Ford's New M5R4: A Radical Design Change in Rear-Wheel-Drive Manual-Transmission Technology

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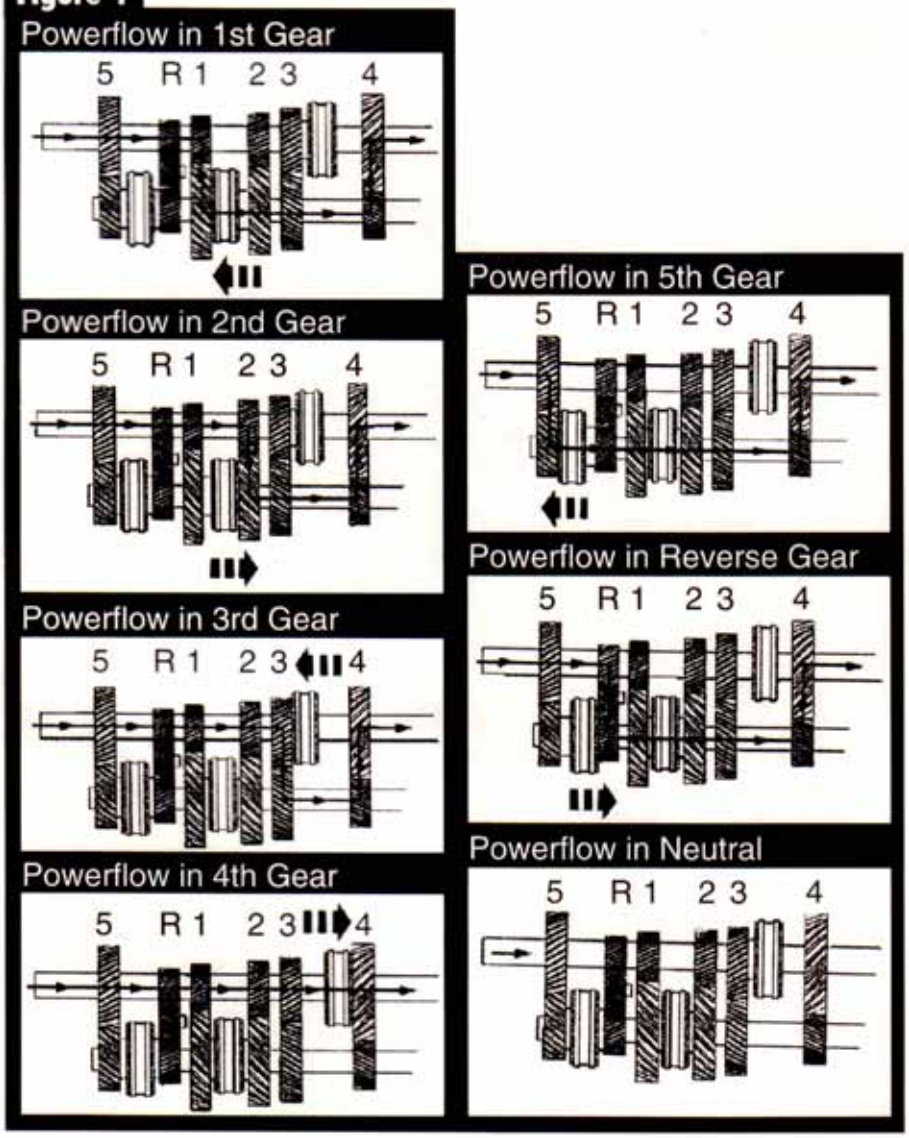
Figure 1



In 2002 Ford introduced a new four-door model of the venerable Explorer and its sister, the Mercury Mountaineer. The manual-transmission option for the new four-door model is a five-speed fully synchronized unit designated the M5R4 or M5OD-R4. The M5R1 transmission we all know and love has been replaced by a radical new design built by Mazda. This unit bears no resemblance to the M5R1.

The new model has a detachable bellhousing, a main case and extension housing, all made of aluminum. The mainshaft and countershaft are supported by tapered bearings with shims under the races to set endplay. All speeds are fully synchronized with helical-cut gears. The speed gears all run on needle bearings on the shafts. Gone is the removable shift cover, and all shift components are housed in the main case. Mercon ATF is the lubricant fill specified for the M5R4.

Ratios are:
1st gear – 3.38-1
2nd gear – 2.06-1
3rd gear – 1.30-1
4th gear – 1.0-1
5th gear – 0.790-1
Reverse – 3.70-1

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Up To Standards

The M5R4 represents one of the most-radical design changes in rear-wheel-drive manual transmissions. Traditionally, rear-wheel-drive stick units have been designed with 4th gear being the input shaft. The input was relatively short, with the drive gear mounted behind the input bearing and a pocket in the input to support the pilot journal of the mainshaft on a needle or tapered bearing. On the M5R1 unit the 3-4-synchronizer assembly is on the mainshaft directly behind the input gear. The 1-2 speed gears and synchronizer assembly and the 5th and reverse driven gears are on the mainshaft. The 5th and reverse speed gears and synchronizer are mounted on the countershaft.

The design of the new M5R4 locates the 5th gear as the first gear on the input shaft, followed by reverse, 1st, 2nd and 3rd gears, in that order. At the rear of the input shaft is the 3-4-synchronizer assembly. Fourth gear is part of the shortened output

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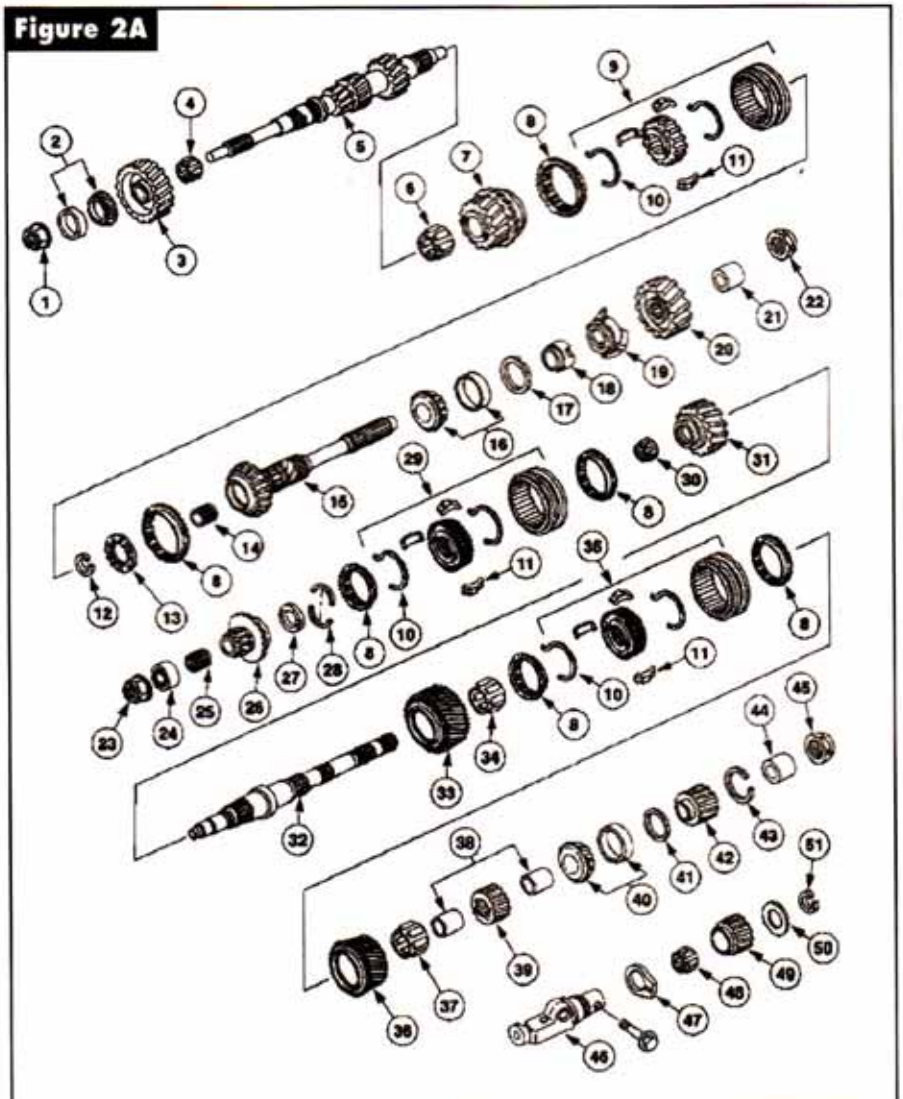
Figure 2A



shaft or mainshaft. Mounted on the countershaft are the 5th and reverse synchronizer and speed gears and the 1-2 speed gears and synchronizer assembly. The input gear drives the 5th, 1st and 2nd gears and the reverse idler gear. We have included a parts illustration and power-flow charts to help you understand how this design works.

Three stirrup-shaped shift forks ride on shift rails and are positioned by three pairs of shift-fork lock plates that are bolted through the sides of the main case. There is a conventional detent and interlock system to give the driver shift feel and to prevent engaging two gears at once.

Figure 2B

Item	Part Number	Description
1	—	Input-shaft locknut
2	7025	Input-shaft bearing and bearing cup
3	7112	Fifth gear
4	7R130	Fifth-gear needle bearing
5	7017	Input shaft
6	7133	Third-gear needle bearing
7	7101	Third gear
8	7107	Synchronizer blocking ring
9	7124	Synchronizer assembly, third and fourth gears
10	—	Synchronizer key spring
11	7A044	Synchronizer key
12	7030	Retaining ring
13	7C096	Needle bearing
14	7064	Input-shaft needle bearing
15	7061	Output shaft
16	7121	Output-shaft bearing and bearing cup
17	7029	Shim
18	7072	Spacer
19	7046	Fluid-slinger ring
20	7L231	Output-shaft gear
21	7R205	Output-shaft bearing
22	—	Output-shaft locknut
23	—	Countershaft locknut
24	—	Countershaft front bearing and bearing cup
25	—	Countershaft fifth-gear needle bearing
26	—	Countershaft fifth gear
27	—	Thrust washer
28	—	Thrust washer (2 piece)
29	7124	Synchronizer assembly, fifth and reverse gears
30	—	Reverse-gear needle bearing
31	—	Reverse gear
32	7113	Countershaft
33	7100	Countershaft first gear
34	7127	First-gear needle bearing
35	7124	Synchronizer assembly, first and second gears
36	7103	Countershaft second gear
37	7133	Second-gear needle bearing
38	—	Inner race
39	—	Countershaft third gear
40	—	Countershaft bearing and bearing cup
41	7119	Countershaft shim (selective fit)
42	7158	Fifth gear
43	7064	Retaining ring
44	7R205	Countershaft rear bearing
45	—	Countershaft rear locknut
46	—	Reverse-idler-gear shaft
47	—	Thrust washer
48	—	Reverse-idler-gear needle bearing
49	—	Reverse idler gear
50	—	Reverse-idler-gear washer
51	—	Retaining ring

Study the power-flow diagrams and parts schematics in Figures 1 through 5, as the diagnostic routines will be very different on the M5R4 because of the unconventional gear placement. We are used to seeing the geartrain mounted from front to back as 4th, 3rd, 2nd and 1st. Here we have 5th, reverse, 1st, 2nd, 3rd and 4th. Studying the design, we see

Figure 3A
Transmission Internal Components – Disassembled View

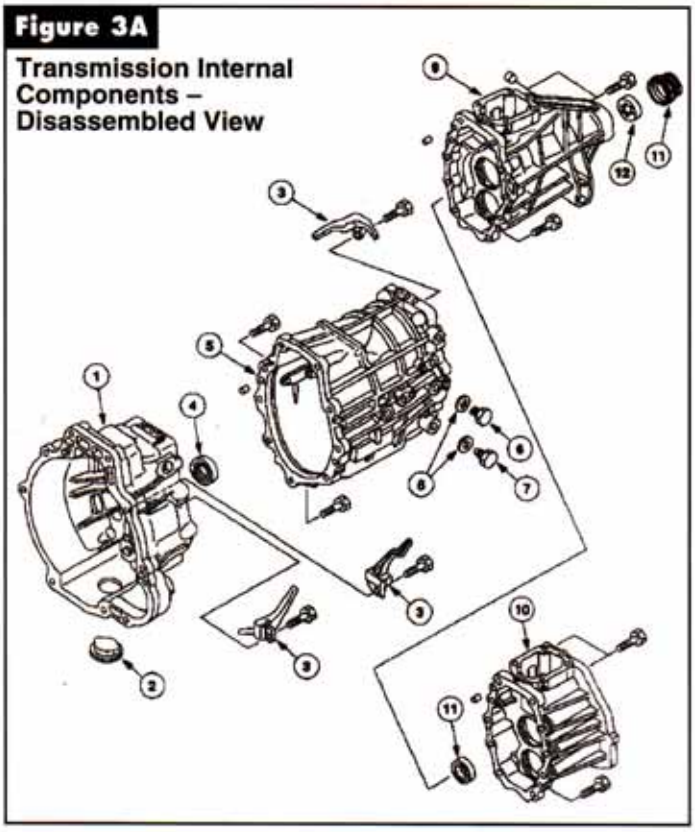


Figure 3B

Item	Part Number	Description
1	7505	Clutch housing
2	7564	Inspection hole cover
3	7A174	Oil trough
4	7052	Input oil seal
5	7005	Transmission main case
6	7A010	Fill plug
7	7A010	Drain plug
8	—	Plug gasket
9	7A039	Extension housing (4x2 vehicles)
10	7A039	Extension housing (4x4 vehicles)
11	7052	Output seal
12	—	Anti-spill seal

Figure 4A
Transmission Shift Components – Disassembled View

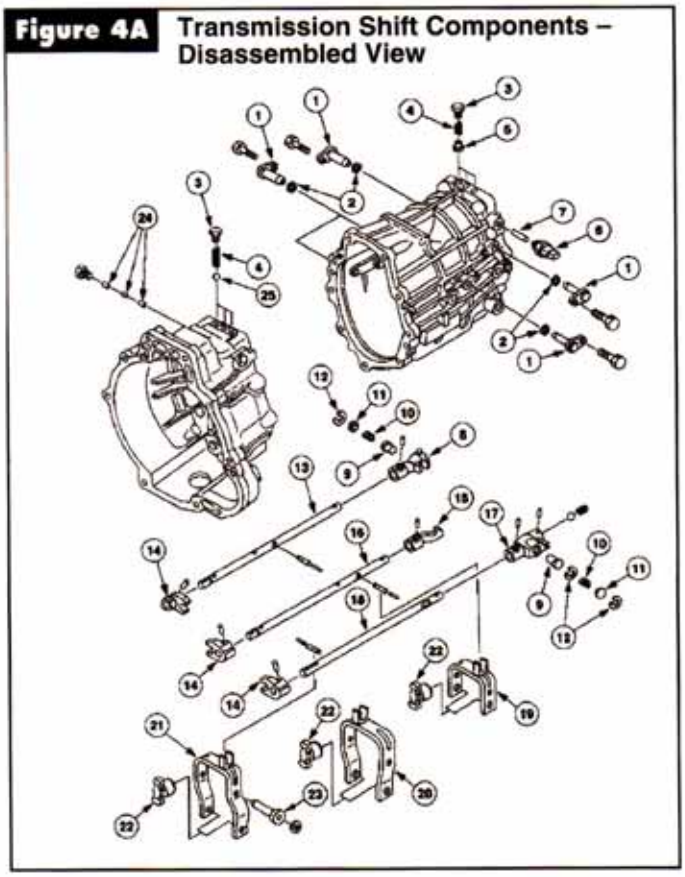


Figure 4B

Item	Part Number	Description
1	—	Shift-fork lock plate
2	—	O-ring
3	—	Shift-rail friction plug
4	—	Friction spring
5	—	Friction spring seat
6	—	Reverse-lamp switch
7	—	Reverse-lamp switch pin
8	—	First and second shift-rail end
9	7247	Push pin
10	7N120	Spring
11	—	Washer
12	—	Retaining ring
13	7240	First and second shift rail
14	—	Shift-rail stop
15	—	Third and fourth shift-rail end
16	7241	Third and fourth shift rail
17	—	Fifth and reverse shift-rail end
18	—	Fifth and reverse shift rail
19	7230	Third and fourth shift fork
20	7239	First and second shift fork
21	7231	Fifth and reverse shift fork
22	—	Shift-fork pad
23	—	Shift pin
24	—	Interlock pins
25	—	Checkball

Figure 5A

Transmission Shift Components — Disassembled View

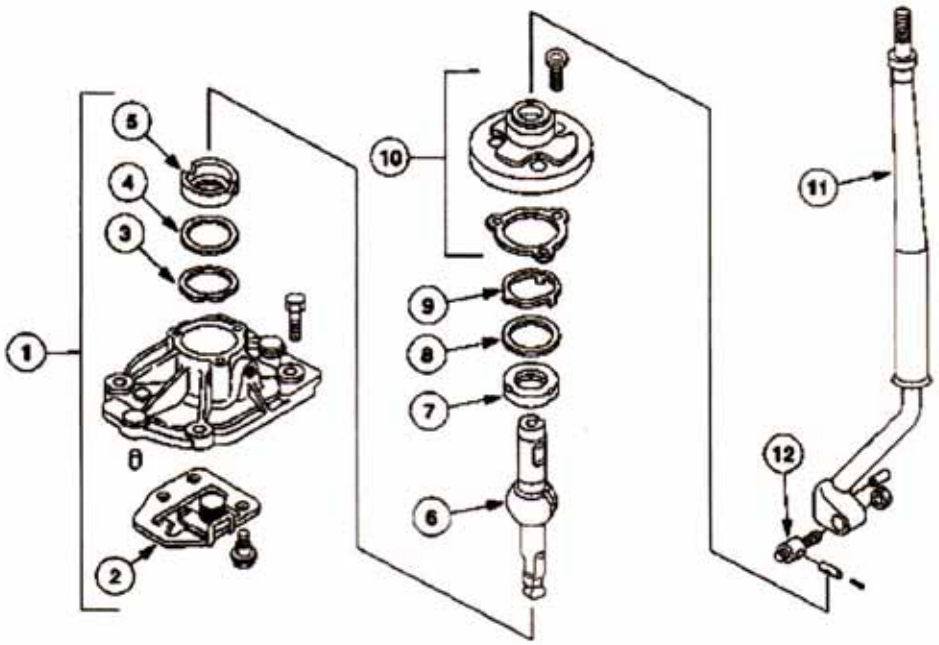


Figure 5B

Item	Part Number	Description
1	7222	Shift housing assembly
2	—	Shift guide assembly (part of 7222)
3	—	Spring washer (part of 7222)
4	—	Washer(part of 7222)
5	—	Dust boot (part of 7222)
6	—	Lower shift lever
7	—	Dust boot
8	—	Washer
9	—	Spring washer
10	—	Lower-shift-lever retainer
11	7210	Upper shift lever
12	—	Upper-shift-lever bolt

that the input shaft resembles the design found in a transaxle rather than that in a rear-wheel-drive truck transmission.

With this being the introduction year for this gearbox, it is too soon to judge the durability of this design, but time will tell. One thing I've learned in the decades I've spent in auto repair is that it is never dull and that change in vehicle and component design will never stop. This design may not start a trend, but we will learn to service and repair these units profitably because we are professionals. TD