Fast-ratio steering really comes into its own on the Pikes Peak hillclimb and the autocross track, but the benefits will be evident in daily driving.

FAST, FASTER, FASTEST

FFI resurrects fast-ratio manual steering, and it's better than ever.

STORY By Richard Ehrenberg, SAE

PHOTOS By TheBruntBros

Driving a fat-tired, properly-suspended, fast-chassis Mopar on some twisty backroad, with ample power at your beck and call, is one of life's pleasures not to be missed. Ditto with harrasing "sports car" drivers at some open-track-day road course event, or looming large in a Vette's rearview on an expressway ramp. Of course, if you have Ma Mopar's standard 24:1 manual steering, you're denied the above delights. With that setup, you're relegated to Ralph Kramden-land forever. Heck, you may as well get one of those spinner knobs for your steering wheel, you're doing a ton of wheel-winding.

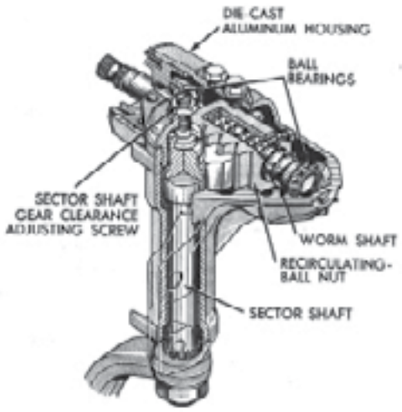
Back in the early '60s, there were rumblings from deep within the bowels of Chrysler Engineering calling for something more appropriate. The rally/road-race contingent, headed by Scott Harvey, cried out for a 16:1 setup, which is 'bout perfect for a svelte A-body, or a weight-conscious B- or E-car. Over on the NASCAR side, with speeds well up into the 175 MPH area, weights close to two tons, and bias-plys, 20:1 was deemed to be spot-on.

Soon enough, these ratios were realized. The 20:1 setup, while never offered as a

> *"The 16:1 setup, to our eyes, the cremé de la cremé, was a production option on A-bodies from 1965 thru 1969."*

production option, was catalogued by Direct Connection (now MP), so you, I, or any taker could swap it into your existing manual box. The 16:1 setup, to our eyes, the cremé de la cremé, was a production option on A-bodies from 1965 thru 1969. By the late '70s, finding either a complete, useable 16:1 box, or a NOS wormshaft assembly, had become one of the holy grails of Mopar partsdom.

As the millennium end neared, a savior appeared, on the left coast, of all places. Dick Ross, CEO of Firm Feel, Inc., in Vancouver, Washington, released a 16:1 wormshaft. Dick would also sell you a complete bolt-in reman box, 16:1 equipped. Life was good. As with most pleasures, however, the manual steering nirvana was short lived. By 2004, Dick was sold out. Truthfully, he was almost relieved – the QC of the wormshafts was so flaky that his crew was spending untold hours blueprinting each and every one. This is no way to run a business,



1. Chrysler's aluminum-cased manual steering was a marvel of low-friction precision steering when introduced in 1962. It still is today. Note that the sector-shaft bearings or bushings, as the case may be, are omitted in this Chrysler engineering graphic. (6-cylinder A-bodies received bushings, all other used needle bearings)

2. This hand-held mockup helps explain the principle of operation. The wormshaft (left) is connected to the steering column, the sector shaft (right) receives the pitman arm. Pretty simple, really.

4. The 16:1 wormshaft can be used in either style Mopar manual box. Note that the C-body/B-van version takes the large-spline pitman arm.

3. Since the mid-'60s, there have been three wormshaft ratios available. The most common (by far), is the snail-slow 24:1 seen in the foreground (FFI is actually able to blueprint these, if you must). In the center is the NASCAR/MP 20:1 setup; at the rear is the latest 16:1 re-pop (actually, it is much higher quality, in every way, then the original late-'60s equivalent). The caliper shows how to quickly ID the versions. The small metal tubes are the antifriction ball guides.

5. Disassembly begins by removing the sector gear cover (3 screws) and tapping the shaft out with a rubber or dead-blow plastic hammer, or block of wood and BFH.

HOW FAST IS TOO FAST?

Some have asked whether 16:1 might, indeed, be too fast a ratio for street use? First, we need to discuss the ratio itself and the meaning of the numbers: "16:1 steering" simply means that for every X number of degrees (or faction of a turn, or whatever) that the worm ("input") shaft is rotated, the sector ("output") shaft turns exactly 1/16th as much. This is not the same as overall steering ratio, which can be varied by finagling the length of the pitman arm and/or the steering arms (which, on most muscle-era Mopars, are integral with the lower ball joints). Think of the optional fast-ratio power setup in a '70-'71 E-body: These utilized the same 15.7:1 worm setup as any other PS-equipped Mopar, only the pitman arm was longer. In general, most muscle-era Mopars have steering and pitman arms of similar length, so the overall ratio is pretty close to the chuck's ratio.

OK, too the point: Too fast? As far as high-speed twitchiness, which some have worried about: Fugghetaboutit. Your daily-driver rack-equipped car, Mopar or otherwise, is almost certainly in the 12.0 to 14.0:1 range. And the steering wheel is also smaller than your classic Mopar, effectively quickening the ratio even more, just as smaller rear tires cranks up the "effective" axle ratio (increasing revs per mile).

The potential problem comes into play at very low speeds. With today's wide rubber, parking can be a chore. This phenomena, or course, varies directly with vehicle weight. On an A-body, or relatively svelte B- or E, you'll love the fast ratio setup, unless you live in midtown Manhattan, or have stick-figure-like upper body strength. On the highway, or, especially, on winding back-country roads, expressway ramps, etc., FRM is pure pleasure.

C-body, loaded wagon, towing, etc.? Frankly, you don't want any kind of manual. You're the guy Chrysler introduced hydraulic power steering for in 1951. — *R.E.*

especially if you plan on staying *in* business. Dick busied himself with his well-known Firm Feel power boxes, as well as a slew of suspension and steering upgrades, such as forged-in-house torsion and sway bars, his bar-raising pitman arm lower support bearing kit, ball bearing idler arms, and so on. Still, the huddled masses, your tech editor included, kept up a slow rumble of protest. (Sounds of restless natives banging drums in the distance). We want our fast ratio manual!

After a decade, Dick capitulated, and has now reintroduced the 16:1 setup. Better still, thanks to the magic of CNC machining, the quality control is now spot-on. This means zero hassles for Dick, but, more importantly, it means precise, smooth steering for us. Yeah! FFI is again offering D-I-Y wormshafts, and complete blueprinted OEM aluminum boxes, ready to bolt in. As you've come to expect over the last almost 30 years of E-Booger tech, the hands-on, greasy-fingernails part of the deal will be handled by the nearby ritzy photographs and their attendant captions, allowing you the cheap luxury of following step by step. Having a FSM handy is also helpful.

And, as always, MoPar to ya!

6. Unless you have a 3½″ inch socket or box wrench, you'll probably remove the wormshaft adjuster with a pin punch. This is okay as long as you're careful not to trash the delicate aluminum threads on the adjuster itself. A brass punch is good insurance.

7. You'll need a pin spanner to remove the adjuster. You could rig up something from a scrap of steel and two screws.

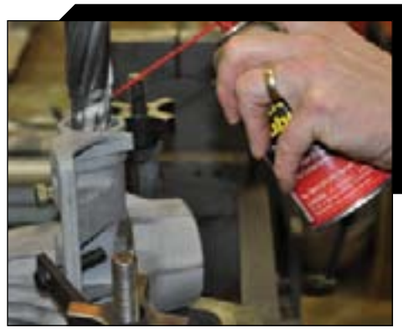
8. Needles will fall all over the place. Not to worry, you'll replace all the bearings.

9. You'll yank the sector seal and press out all the bearings.

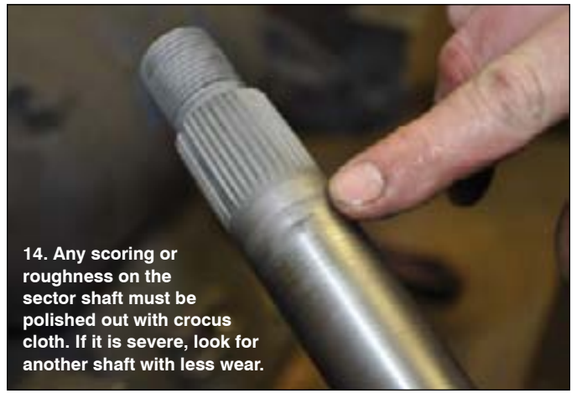
10. Expect plenty of caked grease. Nasty.

11. Clean it thoroughly – no shortcuts.

12. Six cylinder A-bodies had bushings on the sector shaft. They can be replaced with needles, but you can't do this yesrself, since...



13. ...the case must be re-machined using a custom mill. DIY? Start with a needle-equipped case.



14. Any scoring or roughness on the sector shaft must be polished out with crocus cloth. If it is severe, look for another shaft with less wear.

15. Also check the ball races for excessive wear.

16. This is all the internals ready to be assembled.

17. Here's the new sector needle bearings installed and lubed. Bearing lettering reads: "USA".

18. Although the case will be filled with grease (Dick recommends EP NLGI Grade 2), be sure to hand-lube the important areas before assembly. Wormshaft goes in first.

19. Threaded adjuster should turn freely, use heavy grease, ant-seize, or pipe-thread compound on the threads.

20. Tighten the adjuster so that the turning torque is at least 20-30 inch-lbs. A $^{11}/_{16}$-inch, 12-point socket fits the splined shaft perfectly. Then turn the shaft lock-to-lock at least 3 or 4 times. Next, back off the adjuster, then tighten again until the turning torque is 1.2 to 4.5 in.-lbs. If the bearings are new, use the higher spec., otherwise, shoot for around 2.0 in.-lbs. Then reinstall the large locknut and tighten (with the punch).

21. Next, grease the large teeth on the sector shaft and the new wormshaft, as well as the worm threads, and pack the case as full of grease as you can. Back off the adjuster screw at least 3 or 4 turns, and run a bead of RTV around the case opening, then drop in the sector shaft. Have the wormshaft in the center of it's range while doing this. The worm gear will need to be held upward with you finger so the sector gear will be able to slide in.

22. Torque the cover screws to 25 ft./lbs. - not inch-pounds! With the same torque wrench setup as photo 21, tighten the adjusting screw so that the torque reading as the wormshaft is moved though the center high-spot range is 7 in.-lbs. more than what you set in step 21.Then tighten the locknut.

23. All that remains is cutting or grinding the master spline. This must be at 12 O'clock, with the gear in the exact center of its travel. This point should coincide with maximum turning-torque reading, you should also confirm that there close to the same number of turns (and factions of a turn) in both directions, CW and CCW. You need to remove exactly one tooth. We used a die grinder, a Dremel tool with a super-small cutoff wheel would be mint. Put some tape over the seal while grinding to keep the chips away from the seal lip.

24. Even though you packed the case with grease, it cannot be really full. Pour in the heaviest gear oil you can find to top it off, synthetic is great. Even better: You can blend the #2 grease with gear oil, warm it up to thin it some (outside on the propane grille, please - it will stink!), and pour in the mix.

25. A big thumbs-up for a job well done. Bolt it in and go carve some canyons.