials. Hanging from the rear view mirror was a parking tag from the local high school. *Faculty*, it read. Must be a teacher. I said she had class.

“Idle sounds a little high,” I told her. “Pop the hood so I can eyeball it.”

She popped. I looked. There were fingerprints all over the scene of the crime. It looked like every screw under the hood had been twisted, some of them twice.

“Someone’s been tinkering,” I casually remarked.

“One of the shop teachers tried to help me out.”

“Was it like this before he worked on it?” I asked, trying not to sound snide.

“He gave it a tune-up four months ago, and it was fine until last week. He worked on it again yesterday. As you can hear, he didn’t get it fixed.”

“Let me see what I can find.”

Normally, I work alone. A detective like me doesn’t usually care much for an audience. This time I made an exception. I was ready to do a little showing off.

I leaned in and cracked the throttle. The engine raced even higher. I let the throttle snap shut and watched the throttle cable. Damn! It was slack.

“Let’s see if this helps.”

With a quick flick of the hand, I reconnected the wire to the idle switch. Help? Heck no, it made it worse. Instead of screaming along at a constant two grand, the engine started surging, two thousand to maybe fourteen hundred, and back again.

Over the roar I heard her little voice, “He disconnected something because it was doing that.”

Like, I couldn’t have figured that out by myself. I stuck my pocket screwdriver in the air bypass screw and tried to close it. It was already screwed down tight.

It was scanner time. A lot of those hot-shot movie detectives carry .38’s in their shoulder holsters. Not me. I carry a Snap-on MT2500. Nothing fancy, but it gets me the facts. Besides, it’s paid for.

I plugged it in and checked for codes: engine, trans, air bag. I like to scope out the whole neighborhood so I don’t get blind-sided later. Everything was copacetic, so I ran the numbers. They looked right, too. TPS was in the low .5’s. Idle switch was ON. ISC steps were at zero. Air and coolant temps appeared innocent.

“Don’t you have one of those machines that can tell you what’s wrong?”

She was starting to sound like every other customer.

“Sure,” I answered. “I’ve got a Simutech over in the corner. I keep it around in case the Space Shuttle makes a pit stop. This one isn’t that far gone yet.”

I knew I was going to need a little time to solve her problem, so I sent her home to work on her tan.

Good detective work always starts with the basics. Idle control is about as sophisticated as a double-hung window. Open the window, get more air, idle speed goes up. Close off the air, idle speed goes down. High idle means air is getting in somewhere.

I checked the easy stuff. I already knew the throttle cable wasn’t the problem. I tried backing off the idle switch because I’ve seen a lot of guys misadjust it, using the switch for a throttle stop, which it isn’t. While I was in the neighborhood, I checked out the throttle plate to make sure it was fully closed. It was.

I ratcheted the investigation up a notch. Using an ohmmeter, I checked the resistances across the four windings in the ISC servo motor. I don’t try to remember what the spec is — it changes with temperature. I knew the four measurements should be about equal. An open winding kills the servo motor. A shorted one kills the ECU. This servo checked out fine.

I decided to risk it. I started the engine with the air duct disconnected. I knew this would disable the MAF (it’s in the can with the air filter.) and trip the Check Engine light. Sure enough, it ran. A little ratty and still way too fast. I looked into the throttle body and noticed the two slots in the floor in front of the throttle plate. This had to be where the idle speed servo draws its air. But why were there two of them?

I stuck a finger in there. I couldn’t feel the air being drawn into one slot. Closing it off by pressing a digit against the opening slowed the engine. Doing the same thing to the other slot had no effect. I knew I was getting close.

I killed the engine and removed the two little bolts that hold the ISC servo motor in place. I put the motor off to the side and grabbed a can of carb cleaner. Taking deadly aim, I blasted away at the two slots in the throttle body. The slot that didn’t show any airflow drained into the ISC opening. The carb cleaner that went into the other slot just disappeared. This had to be where the air was sneaking in. I wasn’t sure what that slot was connected to and looking it up in the book didn’t help. Must be some kind of top secret device.

I pulled the throttle body off the surge tank and took it to the bench where I could open it up. When I took the screws out of the bottom I could see the culprit. The coolant that passes through the throttle body isn’t just for temperature stabilization. A thermo device is also connected to an air passage. The throttle body has a thermostatic fast idle built in! This one was stuck open. That’s why the idle was so high.

If this car had one, I'll bet a lot of cars have got 'em too. It would be awful hard to keep something like this a secret. If it ain't in the book, it's got to be somewhere. So, I checked the TSB's. Like always, it's easier to find what you're looking for when you know what it is.

Hyundai Technical Service Bulletin Number 95-36-002 told me a bunch of stuff I already knew, and it included the skinny on that thermo thing. Like the right name "fast idle air valve assembly," which I needed to get the right parts.

I called the dealer. This being a work of fiction, the dealer had the parts in stock, sold 'em for a reasonable price and guaranteed delivery in 30 minutes or less.

The wrap-up was a piece of cake: Bolt up the new pieces, make sure the gasket (Hyundai calls it a "packing") was lying flat so it would seal; touch-up the adjustments. The Hyundai idled like a sewing machine. All that was left was toting up my bill.

Later that evening, she was standing at the front counter, handing over a pile of dead green presidents. I figured we'd never see each other again. Then she cleared her throat, hesitated a little and acted like she was working up the courage to ask me something. Something big. Something outside the lousy rules we're all forced to live by.

Finally, she spoke. "Would the world's greatest automotive detective be willing to take a look at the Hyundai's radio? If it's not too expensive I would like to get it fixed."

I didn't answer right away because I was thinking, "This could be the start of something special."

But, that's not how detectives work. That's not how I work. You can't let nice-smelling customers turn your head.

"Sorry, sweetheart. This is a detective story. If you want your radio fixed you'll have to find a musical." ■

—By Bill Wheaton

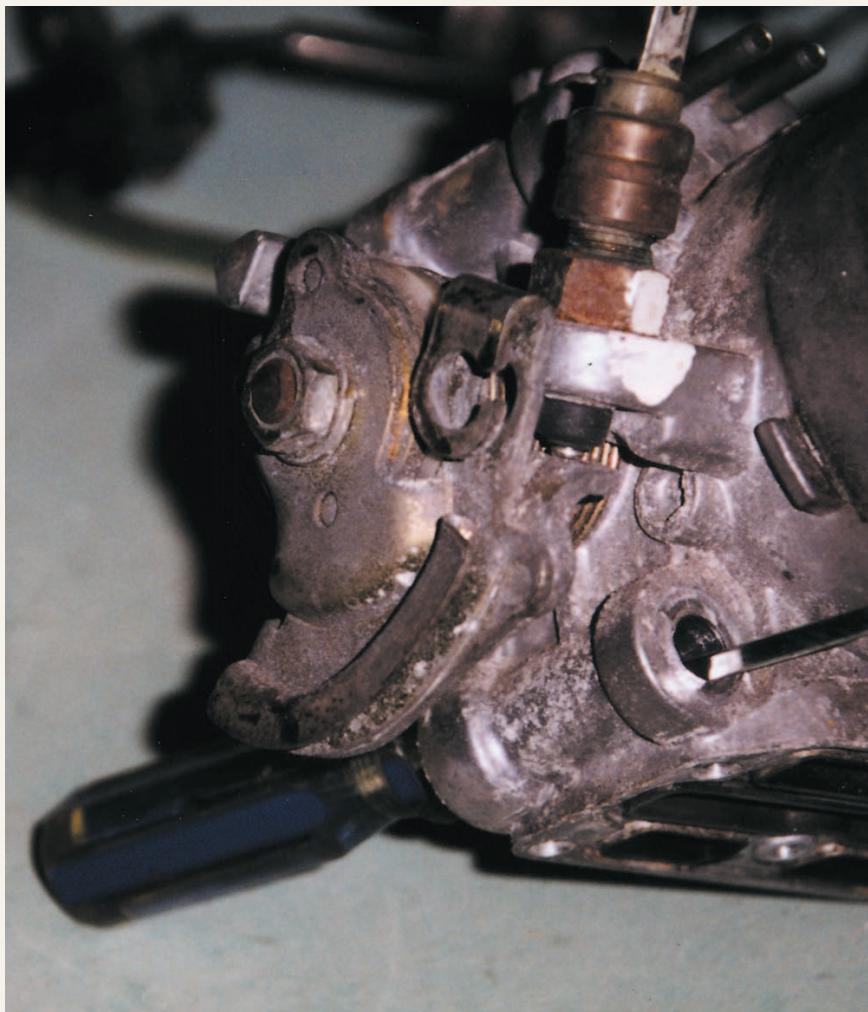
The Clues:

Below: The throttle position switch is the item of interest here. It threads into the throttle body and locks in place with a 14mm nut. Correctly adjusted, it will read CLOSED on your scan tool at idle, and will switch to OPEN with the slightest movement.

It can be adjusted with an ohmmeter, one lead connected to ground, the other to the spade terminal on the top of the switch.

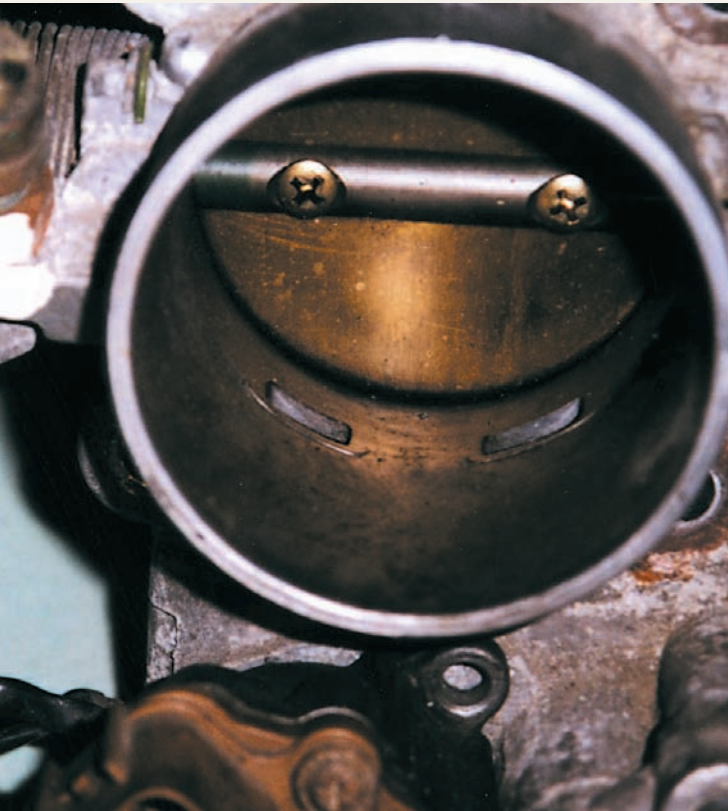
The idle switch is the only way the ECU knows that the engine is idling. Do not use the idle switch as a throttle stop.

A note for those of you who like to work with the car raised slightly: If the wheels are turning, the ECU thinks the car is moving, not idling. This applies a different idle speed control algorithm. You can't set the idle speed if the wheels are turning.



Below: Here are the two idle air bypass slots in the throttle bore. On most throttle bodies there is some bleed-over from one passage to the other; however, the story is basically correct. One passage primarily feeds the ISC servo motor, the other passage primarily feeds the fast idle device.

On a throttle body with a stuck fast idle device, putting a piece of duct tape over the fast idle feed hole brings the idle speed back into the normal range. Using duct tape is much more professional than sticking your finger over the hole.

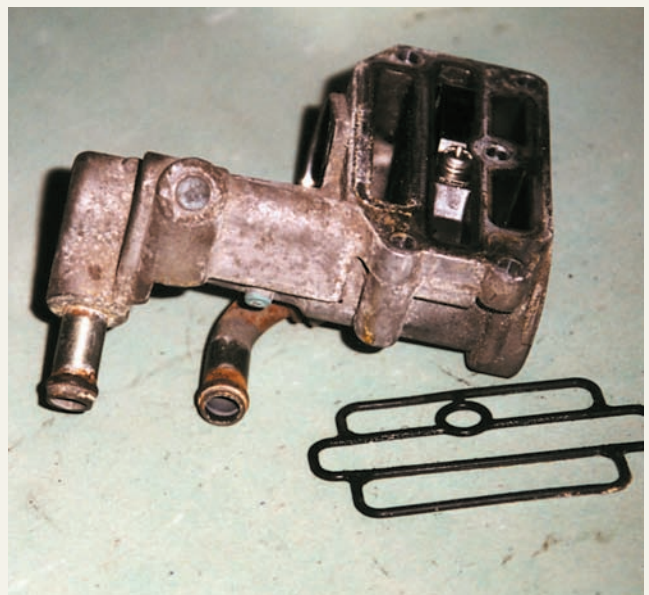


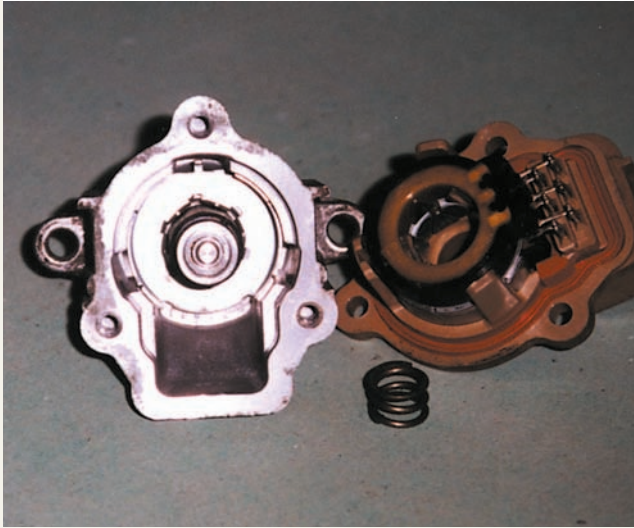
Right: The culprit in the story (the fast idle air valve assembly) looks like this. It attaches to the bottom of the throttle body with five screws. The odd-shaped black thing in the foreground is the “packing” (or gasket) which seals the device to the throttle body, keeping the coolant on the wet side.



Above: To see a throttle body from this angle, you have to get it out of the car. The two hose nipples on the right are the coolant inlet and outlet for the fast idle control device. As you can see in this photo, the fast idle control device is attached to the bottom of the throttle body.

The ISC servo motor has been removed. It normally covers, and extends into, the blackened well on the left. At the bottom of the well is a hole about the size of your little finger. That’s the passage for idle air. The ISC motor has a plunger that blocks or opens this passage.





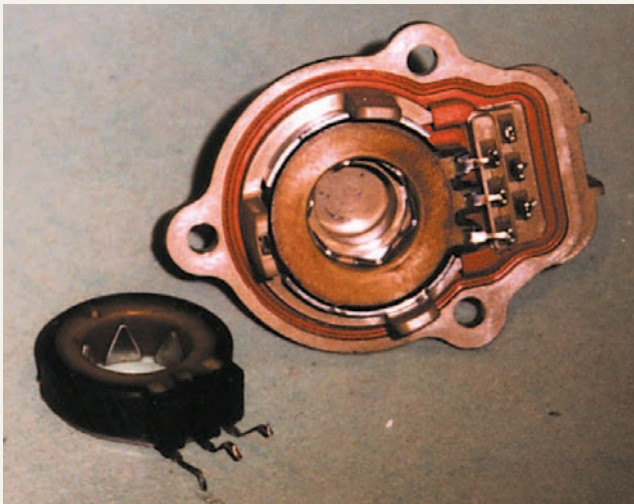
Above: Only three screws hold the cover on the ISC servo motor. Here's what one looks like opened up. The hefty-looking spring helps to seat the plunger.

Question: Why would you ever take one apart?

Answer: To check for signs of coolant inside the ISC servo motor. Coolant inside is a very bad thing, it shorts out the motor which may blow the driver circuit inside the ECU. If you do find coolant, replace the "fast idle air valve packing" (gasket) and the ISC. Then check the idle control functions. Odds are, you'll need an ECU.

Below: Here's another view of the inside of an ISC. This time one of the coils has been removed.

Follow along here and see whether ISC operation doesn't begin to make sense. The ISC motor has two coils inside. Each coil has two windings, which share the center connection, pretty much the same way an



1157 bulb has two brightness levels with only three wires connected. The ECU grounds (pulse-width modulated, of course) the coil windings to move the plunger back and forth, opening and closing the idle air passage. If you think 'giant steps' and 'baby steps,' you'll better understand the reason for two opening coils and two closing coils.

Testing with an ohmmeter is fairly straightforward. Check resistance from the center terminal to each of the two outer terminals. The resistance changes with temperature but is usually in the 20-24 ohm range. You will be making four separate impedance checks, the four readings will be about equal. What you are really looking for is an open or shorted winding.

It is not unusual for all four windings to test okay on a cold engine and stay okay for an hour idling in the shop. Then on a test drive, one winding goes open and you lose idle speed control. Back in the shop, the ohmmeter shows an open that wasn't there before. Motion brings out the worst in ISC's; just test drive all the suspect vehicles to be sure.

Just a thought in passing. The IN coil and the OUT coils are the same, the tabs just get bent differently depending on where they go. If a guy had a bunch of these ISC's and knew which coils were good, he could rebuild a couple for test purposes.



Above: The recessed idle air bypass screw is on the top of the throttle body. Make the idle speed adjustment here. In this photo, the black rubber plug that covers the screw is missing, which allowed moisture to collect and seize the screw. Putting the plug back when you are done will save a lot of grief down the road.

Case Closed