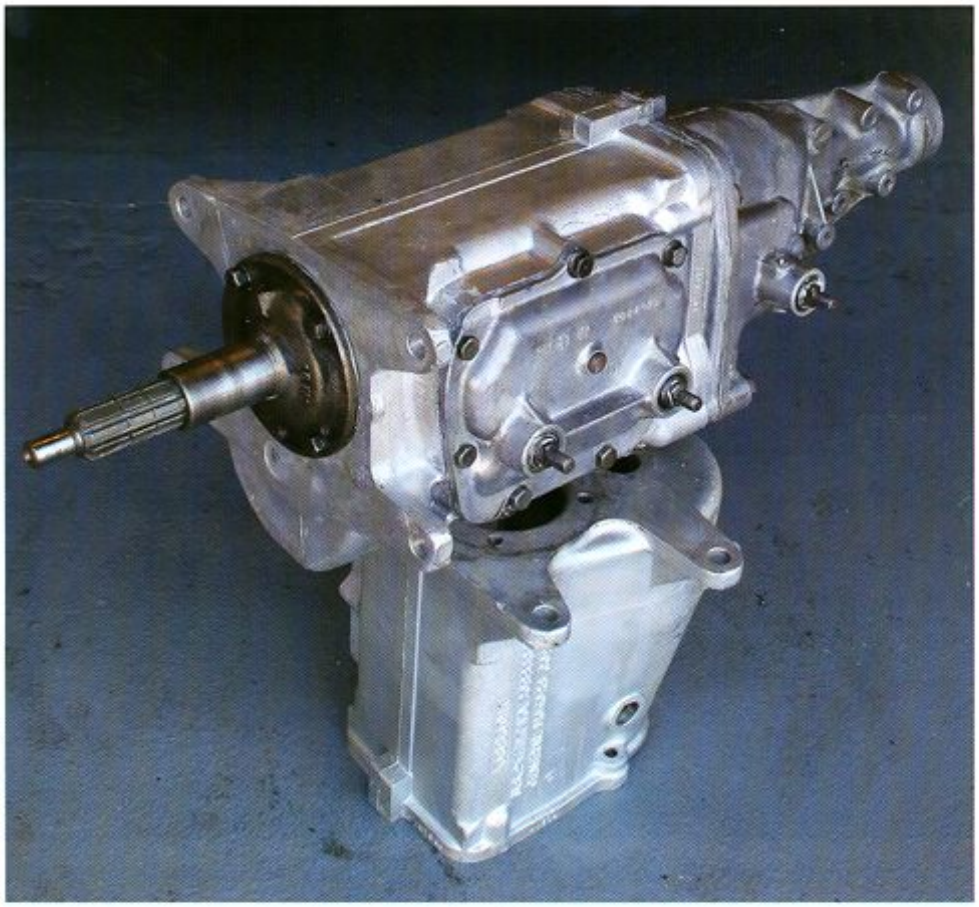
From Gears to Eternity: Part I

Rebuilding a Muncie can make your head spin; Jeff Glenn explains how to do it without freaking out.

Pat Hendrix, of Precision Motive in Hayward CA, has rebuilt plenty of Muncie four-speeds over the last 30 years. It's a job he enjoys doing. For mechanical types, this task is a little like Zen meditation: You unbolt the bits, study what's there, replace the worn items, and reassemble it again. It sounds easy enough, but there are a lot of pieces spinning around in a four-speed. Here's what the job *really* takes.

This particular Muncie M20 was on the bench as part of a complete restoration of a '66 big-block. It wasn't showing any major issues, but in keeping with the spirit of the resto the owner wanted to make it as fresh as he could. By and large, the common faults with these units all stem from excessive wear; symptoms include excessive noise, popping out of gear, grinding during gearchanges, and a refusal to go into gear at all.



A: Let's start with the unit out of the car, on the bench, and drained of oil. The M20 and M21 are easily spotted by their absence of lower drain plugs and small input shafts relative to the race-ready M22 "rock crusher."

Inspect the case for hairline cracks or other damage, particularly at the ears where the box will attach to the bellhousing. If you care, a stamping on the top of the box can indicate whether or not the transmission is original to the car; the last eight digits of the VIN should be stamped into the case. Moving along to the tail housing, check the threaded mount holes at the rear. These are often trashed by gorilla mechanics, as ours was; one hole was going to need a Helicoil insert, which we figured we'd deal with later.

B: Yank the output yoke at the back of the tailshaft cover and inspect the smooth, shiny wear surface for excessive pitting or grooves *(photo 1)*. It's unusual to find serious scarring here; as long as the piece looks decent, just reuse it. Next, find the pin that goes through the reverse-shift cam boss *(photo 2)*. It should be installed from the top to bottom, meaning the wider head goes on top. With a similarly sized drift, drive the pin out from the bottom. To disengage the attached fork, pull the shaft out once the pin is removed *(photo 3)*.

C: The speedometer hooks to the other side of the tailshaft cover. Flip the gearbox over and undo the bolt holding the drive gear. The gear itself is nylon *(photo 4)* and can be easily chewed up by a badly fit mainshaft gear. Pat likes to see how the gear rides in relationship to the hole in the tailshaft cover; a speedo gear that's misaligned (usually, problematic ones have be pushed too far onto the shaft) or one that's crunched up at the edges is a sign of a less-than-stellar previous rebuild. Also check to be sure the seal inside the drive-gear assembly (the one on the opposite side from the nylon gear) is in place and intact. If it's missing, the finished tranny often leaks at the speedo-drive junction.

D: Before removing the side cover and shift forks, you're going to use them to help loosen the large, reverse-threaded bearing-retainer nut at the front of the input shaft.

To access that nut, tap down the French locks on the bearing retainer *(photo 5)*, unbolt the bearing-retainer cover, and pull it away from the shaft. Once it's gone you'll see the big nut holding the bearing *(photo 6)*. During amateur rebuilds, this nut often gets mangled by frustrated mechanics who, not realizing it is reverse-threaded, try to use Vise Grips or crowbars or nuclear warheads to take it off counterclockwise. This often trashes the hole in the input shaft that lets oil return to the case after lubing the bearing, resulting in a small leak into the clutch area that's tricky to diagnose. In any event, to keep the shaft from turning while you work the reverse-threaded nut,

engage any two shift forks with any two gears simultaneously. Then, with the mainshaft effectively locked, take a thin-head gear wrench and loosen the nut by turning "backward," ie. clockwise *(photo 7)*. When it's loose, move the forks back and disengage the gears. Take out the side-cover bolts and the whole assembly will pop off, leaving the shift forks and two shift cams sticking out of the cover.

E: To get the tailshaft cover off, loosen its bolts and tap the cover with a soft mallet to break the seal *(photo 8)*. Next, with its cover off and retaining pin out, the reverse-detent fork will pop off *(photo 9)*, leaving you free to pull the shaft and seal out of the housing *(photo 10)*. Under the reverse-detent fork, also pull the steel detent ball and its spring, followed by the reverse-idler gear. (The latter can be removed by hand.) Take a look at the thrust surface for the reverse idler *(photo 11)*; if it's unduly worn, the tail housing should be sent out for machining.

F: Okay—let's get the mainshaft out of the case. You'll probably need to give the center-bearing support (the thing that looks like a back cover to the case) a few whacks with your rubber mallet to break its seal *(photo 12)*. After that, slide the unit back and tilt the shaft clear of the cluster gears. Don't be alarmed if the sliders fall into the case *(photo 13)*; the rebuild kit comes with replacements. Also, while we're on the subject, it's interesting to note that the old sliders taper on one side only; the new ones are tapered on both sides, a latter-day upgrade that helps keep the gears engaged more reliably. The synchro-hub detent keys may also fall off during the extraction. Don't worry; when you're done, just grab all the loose items at the bottom of the case and put them in a pile for later cleaning.

G: To finish removing the input shaft, knock out the roller bearings inside fourth gear, then stand the case on its end and tap the input shaft down toward the ground. To finish, undo the snap ring on the front bearing (outside of the case), then coax the parts out *(photo 14)*.

H: Removing the cluster-gear assembly will empty out the case. With a punch, tap out the large securing pin *(photo 15)*. The pin is a little bit tapered, so make sure you hit it on the flat side at the front of the case, not the side with a half-moon-shaped key at the back. When it comes free, clear out the inside cluster gear. Needle bearings will be everywhere, but that's okay—you'll be replacing them all with new ones anyway.

I: A long spacer lives between the two sets of bearings. Take this out, putting it with the rest of the parts waiting to be cleaned. Next, check

the large cluster-gear pin for wear. Serviceable pins will be smooth and unpitted. Worn pins will show lines or pits in the surfaces where the bearings ride *(photo 16)*.

J: Inspect the front of the case to see if the thrust washers have ground themselves into the adjoining surface *(photo 17)*. These washers have a tab that's supposed to keep them from spinning freely and galling the case, but when the tab fails the washers can quickly eat up the nearby metal.

K: Pulling the gears from the mainshaft is a lesson in gravity. Third gear and the third-to-fourth synchro hub are all located on the front of this shaft. To free these, undo the snap ring *(photo 18)* and drop the shaft onto a clean concrete surface or stout bench from a height of ten inches or so. It may take a couple of tries to free the assembly *(photo 19)*.

The other gears and the speedo drive have to be pressed off in the other direction. Undo the snap rings for the rear bearing and reverse gear *(photo 20)*, then bring the assembly over to your shop press.

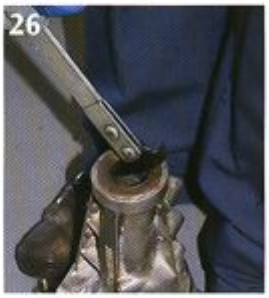
With the speedo-drive gear toward the top *(photo 21)*, press the shaft down until the speedo drive and the other gears slide up and release *(photo 22)*. After that, bring the shaft back to the bench and pull off the speedometer gear, reverse gear *(photo 23)*, bearing, rear plate, and first and second gears. That's it: Once the shaft is clear, the transmission has been fully disassembled.

L: Your rebuild kit *(photo 24)* should include bearings, brass rings, seals, needles, and gaskets. It won't contain major parts like gears and forks, though, so throw all the disassembled parts in the wash pile for closer inspection later. In the meantime, you'll notice the new rear bearing is a heavier-duty unit with more ball bearings than the OE part. That's good, but the rest of the parts ought to match what came out.

Tap the old bearing out of the bearing support *(photo 25)* and throw the support on the ever-rising cleaning pile. Finally, grab the tailshaft cover, extract the rear seal *(photo 26)*, and tap the bushing out toward the body of the case from the rear.

M: Now you're ready to clean all the parts. Put the internal components in a heated parts washer if you have one, or clean them onesy-twosy with solvent and brushes followed by warm water and detergent. Once everything has been sanitized, inspect the parts closely for cracks, excess wear, corrosion, or other issues.

There will probably be considerable wear on the synchro sliders *(photo 27)* and brass rings. Even if they look pretty good, though,



the new-style locking sliders that come in the kit *(photo 28)* are more effective. It's smarter to change them.

N: Carefully study the individual gears *(photo 29)* for pitting, ridges, cracks, or wear lines across the centers of the teeth. Any of these conditions spell curtains for the gear. If the inside of the gear—in other words, where it mates to the mainshaft—is galled, double-check the mainshaft for wear marks, too. Also take an extra-close look at the small engagement teeth that hold the transmission in gear. If there's significant wear here, particularly on the "coasting" side, the tranny will likely pop out of gear.

Our transmission was in pretty good shape overall, but we did find a lot of wear on third gear—consequently, third was replaced with a new part. Its counterpart on the cluster gear looked fine, so that one was left alone. Don't forget to check the center-bearing support for cracks, casting voids, chips, or other flaws before reinstalling it.

O: There are a couple of tricks to know before throwing this stuff back together. First, never re-use any bearings or other small parts; that's why they put new ones in the kit. Second, Pat has found that bead-blasting the shiny surfaces at the rear of the input shaft and on fourth gear *(photo 30)* can make the transmission bite into fourth, rather than lazily sliding into gear like some Muncies do.

He also cleans off the synchro hubs with a wire wheel *(photo 31)*, and in performance rebuilds he'll replicate the better-lubricating first-gear sleeve of later-model Muncies by grinding three small, evenly spaced flat spots around the component *(photo 32)*. These reliefs help keep the first-gear assembly oiled in strenuous racing and autocross use.

P: Okay—you've run out of stuff to disassemble and clean. There's nothing left to do but start putting it all back together.

On the mainshaft, brush some white-lithium grease onto the shaft and slide second gear on from the back until it reaches the forward collar. Next, drop on a new brass blocking ring with the flat collar facing upward *(photo 33)*.

Q: Now take the synchro hub and check the spring clip. If it still has good tension, you can re-use the old spring. All-new synchro keys, sliders, and springs will give a super-notchy shift feel; this quickly wears away and it certainly doesn't hurt anything, but it's a personal call whether a sound used spring or a new one *(photo 34)* is more desirable for you.

I'd say that's enough for today. In the second (meaning final) installment, we'll get the rest back together and take this thing for a spin. ❍