

REAL TECH

The unexpected side benefit of running a magazine is establishing deadlines for your projects – even unrealistic ones – and trying your best to fulfill them. It's brought some much-needed structure to my resto efforts. But some promises made with good intentions still go unfulfilled. Last month, we promised you the February issue would feature rebuilds of a Muncie 4-speed and a 12-bolt rear axle. As luck would have it, the Muncie ended up having a cracked mounting ear, and the 12-bolt was diagnosed with a bad spring perch and bent axle tube. The Muncie story barely made it to print this month, and the 12-bolt housing is being welded and bent back into shape. And that's about par for my often frustrating course of car restoration.

We actually wrote two separate stories chronicling the rebuild of the Muncie M-20 – this one takes you through the process of disassembly, inspection, and rebuild. The second story details the work required to repair a broken

mounting ear so that it's nearly undetectable to anyone but you. That story will follow next month in the March issue.

Sharp eyes will notice that there are two separate M-20 transmissions featured in this article. The trans that's being disassembled is a 1968 Pontiac M-20, and the pile of parts that's rebuilt into the finished product is another M-20 from our '69 Z/28. Both are nearly identical except for the speedometer drive gear – the '68 has a steel pressed gear, and the '69 has a failure-prone

plastic gear clipped to the mainshaft. We show you both designs.

We also show you a great deal more detail than your typical print magazine article. I tried to create the article I wish I'd had to help me work through the trickier parts of my first Muncie build. It's based on the steps outlined in the 1971 Chevrolet Chassis Overhaul Manual but (I hope) more helpful for the first-timer. [Click here for a high-resolution exploded view \(©GM 1971\) to assist you](#), and let's get to work on that gearbox!



By Tony Nausieda



Look for clues to help you ID the trans quickly. Check out the input shaft: 10 spline teeth mean it's 1970 or older, and its two circumferential grooves mean it's a wide-ratio M-20. The 1" diameter countershaft means it's 1966 vintage or newer ('63-'65 Muncie shafts were 7/8").



The date code P8M14 identifies this as a '68 model year Muncie. It's typically stamped on the RH side of the case near the midplate.



Partial VIN is typically stamped on the same region of the case, on the RH side or on top.

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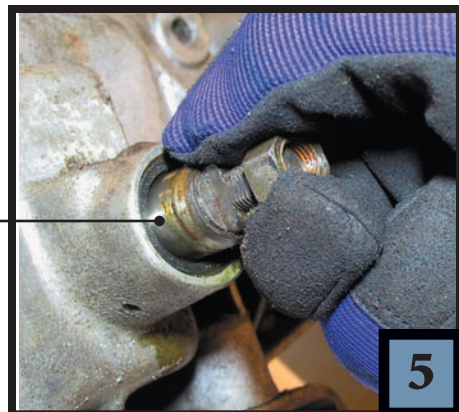


1 Factory-installed Hurst shifters often use a version of this stamped-steel bracket to mount the shifter body to the tailhousing. The monster Phillips-head screw is tough to break loose. Remove the two 9/16" head bolts (already removed in this picture) and lightly tap the plate counterclockwise until the screw breaks free and loosens up – easy!



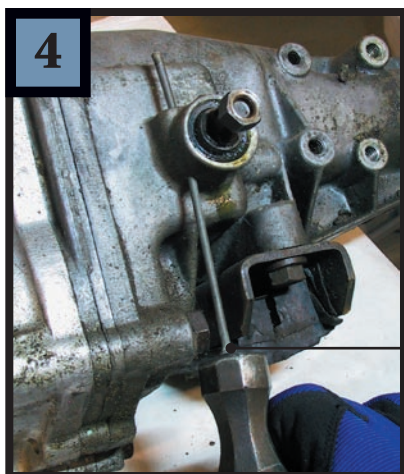
2 With the roll pin removed, pull the reverse shaft out as far as it will go to disengage the reverse lever from reverse gear.

Shift the trans into neutral if you haven't already. 7 1/2"-head bolts retain the side cover assembly to the main case. Remove them and lift off the side cover, shift levers, and shift forks as an assembly. Pry lightly on this corner if the gasket is stubborn.



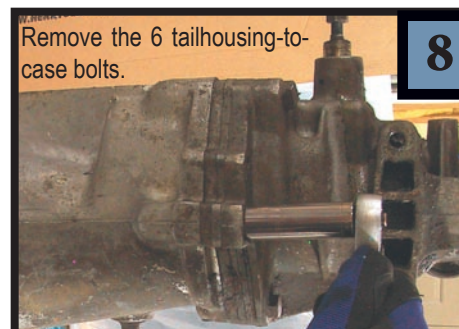
3 Before you get too far into the disassembly, remove the two 5/8"-head bolts that secure the transmission mount to the tailhousing and set the mount aside.

With the side cover assembly removed, it's easy to assess the condition of the gears. Ours were clean, with no obvious pitting, corrosion, or chipping. Don't buy a used Muncie without pulling off the side cover for a look at the internals.



4 Move to the tailhousing, grab a hammer and a small pin punch, and drive out the reverse shaft roll pin from the bottom up. We had to heat up the aluminum boss with a propane torch – your pin may be stubborn, too. Heat it 'til the oil just starts to seep out the shaft seal, and tap away.

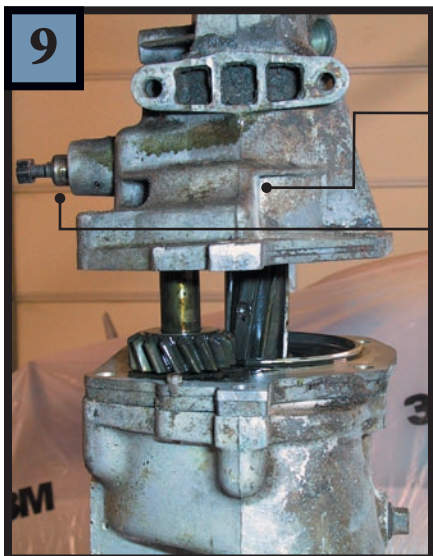
5 Remove the 7/16"-head bolt and clip that hold the speedometer driven gear assembly in the tailhousing. Carefully pull the gear assembly out of the trans and set it aside.



6 Remove the 6 tailhousing-to-case bolts.

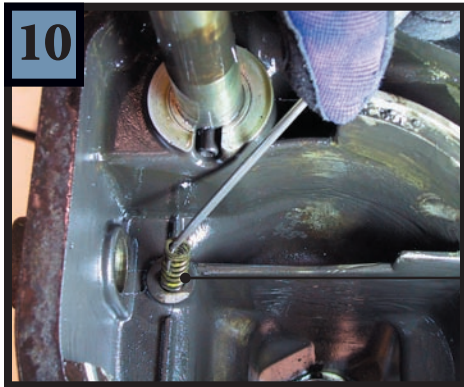
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Flatten the tangs on the French locks and remove the four 9/16"-head bolts on the front bearing retainer. Tap lightly around the snout of the bearing retainer to break its gasket free.



Slowly lift the tailhousing from the midplate. In this picture, the reverse gear is hidden by the tailhousing because the gear is still engaged by the reverse lever. Pull the reverse lever shaft out as far as it will go, and move the tailhousing from side to side to disengage reverse gear and allow removal of the tailhousing.

Shift the transmission into first and fourth gear (any two gears will do) to lock up the mainshaft, and turn the input shaft nut **CLOCKWISE** to remove it – it's left-hand threaded. You'll need a special wrench that's readily available from a good transmission shop – we got ours from www.5speeds.com.

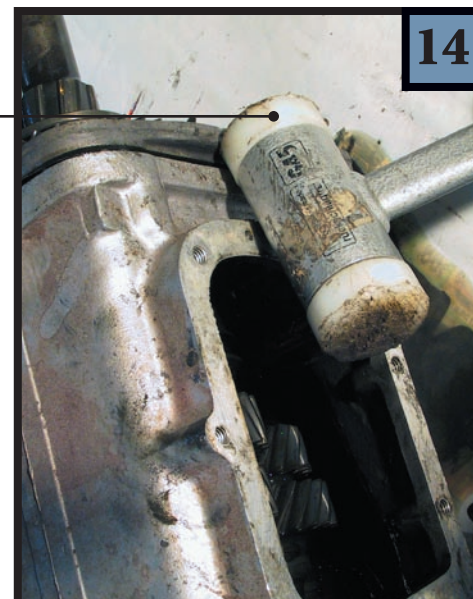


With the tailhousing off, push the reverse lever shaft into the case and set it aside. Watch for the spring-loaded detent ball that pops out of its bore when the lever is removed. Remove the spring from the bore so you don't lose it.



Tap lightly on the midplate with a soft face hammer to disengage its dowel pin from the case. Once free, lift the midplate and mainshaft assembly out of the rear of the case.

Lift the splined reverse idler gear and its smooth thrust washer out of the case. The reverse gear remains on the mainshaft until the speedometer gear is removed at a later stage of disassembly.



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Don't worry if the 3-4 gear slider and its keys fall off the mainshaft as you remove it from the case. With the mainshaft out, you can remove the other half of the reverse idler gear and tanged thrust washer from the case.

Press out the countershaft from the front of the case using a $\frac{1}{2}$ " socket, and support the cluster gear as you pull the countershaft rearward and out of the case. Our countershaft took a good bit of force to remove, probably from lack of lubrication in service.



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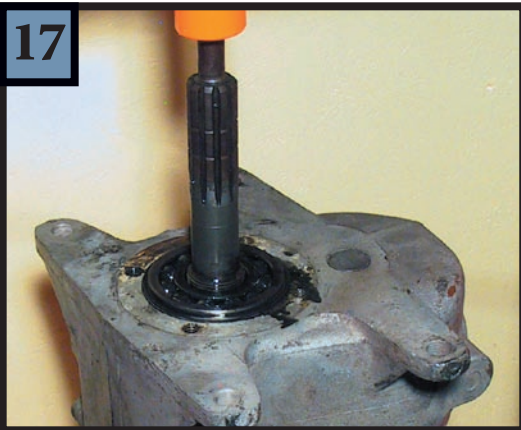
Removing the mainshaft means the 17 bearing rollers and cage that support the front of the mainshaft will also fall into the case. You're going to reuse the cage, at minimum, so bag these together and set them aside.

Remove the cluster gear and its two tanged thrust washers from the case, and set them aside. Gather up all 112 bearing rollers, 6 spacer rings, and spacer tube, and bag everything up.

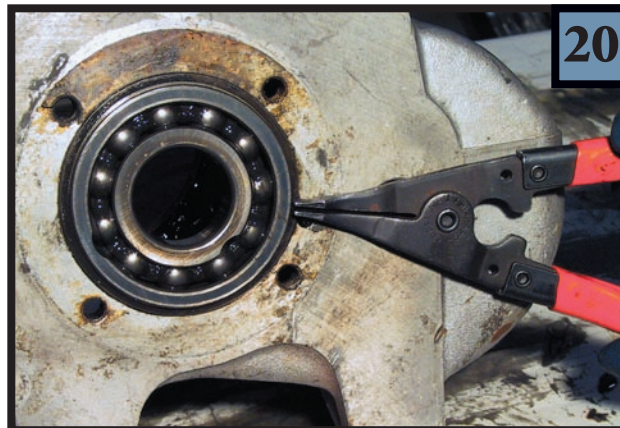


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Support the bottom of the case, and carefully press the input shaft out of the front bearing. The shaft will drop down quite suddenly, so place a rag inside the case to prevent any impact damage to the gear teeth.



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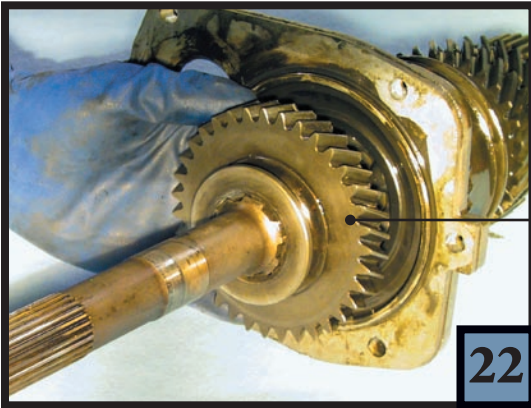
Remove the snap ring from the input bearing and carefully tap the outer diameter (OD) of the bearing into the case. Tapping on the ID can damage the balls – not good if you plan to reuse the old bearings.

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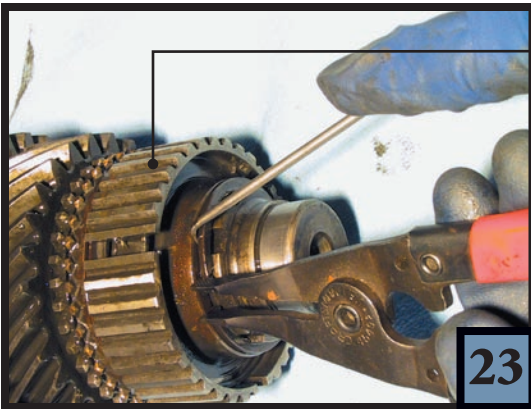
21

First order of business in disassembling the mainshaft is removing the speedometer drive gear. If yours has the plastic gear clipped to the shaft, it's easy to remove. Our metal gear was pressed to the shaft, so we supported the gear with a bearing splitter and whacked the end of the shaft with a soft-face hammer until the gear parted company. Don't let the mainshaft fall on the ground!



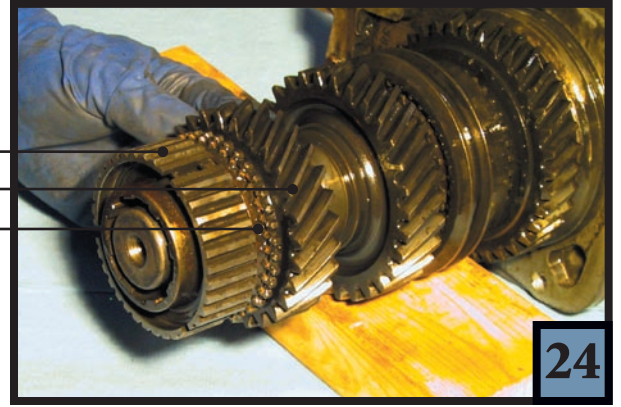
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With the speedometer gear removed, the reverse gear can be slipped off the mainshaft.



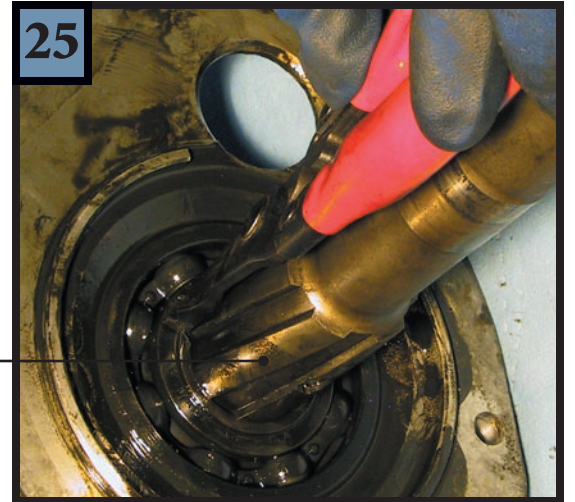
23

Remove the snap ring on the 3-4 clutch hub – if the ring is stubborn, it helps to use a small screwdriver or awl to coax the ring out of its groove as you're expanding it with the pliers.



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Remove the 3-4 clutch hub, 3rd gear synchronizer ring, and 3rd speed gear from the mainshaft.



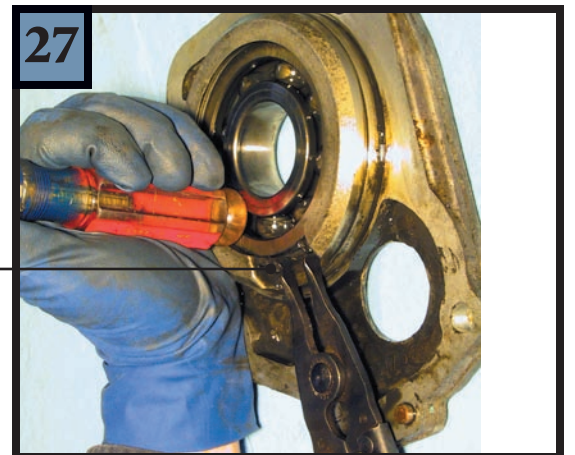
25

Remove the snap ring that holds the rear bearing to the mainshaft, and slip the midplate and bearing off as an assembly.



26

Slide the 1st speed gear and its synchronizer ring off the mainshaft.



27

Spread the snap ring that retains the rear bearing in the midplate, and carefully tap on the bearing OD to drive it out of the midplate.

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Support the bottom of the 2nd speed gear on the press as shown, and press from the rear of the mainshaft to remove the 1st gear sleeve, 1-2 clutch, and 2nd speed gear.

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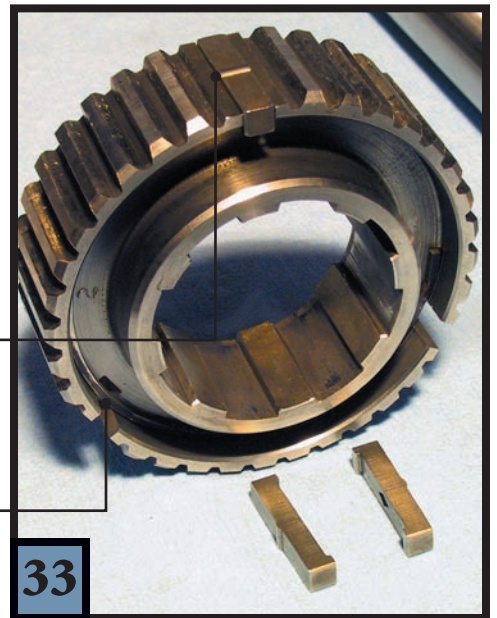
Note the difference in the 3-4 slider and the 1-2 slider. The 3-4 slider has a flat edge facing 3rd gear. The 1-2 slider has a chamfered edge facing 2nd gear. If you mix up the sliders, the non-chamfered edge will scrape (loudly) against the cluster gear in 2nd.

29

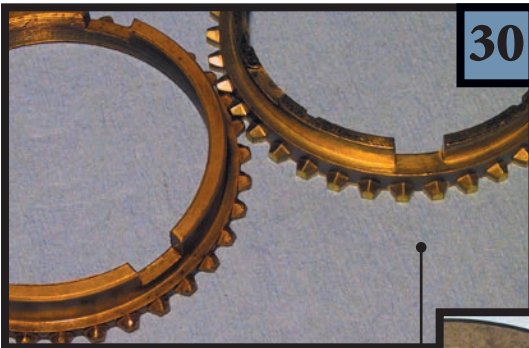


The front half of the table shows what's included in a high-quality rebuild kit, and the rear half of the table holds all the cleaned original parts that we're reusing. Aluminum castings (not shown) were cleaned and glass-bead blasted.

Assemble the clutch hub, springs, keys, and slider before reinstalling on the mainshaft. Install the springs first, then the three keys (with the single tooth pointing outward as shown), then the slider. It's a bit tricky getting the springs to compress enough to allow the slider to snap into place.



33

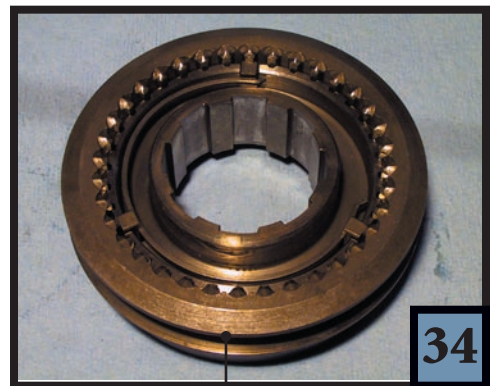


30

The clutch hub slider engages with the face teeth on each pair of speed gears. Fast shifts cause the teeth of each to become blunt or rounded, and may cause your Muncie to pop out of gear. We replaced the 3-4 slider shown here because the leading edges of its splines were pretty well chipped.

The brass synchronizer ring speeds up or slows down the speed gear you select, so its speed matches the speed of the mainshaft. Fast shifting will blunt the pointed teeth on the synchronizer rings (left) – compare its teeth with the new ring on the right.

31

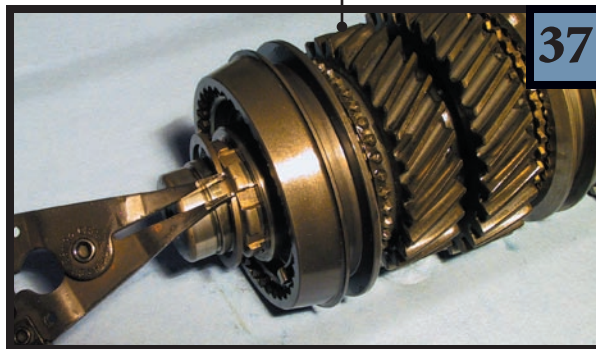


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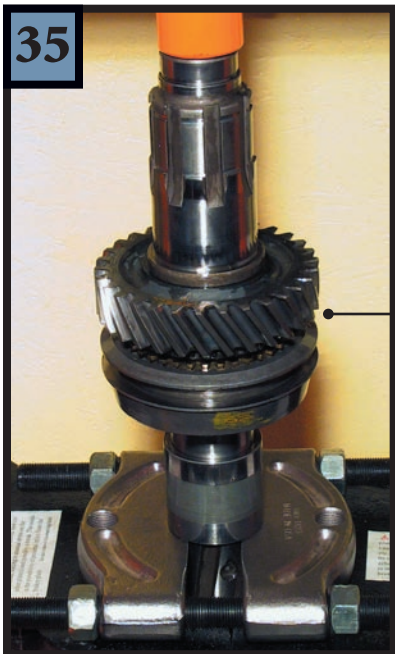
The completed clutch assembly should look like this. Note the chamfered edge, which identifies this assembly as the 1-2 clutch. Pay attention to which direction you install the slider – look at the exploded view diagram to be sure.

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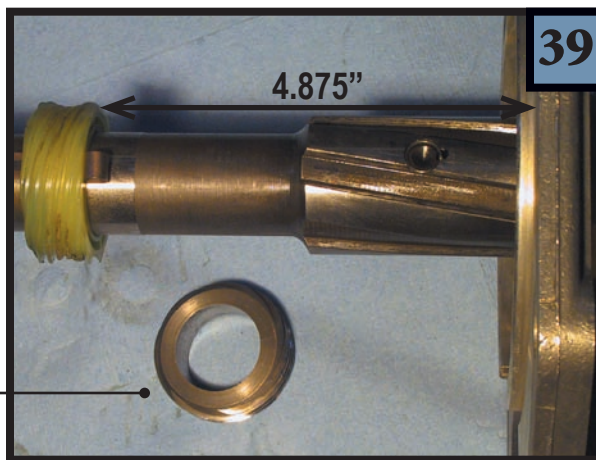
Slide the 3rd speed gear, synchronizer ring, and the 3-4 clutch assembly onto the front of the mainshaft. Install a new snap ring to retain the gears.



Install a new snap ring in the midplate, spread the ring apart with a pliers, and slide the midplate over the mainshaft. Tap lightly on the midplate until the snap ring engages the groove on the bearing OD.



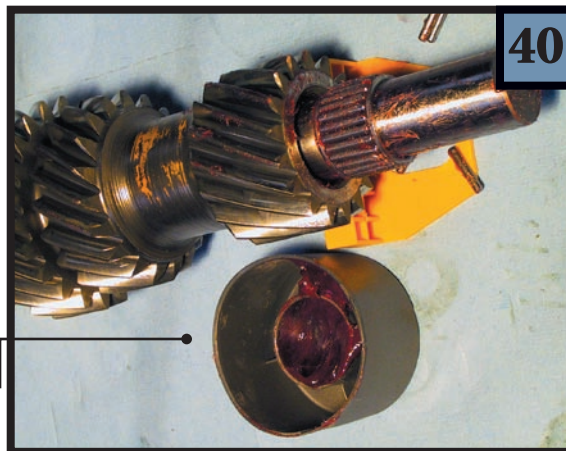
With the 1-2 clutch assembled, you're ready to begin reassembly of the mainshaft. Slide the 2nd speed gear, synchronizer ring, 1-2 clutch, and 1st gear sleeve onto the mainshaft, support the end of the sleeve, and press the shaft into the sleeve until it bottoms out. Use a flat surface like this bearing splitter to apply an even load to the sleeve to avoid damaging its edge. Be sure to coat all sliding and pressed surfaces with gear oil before assembly.



Slide reverse gear onto the mainshaft (not shown here) and install the speedometer drive gear. The original worn-out plastic gear and retaining clip are shown installed on the shaft, but your trans may have the steel drive gear that needs to be pressed on the shaft to a specific depth.

Slide the 1st speed gear, synchronizer ring, and the rear bearing onto the mainshaft. Support the ID of the bearing with a pipe of ~1 5/8" ID and press down on the front of the shaft to drive the bearing in place. Note: make sure the pipe does not contact the bearing OD, as it will damage the balls.

Assemble the cluster gear in this order: spacer ring, 28 needles, spacer ring, 28 needles, spacer ring, tubular spacer, spacer ring, 28 needles, spacer ring (the exploded view really helps here). Use heavy chassis grease on the needles to keep them in place.



The bearing's snap ring groove faces this way.

41



Find a broom handle that's ~0.950" in diameter (it's a pretty common size) and saw off an 8.5" length. Sand the edges carefully to break the corners. Grease its surface, and push it into the cluster gear as you pull the countershaft out the other end. Keep the bearing needles and spacers from being pushed out while you're doing this! Your wooden dowel should be flush with both ends of the cluster gear when installed.

42

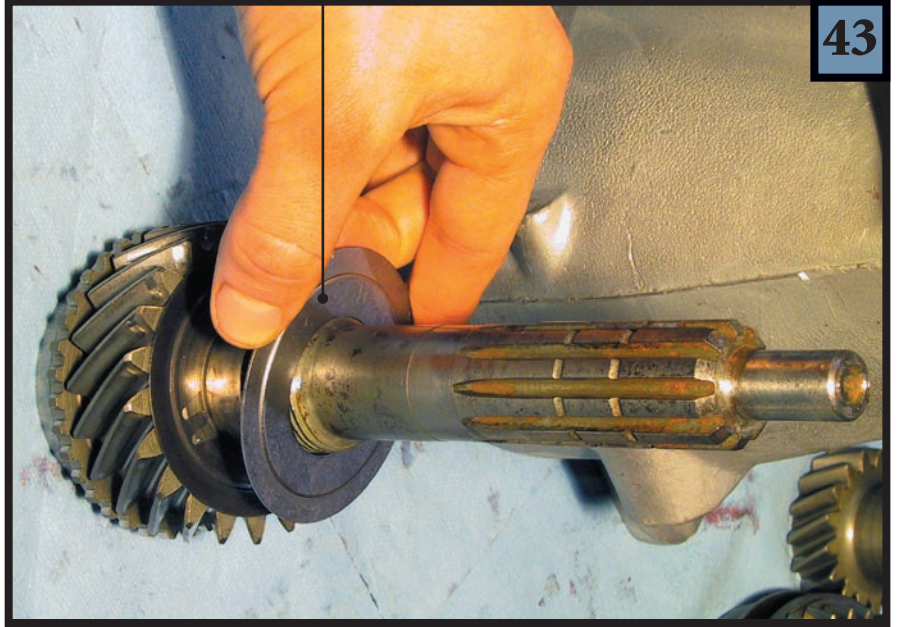


Stick a new tanged thrust washer on each end of the cluster gear, tangs facing out, and hold them in place with heavy grease. Carefully install the cluster gear into the case, making sure the washer tangs engage in the slots that are milled into the case (this is tricky!). Now, install the countershaft into the rear of the case and slowly push it forward, which will, in turn, push your wooden dowel out of the front of the case. Make sure the flat on the rear of the countershaft is pointing downward, as shown, and drive the shaft into place with a soft-face hammer until the front of the shaft is flush with the front of the case. Your installed cluster gear endplay should be less than 0.025" – ours was 0.012".

Our rebuild kit came with a 0.032"-thick oil slinger for the input shaft. We stacked it on top of the 0.021"-thick factory slinger to set 4th gear a little deeper into the transmission for better engagement with the 3-4 clutch.

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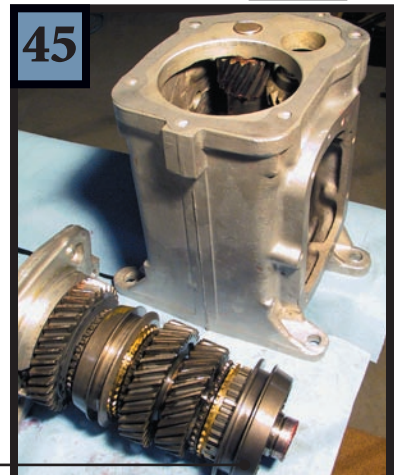


44



Lower the input shaft assembly, minus the front bearing, into the case and place the 4th gear synchronizer ring into position. Install the 17 bearing rollers and cage into the gear's bore, as shown, making sure the rollers are on the **OUTSIDE** of the cage. This is also the time to install the front half of the reverse idler gear and its tanged washer.

45



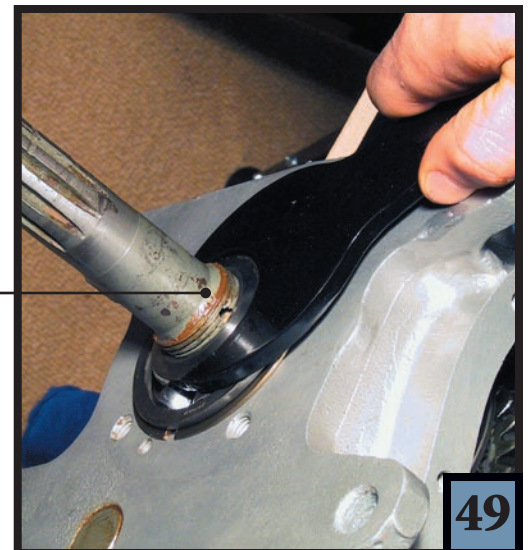
Prior to installing the mainshaft, place a gasket on the rear face of the case. Move the 3-4 clutch slider into the forward position so it engages 4th gear when the mainshaft is lowered into place.

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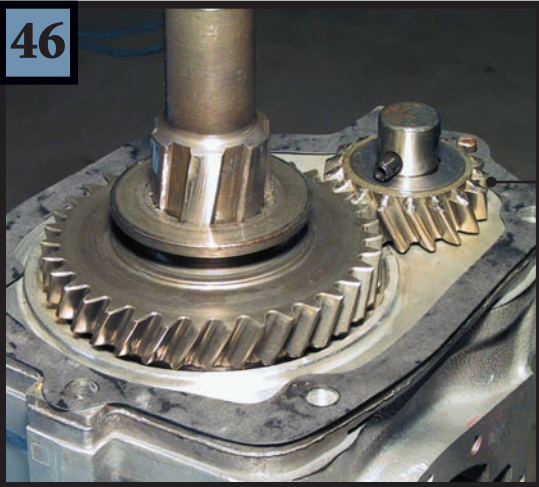
The tailshaft bushing should be replaced to prevent driveshaft vibration. Carefully drive out the old bushing with a punch, orient the new bushing grooves as shown, and drive it in from the rear using a 1 1/4" PVC pipe cap until it's seated flush. Smear some Permatex #1 on the seal bore, and install the output seal.



Install a new snap ring on the front bearing and slide it onto the input shaft. Carefully tap the bearing OD until a few of the input shaft threads are exposed. Shift the transmission into 2 gears at once, and alternate between tightening the input shaft nut (counterclockwise!) and tapping the bearing OD into the case, until the snap ring bottoms out and the nut is ~40 lb-ft.

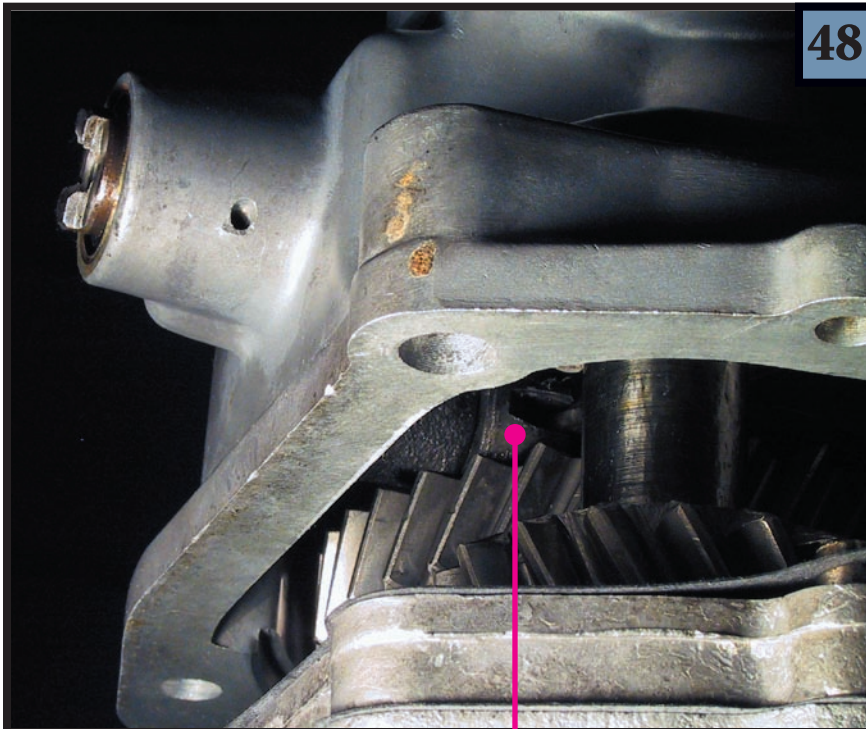


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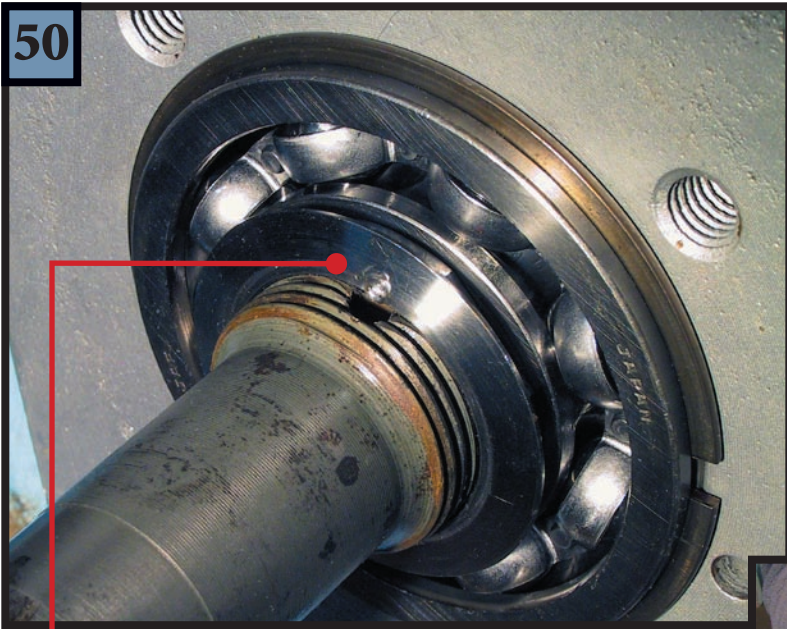
After the mainshaft is lowered into place, make sure the 4th gear synchronizer is properly engaged with the 3-4 clutch assembly, and carefully tap the midplate into place until it seats against the case. Install the other half of the reverse idler gear, smooth thrust washer, and idler shaft (the roll pin should be vertical), and place a new gasket on the rear face of the midplate as shown.

48



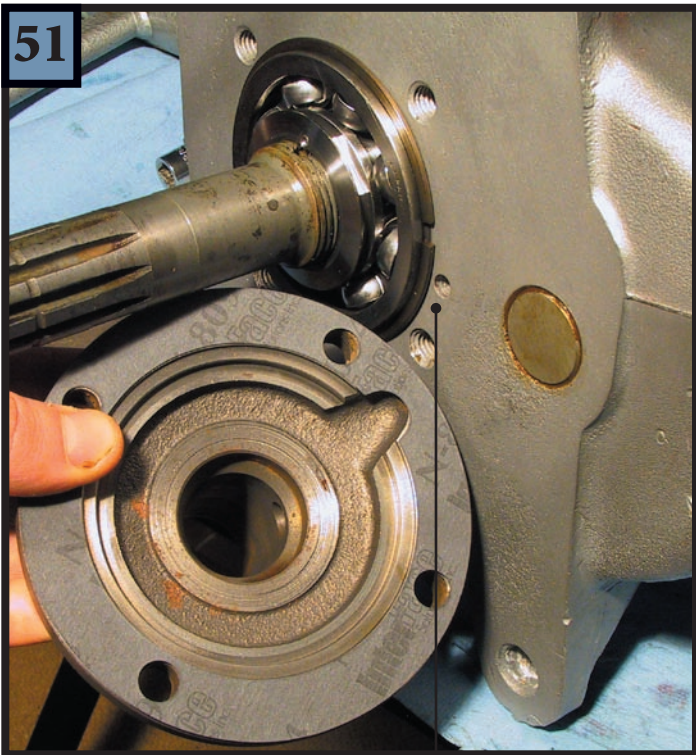
Install a new shift lever seal in the tailhousing (the lip faces outward) and reinstall the reverse lever and its spring-loaded detent ball. Make sure the reverse gear lever is in the forward position, and pulled out as far as it can go. Lower the tailhousing into place, and carefully line up the reverse lever groove with the reverse gear collar. Push the reverse lever shaft all the way into the tailhousing, and verify that its groove engages the collar on reverse gear, as shown. Continue to lower the tailhousing into place, now making sure the reverse idler shaft is properly piloted. If you encounter resistance, check that the reverse idler shaft roll pin is oriented vertically. Torque the 5/8"-head and 9/16"-head bolts to 30 and 20 lb-ft, respectively. Drive the reverse lever roll pin into place using a punch.

50



Stake the input shaft nut with a center punch over the hole in the shaft to retain it in place.

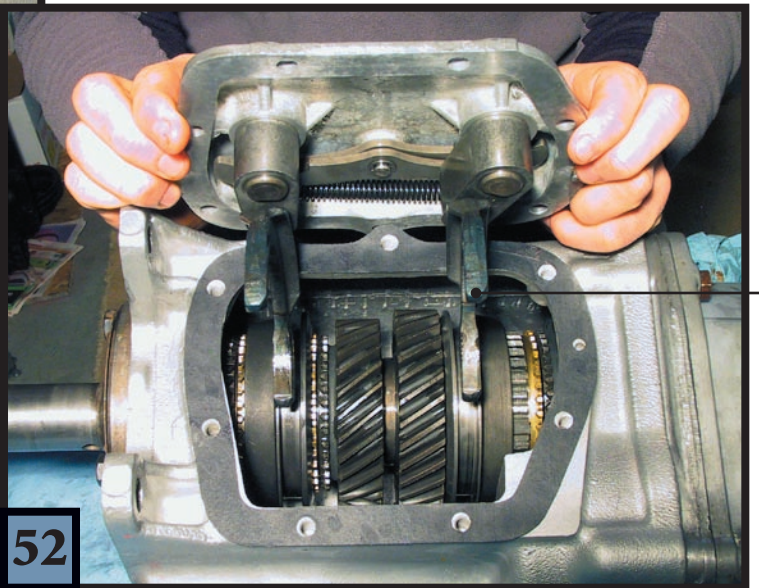
51



Install a new gasket on the front bearing retainer and mount it to the case with the French locks and 4 9/16"-head bolts. Make sure the retainer's cast recess is aligned with the drilled drain hole on the case. Use sealer (Permatex #1 works) on the bolts and torque to 25 lb-ft. Bend over the tabs on the French locks to hold the bolts in place.

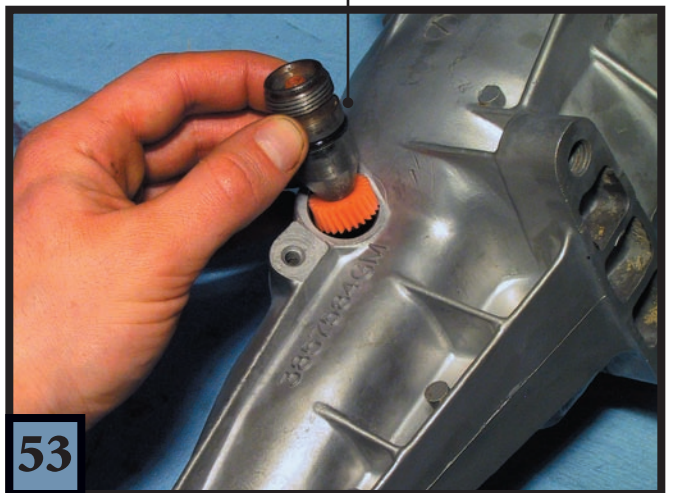
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Install new shift lever seals on the side cover (lips pointed outward) and reassemble the shift arms, spring-loaded detent "scissors" and shift forks. Measure the tips of each fork and replace the fork if they are smaller than 0.330." Make sure the 1-2 clutch and fork are in 2nd position, and the 3-4 clutch and fork are in neutral position. Place a new gasket on the case, lower the side cover assembly into place, and tighten the 7 1/2"-head bolts to 20 lb-ft.



52

Install a new O-ring on the speedometer driven gear assembly, lubricate the bore, and push the assembly into the tailshaft until the groove lines up with the clamp. Snug the bolt.

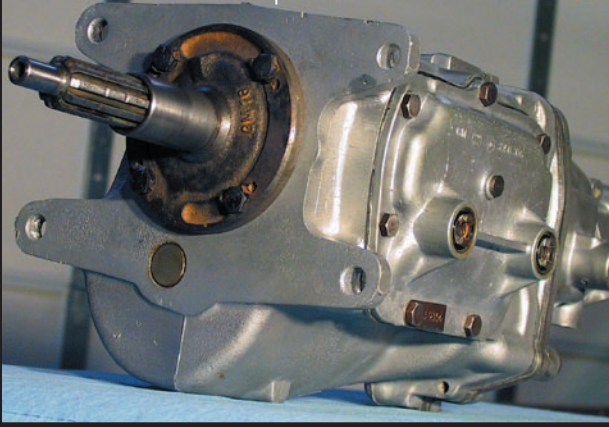


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The aluminum castings look great after 1) glass bead blasting and 2) scrubbing with a white Scotchbrite pad and water for an as-cast look.



PROJECT LOG

Time: 16 hours (but we do work slowly)

Price: varies by vendor (see below)

-Click on description for website link-

Description	Vendor	Part Number	Price*
Rebuild Kit	Medatronics	BK-297A	\$179.00
Rebuild Kit	Muncie4speed	OH-297C	\$130.00
Clutch Slider	Medatronics	T85B-15	\$38.50
Clutch Slider	Muncie4speed	T85B-15	\$34.25
Input Nut Wrench	Medatronics	M-Wrench	\$29.95
Glass Bead Blast	S&S Stripping	N/A	\$40.00
Hydraulic Press	Harbor Freight	32879	\$239.99
Punch Kit	Harbor Freight	4885-3VGA	\$8.99
1 1/4" PVC Cap	Lowe's	51409	\$1.24
Bearing Splitter	McMaster-Carr	6342K2	\$59.53

*All prices are quoted as of January 30, 2006.
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