

Avoiding the Bum Steer

Some years ago, while driving my '38 La Salle Coupe, I remember one extraordinary right turn. When I straightened out the steering wheel, the car just kept turning, swinging into the adjacent lane. Horns blared. The guy in a new BMW that I had unintentionally cut off was particularly displeased.

I had just recently purchased the old La Salle, so I hadn't yet adjusted to its idiosyncrasies. As I learned, in memorable fashion, it needed front-end work. Someone attempted to compensate for the considerable wear in the entire steering system by only adjusting the steering box. Over adjusted might be a better description. The lash in the worm-and-roller gears of that old Saginaw box was "adjusted" so that the gears bound up in the center. I had to jerk the wheel to get past that tight spot.

This little tale illustrates an important point: until you eliminate other possible causes for your problems, never adjust your steering box to improve handling.

Attempting to do so could ruin a good steering box and may still not remedy your situation. When I tore down the La Salle's steering box, I discovered the gears were damaged beyond repair. It took me two years to find a replacement for such a rare old car.

Even though a steering box may be available for your classic, a thorough inspection to isolate the problem comes before messing with the steering box. If the steering box is the problem, it's usually not a big deal. If the gears aren't ruined, you can easily adjust them. Or, if need be, you can remove and rebuild the box.

THINGS TO LOOK FOR

If you've given your chassis a good lube job, properly inflated its tires and made sure the front end is properly aligned, but are still having problems, check each component of your steering assembly and suspension for worn parts before doing anything to the steering box. Jack up your car so the front wheels are off the ground. Then put it on sturdy jack stands. Turn the steering wheel so the front wheels face straight ahead.

Get under the car, grasp each component of the steering system and try to move it. There should be no slop in the tie rods, connecting arms, kingpins, ball joints, steering knuckle or Pitman arm. If there is, replace the worn parts before attempting to adjust the steering box. Also check for bent tie rods, steering knuckles, steering arms or a bent Pitman arm. Look for signs of a bent frame as well.

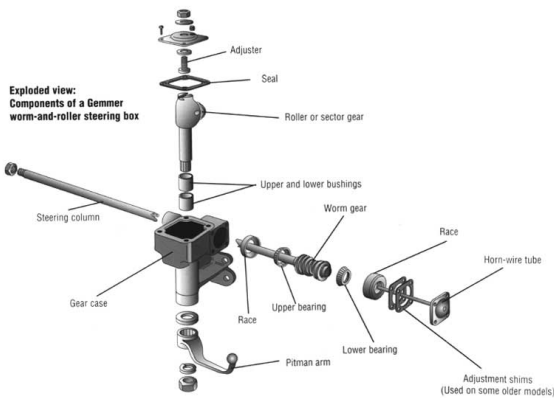
Sometimes you can easily see a bent frame. Inspect for crush deformities, especially around the frame ends where the bumper-bracket bolts attach. Also look for bulges or amateur welds along the frame rails. Finally, use a tape to verify an equal measure from the left corner of the front cross-brace to the right corner of the rear cross-brace and vice versa. If there is more than 1/4-inch difference, you have a bent frame.

Make sure the back axle is properly attached to the springs and that it is correctly aligned. Measure from fixed points on the frame to the back axle mounts to verify. Make sure the front wheel bearings are in good shape (not galled or worn), freshly greased and adjusted to the correct preload, as noted in the vehicle's shop manual. Fix any problems you come across before going any further.

MAKING THE ADJUSTMENT

There have been several different steering-gear systems used over the years, but all are designed to solve the same problems. Light responsive steering makes a car enjoyable to drive. The gear ratio in the steering box must minimize effort but not require excessive wheel turns. The steering gear arrangement must also be nonreversible. This allows the driver to turn the car but prevents bumps and road shocks from being transmitted back through the system to the driver, deflecting the steering wheel. The three most common designs installed by various car manufacturers are the worm-and-sector (or roller) type, the recirculating-ball type and the cam-and-lever type.

Note that power steering systems have the actuating mechanisms integrated into the steering box. However, adjusting the box is essentially the same as described in the general instructions that follow. Always check the shop manual for specific details.



For years, Gemmer made the majority of the worm-and-sector steering boxes for American cars. Gemmer steering boxes were used from the '30s into the '50s on Chrysler's line as well as Ford products, and they appear on Packards and Nashes as well. Their design uses an hour-glass shaped worm gear at the end of the steering column to turn a sector gear on the cross-shaft (also called the Pitman arm shaft or sector shaft) that in turn actuates the Pitman arm. Illustration #1 shows the construction of a typical Gemmer steering box. Some of them were simple worm-and-roller types. Others, such as those used on '30s, '40s, '50s and later Cadillacs, Chevys and some Ford products, were a recirculating-ball design. The recirculating-ball steering box had

a special sliding nut that rode the worm gear on loose ball bearings that circulated and were fed back to the beginning by tubes on the outside of the nut. The nut then drove a sector gear that moved the Pitman arm shaft. Because ball bearings roll with almost no friction, steering effort was minimized with this innovation.

A third steering box design was the Ross can-and-lever design. Studebaker used these. A cam attached to the cross shaft had one or two pins that rode up and down the worm gear's grooves, thus actuating the Pitman arm. This design resulted in smooth, comfortable steering, because it eliminated "rebound" over bumps.

These designs are adjusted differently, but in each case, the desired outcome is the same. The Pitman arm needs to be lined up along the length of the car. The steering gears should be correctly aligned so the wheels are straight ahead, and the steering wheel is centered. The lash between the gears must be correct. Also, there should be no end-play in the sector shaft or steering column. Here is how to check and adjust them.

The adjustment process for the worm-and-sector or roller-type box (our chosen example) is similar to the process used on other steering boxes as well, even those of the 1970s and '80s. Over the years, steering-box design has improved in many minor ways, so check a shop manual or Chilton's Guide to see how your car's steering box is configured before attempting adjustment.

Jack up the car so the front wheels are off the ground. Then put the car on jack stands. Roll under the car and disconnect the steering connecting arm from the Pitman arm. Do this by removing the cotter key in its end and unscrewing the plug behind the key. Count the number of turns it takes to unscrew the plug, and note it so you can reinstall it with the same spring tension. Finally, make sure the bolts holding the steering box to the frame are tight.

Get inside the car and loosen the steering-column mounting bracket to relieve any tension on the column. If the column is sprung while you are working, your adjustment will be adversely affected. This could be due to a history of misalignment problems resulting from ramming into curbs or other jolts. After adjusting the steering box, if you discover that the column is in poor alignment, use shims or elongate the steering-bracket mounting holes to relieve the stress.

ADJUST THE END-PLAY

Next, turn the steering wheel all the way in either direction until it stops. Then turn it back 1/8 of a turn. The hourglass worm gear in a worm-and-roller steering box is made in such a way that it allows more of a gap between it and the sector gear at its extreme ends and less in the middle. So when you turn the wheel until it stops, then back slightly, the tolerance between the two gears enables you to accurately check the sector gear (or roller) end-play without interference from the worm gear.

On the top of the steering box is an adjuster screw with a lock nut. Loosen the lock nut, tighten the adjuster screw until it is snug, and then back it off until it is free. Finally, tighten the adjuster screw slowly until you feel it just touch the top of the sector bearing shaft. Hold it from turning while you tighten the lock nut.

Next, get underneath and check the sector shaft end-play by attempting to move the shaft up and down. If there is still end-play, readjust and test it again. If end-play problems persist after a second adjustment, you may

be able to remedy the matter (depending on the design of your steering box) by removing shims from under the plate on top of the steering box. Otherwise, you need to rebuild the box.

The next adjustment is to eliminate steering column end-play. Turn the steering all the way right or left, then back off 1/8 of a turn. Get in the car and try to pull the steering wheel up and push it down. If there is any movement, it indicates excessive end-play. On steering boxes from the '30s and '40s, adjusting for end-play is a little more trouble than on later cars. It requires you to loosen the end plate against which the worm gear rides, then remove shims to compensate for wear.

If your car has one of these early boxes, put a pan under the end plate to catch the drippings. Then loosen it evenly, and gently pull back on it until its gaskets and shims separate from the main steering box casing. If it doesn't come apart easily, use a sharp putty knife to work it loose. Be careful not to ruin any of the thin metal shims or the gaskets. There should be three or four shims. Just pull out one thin shim, tighten things back up and test the end-play. If there are no shims, the end-play has already been adjusted to the maximum.

A more accurate test for correct end-play is with a small, spring-type scale available at bait-and-tackle shops. Fishermen use them to weigh their catch. Attach one hook of the scale on a spoke of the steering wheel and tug gently. Generally the lash is about right when the pull on the scale required to move the wheel is between 1 1/2 and 2 1/2 pounds. If the pull is lighter, remove another shim. If heavier, add a shim. If you only removed one thin shim to begin with, your steering shouldn't be so stiff that you need to add a shim to loosen it.

Steering boxes from the mid '50s and newer cars allow end-play adjustment between the worm and roller by adjusting a sleeve in which the upper roller bearing race of the worm gear is mounted. The adjuster for this sleeve is usually located just below the junction of the steering column and steering box. It usually consists of a lock nut and adjuster screw. As with any top of worm-and-roller steering box, turn the steering wheel all the way in one direction until it stops. Then back off 1/8 of a turn, so there will be plenty of play between the gears before making this adjustment.

After adjusting your steering box, get in the car and turn the steering wheel from one stop to the other. There should be a slightly increased effort required at the center of the turning range. Turn the steering wheel to the middle so the front wheels are pointed straight ahead. Get under the car and see if you can move the Pitman arm. If there is any side-to-side movement, the sector gear adjustment is too loose.

Your fisherman's scale can be used to test for tightness at the high spot at the center. Attach the scale to a steering wheel spoke out near the rim. Then pull through the high spot. The scale should register no more than 4 1/2 pounds and no less than 3 pounds. If it is less, you need to adjust the gears a little tighter. If more than 4 1/2 pounds pull is necessary, you need to loosen things a little.

Some worm-and-roller steering boxes have a worm gear end-play adjuster on the lower end of the steering box. It is harder to reach, but the method of adjustment is similar. When you have finished making your adjustments (if disassembly was required), seal the gasket mating surfaces with silicone sealer, top off the steering box with the same hypoid gear oil you would use in a standard transmission or differential, then take the car out for a test drive. Your car should steer lightly and smoothly without catches or tight spots. If after careful adjustment, your steering still isn't right, a rebuild of the steering box may be in order.

TROUBLE SHOOTING STEERING PROBLEMS

Hard Steering

Possible Causes:

- 1) Underinflated tires.
- 2) Steering gear or joints not properly lubricated.
- 3) Excessive caster in front wheels.
- 4) Suspension arms or steering knuckles bent or twisted.
- 5) Sagging front springs.
- 6) Steering gear adjusted too tight.

Remedies:

- 1) Inflate tires to specified pressure.
- 2) Treat the car to a lube job and top off the lubrication of the steering box with a 90-weight, standard transmission oil.
- 3) Have front end aligned.
- 4) Replace bent parts(s).
- 5) Replace sagging springs.
- 6) Adjust lash in steering gear.

EXCESSIVE PLAY OR LOOSENESS IN STEERING

Possible Causes:

- 1) Front wheel bearings are adjusted too loosely.
- 2) Steering knuckle bearings are worn.
- 3) Steering gear or connections are adjusted too loosely or are worn.

Remedies:

- 1) Adjust bearings or replace them if worn.
- 2) Replace bearings.
- 3) Install new parts as necessary or adjust steering gear.

CAR PULLS TO ONE SIDE

Possible Causes:

- 1) Low or uneven tire pressure.
- 2) Incorrect or uneven caster, camber or toe-in.
- 3) Wheel bearings are not correctly adjusted.
- 4) Sagging front spring.
- 5) Oil or brake fluid on brake lining.
- 6) Brakes are incorrectly adjusted.
- 7) Steering knuckle is bent.
- 8) Frame bent due to collision.
- 9) Shock absorbers are inoperative.

Remedies:

- 1) Inflate tires to specifications in driver's manual.
- 2) Have front end aligned.
- 3) Readjust bearings.
- 4) Replace springs.
- 5) Fix leak and replace linings.
- 6) Readjust brakes.
- 7) Replace steering knuckle.
- 8) Straighten frame.
- 9) Replace shocks.

FRONT-WHEEL SHIMMY

Possible Causes:

- 1) Low or uneven tire pressure.
- 2) Wheels, tires or brake drums are out of balance.
- 3) Worn kingpins and bushings or bad wheel bearings.
- 4) Steering connections are worn or incorrectly adjusted.
- 5) Steering gear is incorrectly adjusted.

Remedies:

- 1) Inflate to specifications.
- 2) Balance wheels, tires and drums. Also check tires for bulges.
- 3) Replace worn parts.
- 4) Adjust or replace as necessary.
- 5) Take up slack in steering gear.

CAR WONDERS

Possible Causes:

- 1) Steering knuckle bearings are worn.
- 2) Incorrect front-end alignment.
- 3) Rear axle has shifted.
- 4) Steering gear or connections are adjusted too loosely or are worn.
- 5) Steering gear or connections are adjusted too tightly.

Remedies:

- 1) Replace bearings.
- 2) Align front end.
- 3) Check spring clips for looseness. Measure from rear-spring bolt to housing. The distance should be equal on both sides of car.
- 4) Adjust or replace gears and bearings in steering box.
- 5) Adjust properly.