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ON THE FRONT COVER: David McIntosh writes:

This sketch was like a "barn find" discovered among sketches done in my Chevrolet 2 Studio days at GM Design. The sketch, dated 1987, was done about the time we were exploring ideas for show cars. The design craze for sports cars was the mid-engine layout, and by the mid-1980s we had the Celebrity front wheel drive powertrain as a base for a low cost sport coupe. The history—Corvair rear engine, Chevrolet low price point—seemed like a natural fit.

This design suggests Corvair with a contemporary shape. It is a fluid form accented with crisp lines like the 1965 design combined with the continuous round shape of the 1960 original. It had to be a simple and distinctive statement.

My first (and second and third) car was a Corvair which left a permanent impression on me as an affordable, fun to drive and beautifully designed car, a great car for a design student.

This proposal was a no-go, but the Corvair remains a unique experience for me and for Chevrolet.

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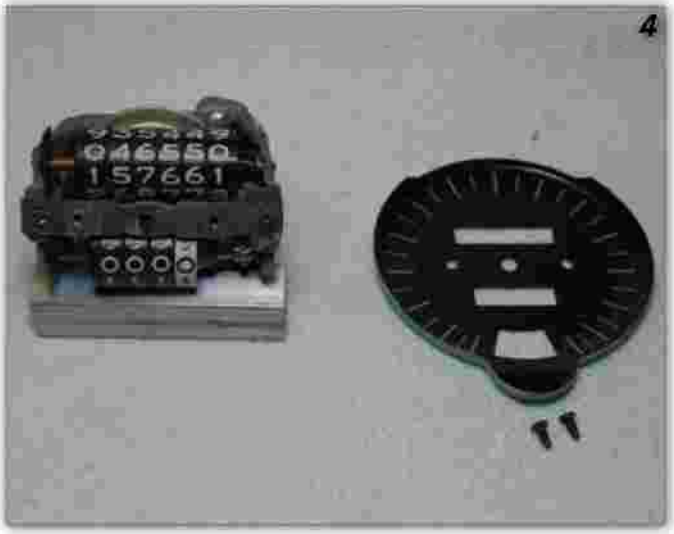
Tech Topics

Speedometer Overhaul



Jim Simpson

So your speedometer is making a little noise and the needle is kicking a bit. That's happened before and of course it was just that the speedometer cable needed a little cleaning and lubrication. Well, maybe not this time. And maybe you should take some preventive action now before things get a lot worse.

My Corsa was showing these symptoms recently and I put "clean and lube the speedometer cable" on my list of maintenance items. But on the last outing before laying the car up for the winter, the odometer quit entirely while the speedometer still worked. Odd, if the cable had failed, then neither the odometer nor the speedometer should operate. So I concluded it must be a problem inside the speedometer head. I was right and a few hundred dollars later, I have a restored speedometer in my Corsa.

My speedometer had been "profession-

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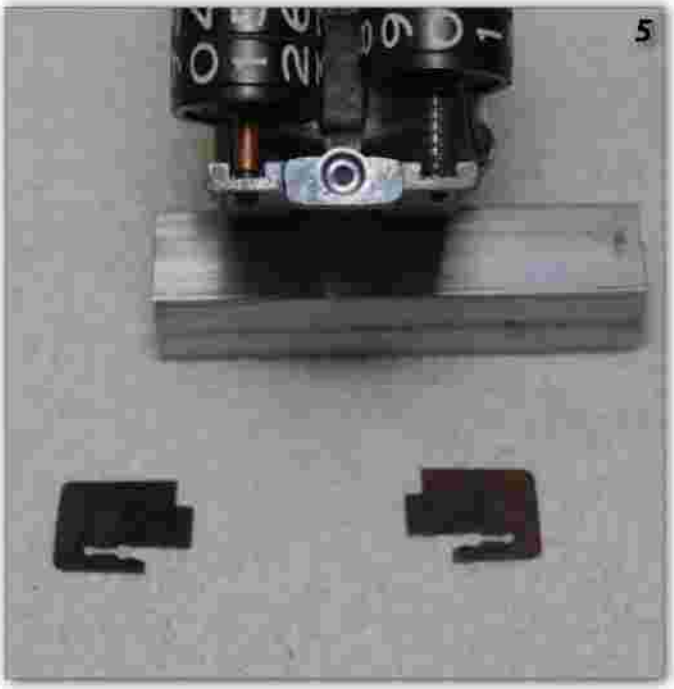
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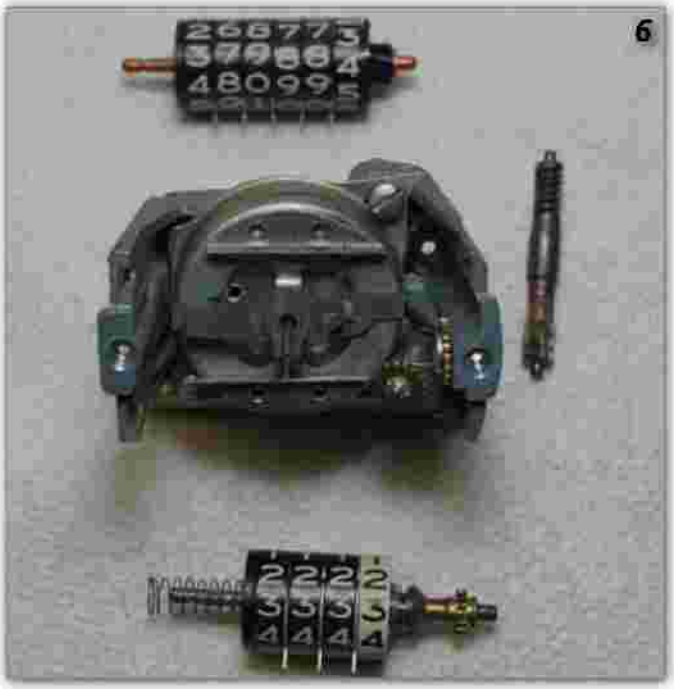
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ally" serviced a few years ago to calibrate the speedometer. Supposedly the internal gears had been cleaned and lubricated but now I'm not so sure. Of course most of the internals were the originals with over 100,000 miles on them which also may have been a factor. I would imagine that the vast majority of speedometers out there have never been out of the car. The grease in the newest ones is now 43 years old and the oldest is 53 years. How well do you think it works now? And if you check with Clark's, while they sell rebuilt speedometers, most of the internal parts are no longer available.

Speedometer heads are not the most complex items in the world. They do require a bit of care if you want to service them, but it's not rocket science. That said, I'll post some cautions and warnings up front. First, if you aren't reasonably careful, you could damage the speedometer beyond easy repair so pay attention to what I say below. Second, it is entirely possible that when you are done, you'll still need to have the speedometer head recalibrated. Third, after all these years, the painted numbers on the odometer counter(s) are getting pretty flaky. The paint can come off very easily so you need to be very, very careful to touch them only at the ends. So don't say I didn't warn you.

Here's a typical Corsa speedometer head. (This is a spare one that seems to be working okay, but is not in great cosmetic condition.) It's still in its housing. Note the low mileage. [Photo 1]

To remove the actual head, use a ¼" nut driver to remove the two hex head screws on the back. Once the head is out, you can start the actual disassembly. [Photo 2]

The first step is to remove the speedometer needle. This is simpler than it would seem. Just grasp it at the center—*not* by the needle—and twist it counterclockwise (down past zero) while pulling gently. The needle is just held in place by friction. [Photo 3]

Next remove the front face. It's held by the two screws. Be careful not to scratch the paint although a dab of semigloss black paint on the screws will hide most damage. [Photo 4]

Now you have the internals visible. Since this is a Corsa speedometer head, there's a bit more to it than the standard Corvair speedometer, particularly the trip odometer and its reset mechanism.

Now comes the fun part. Remove the center metal bracket; again it's held in place by two screws. Then remove the odometer counters. Note the two flat tabs at the left end; they slip into slots on the shafts of the odometer counters. Just pull them straight out to the side, no bending or twisting needed; usually you can do it with your fingers although a small pair of needle-nose pliers might give a bit more grip. They just pop off. [Photo 5] Note how the tabs on the back of the counter fit on the ridges on the "cup" assembly. Slip the odometer counters to the left and then remove them. Remember that the numbers are easily damaged. (You may notice that the Corsa main odometer counter actually has a $\frac{1}{10}$ mile counter; it has a black background and is hidden by the front face. The trip odometer has a normal white background for the $\frac{1}{10}$ mile counter.)

Now you can see the actual speedometer mechanism. [Photo 6] The round "can" in the center is the device that translates the spinning speedometer cable movement to a steady speedometer needle reading. That shaft lying next to it in the picture is one of the gears that drive the odometer counters. It engages with a diagonal gear shaft at the bottom that you'll see soon.

We're going to remove the "can" next; this is the second area you need to be very careful. Always handle it by the speedometer shaft that sticks out toward the front. Do not lift it by the outer casing. See that spiral spring in the center? It's very delicate and can be stretched out of shape if you don't lift it by the center shaft. [Photo 7]


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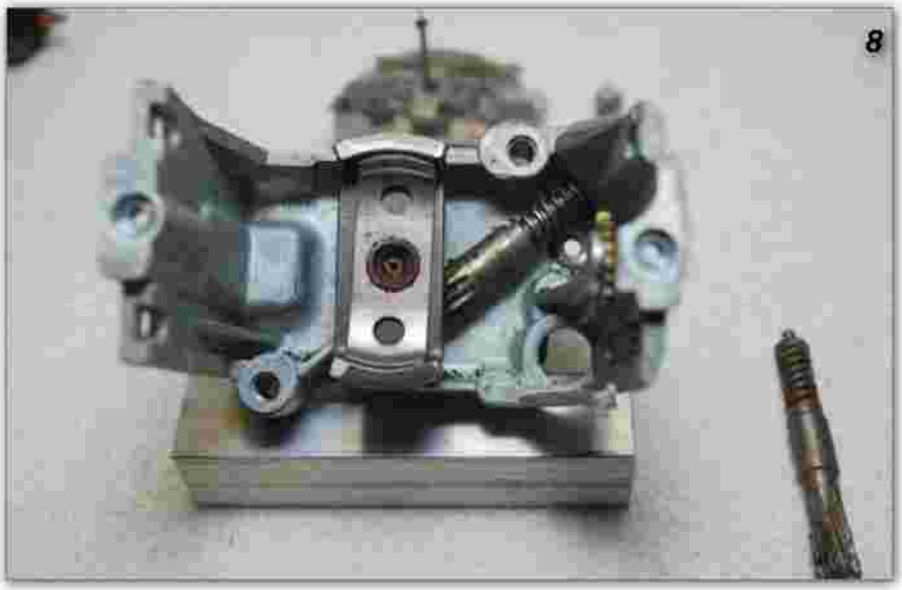
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If you take a look at the next pictures, you can get an idea of just how the speedometer portion works: In the center, the speedometer has a magnet. [Photo 8] It is connected directly to the speedometer drive cable and spins at the same speed as the front wheel on a late model Corvair or at a speed determined by the gear in the transmission on an early model. This magnet is inside that cup-shaped piece, but doesn't touch it. [Photo 9] The cup is made of aluminum, an electrically conductive material. As the magnet spins, it induces a weak electrical current in the aluminum and tries to drag it along as it spins. That spiral spring on the other side, in the previous picture, holds it back. The faster the magnet spins, the harder it drags the cup and the more it turns against the spiral spring, moving the speedometer needle to indicate a higher speed.

There are two adjustments possible to calibrate how far the needle moves. First, you can change the spring setting. The spring is attached to the gray metal bar that goes across the outside (front) of the cup assembly. It rotates around the center allowing a little adjustment of the spring tension. More tension and the speedometer reads lower, less tension and it reads higher. The second adjustment is the magnet itself. If you get a brand new magnet, you'll discover it isn't actually magnetized. It has to be charged, that is done with an electrical coil—an electromagnet—which induces a magnetic field into the new magnet. The stronger the magnetic field, the harder it will drag on the aluminum cup. Both of these are generally a job for a professional speedometer repair shop.

If we are careful, we won't disturb either the tension in the spring or the strength of the magnet and will not need to have the speedometer recalibrated.

Now we're at the heart of the speedometer and the problems with our 50 year old Corvairs. At the base of the spinning magnet there is a worm gear. The magnet and its drive shaft is hard to remove without special tools so we're going to have to clean and inspect it while it remains in place. Note the gear shaft going diagonally across the bottom of the casting. This can be removed. Support the casting with a small socket that clears the round aluminum bushing on the side of the casting. [Photo 10] This bushing supports one end of the diagonal gear shaft. Tap gently


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on the other end of the shaft with a small diameter pin and the entire bushing and shaft will pop out. Once out, clean and inspect the diagonal gear shaft and the worm gear below the spinning magnet. Use a magnifying glass and look carefully. Mine was removed by a professional shop; here's what it looked like. [Photo 11]

Do you see how the spiral worm gear at the bottom of the magnet is worn out and distorted? That's what killed my odometer. The diagonal gear doesn't look too bad, but it was replaced anyway.

That spiral gear is not available from Clark's anymore. There are some professional shops (Bob's Speedometer in Michigan did mine) who have them, but they're hard to find. Clark's has reproduced the diagonal gear shaft and recommends replacing it. They believe that as it wears, it damages the worm gear. That may be true and it's inexpensive. But in my opinion, it's the dried out grease in the entire speedometer head that is the culprit. Anything in the odometer gear train that puts extra drag on the worm gear is going to cause it to wear faster.

Clean, clean, clean, and then lubricate all the moving parts. I'm not entirely sure what GM used as a lubricant, but look for something that is not going to dry out in the next decade. There are good clock and instrument oils as well as synthetic oils and lubricants. Look for something that is fairly light and thin that won't evaporate. (That means don't use WD-40. It is not designed as a serious lubricant.)

Reassembly is just the reverse of the disassembly. Once the worm gear is lubricated, insert the diagonal gear shaft and bushing. Make sure the bushing is well seated and secure; you may want to stake it with a small punch along the edge to be sure. It can pop loose—just ask me sometime. Remember to handle the cup assembly only by the shaft. When you reinstall the odometer counters, be sure the tabs are engaged with the ridges on the cup assembly. Once you have the faceplate back on, install the needle by pointing the needle at about the 60 MPH point and then press and turn it counterclockwise until it is tight and pointing at zero. There's a stop tab that holds the shaft at zero while you are rotating the speedometer needle. If you overshoot, keep on turning CCW to bring it all the way around to zero again; *don't* reverse.

You're done! Reinstall the speedometer in the car and road test it. Check the speedometer against a GPS or time it as you drive past mile markers on the highway. (At a constant 60 MPH, you should travel one mile every minute.)

One final note. If you do ship out your speedometer head for work, pack-

age it carefully. Make sure the face is well protected. Here's how I did mine: I used a piece of plywood and screwed the case to it. [Photo 12] Nothing could touch the face that way. Put the whole thing is a plastic bag and seal it to make sure no dust, dirt, or packing material gets in through the holes in the back.

Take care of things now and the speedometer should outlast the rest of the car.

In Memoriam

Burt Lee Lippold passed away January 15 at home after battling cancer. Born 1950 in Ogden, Utah, he enlisted in the Marines after high school, later joined the Army Reserves, and retired after proudly serving his country in Iraq in 2007-2008. Burt worked at Hill AFB and Boeing for most of his career as an aircraft sheet metal mechanic. He loved working with his hands and was able to fix most everything he touched. Burt's passions were road trips on his motorcycle with his wife, working on his many Corvairs, and making friends wherever he went. He was a longtime member of CORSA and Bonneville Corvair Club where he served in numerous offices including President. Burt had a great love of music and played the piano. He is survived by his wife Deanne and many other family members.

Powerglide Shifting

Craig Nicol

Automatic transmissions, particularly non-electronic ones, are one of the great mysteries of the world. What makes them shift? Some will say one thing and others say something else. I thought it would be fun to get to the bottom of it once and for all.

The Powerglide two-speed automatic transmission does not have any wiring but it does have a computer on its underside: a hydraulic computer known as the valve body. The main component in the valve body is the "shift regulator" and within the shift regulator, you'll find the shift valve. The shift valve is the key; it has only two positions, low gear and high gear. The shift valve toggles back and forth like a little toy cricket; it's either one way or the other, high or low gear. Whether the valve is in the high gear position or the low gear position is determined by forces tugging the valve in opposite directions. The late Bob Ballew studied this deeply and called the opposing forces the "keep it in low" gang and the "keep it in high" gang. If one gang was ever so slightly stronger, the shift valve would toggle and the transmission shifts gears.

So, how does this play out? On one side we have the throttle valve (the bell crank on the side of the transmission where the accelerator rod and throttle rod connect) applying higher and higher pressure to keep it in low as the driver depresses the throttle more and more. On the other side we have the governor and wheel-driven rear pump—basically a hydraulic speedometer—applying higher and higher pressure to shift it into drive. When the vehicle reaches a certain road speed, the governor pressure "wins" and the transmission shifts to drive. The shift can occur at any road speed between 12 and 45 MPH depending on how far the accelerator (and throttle valve) is pushed down. If the driver is accelerating slowly and the pedal is up, the shift can occur at 12 MPH. If the driver has the pedal floored, the shift occurs around 45 MPH.

Once the shift valve changes position, it diverts hydraulic pressure to apply either the drive clutch (high gear) or the low band depending on which range is being selected.

Next, there's the question of how much pressure to apply to the clutch or band. Too little pressure results in a long lazy shift that decreases transmission life. Too much pressure causes jarring shifts. Enter the modulator. The modulator increases the internal hydraulic shift pressure as the load on the engine increases, indicated by lower engine vacuum. Higher hydraulic pressure is required to keep the transmission clutches from slipping and it promotes quick, firm shifts when the engine is producing higher torque. The modulator does not influence when the transmission shifts, only how soft or hard it shifts.

Of course, there are other valve body components playing minor (and important) roles but the gist of the shift decision is: throttle valve vs. governor and rear pump, with the modulator managing shift quality according to engine output torque. Now we know!