ENGINE SWAP SERIES

TRANS-PLANTS

Everything you need to know to swap a 4-speed behind your swapped engine.

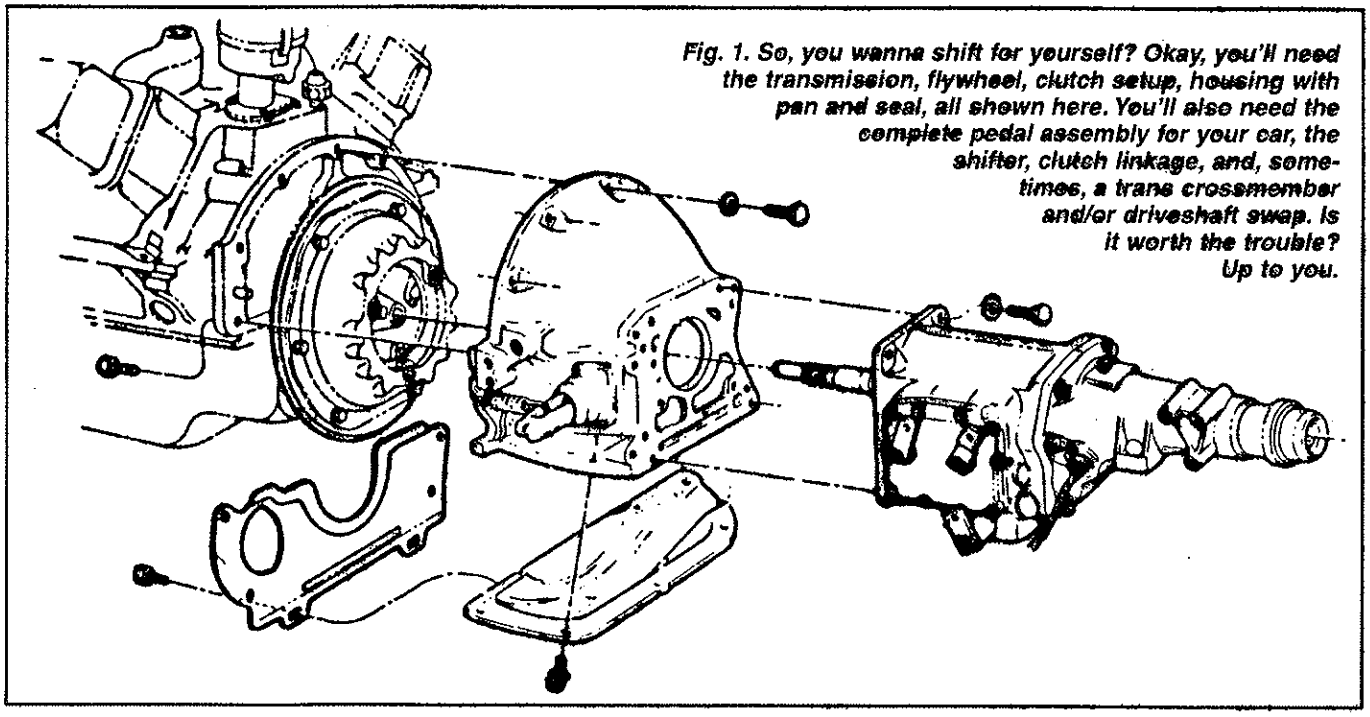


Fig. 1. So, you wanna shift for yourself? Okay, you'll need the transmission, flywheel, clutch setup, housing with pan and seal, all shown here. You'll also need the complete pedal assembly for your car, the shifter, clutch linkage, and, sometimes, a trans crossmember and/or driveshaft swap. Is it worth the trouble? Up to you.

Story and Photos by Richard Ehrenberg

Okay! Armed with the cool, rad, awesome information in our first installment, you've got your engine swap pencilled in upstairs. But, now you've got to back it up—with a transmission. Here, your choices are many. Automatic or manual? 3- or 4-speed? Column or floor/console shifter? Stock or tweaked? Never fear, we'll walk you though the options and permutations. For this installment, we'll cover manuals, so stay tuned to this program.

One more reminder: we're covering '62-up wedge engines *only.*

THE BASICS

Chrysler has built and/or sold several different manual transmissions over the last few decades. These run the gamut from ancient Warner gear 3-speeds and T-10 4-speeds, to import-based 5-speeds (trucks) and the Viper's 6-speed. But, for all intents and purposes, there's really only one transmission to consider: the A-833 4-speed. Why discount the others, you ask? The truck boxes have stump-puller, super-wide ratios, and the neatest one isn't very

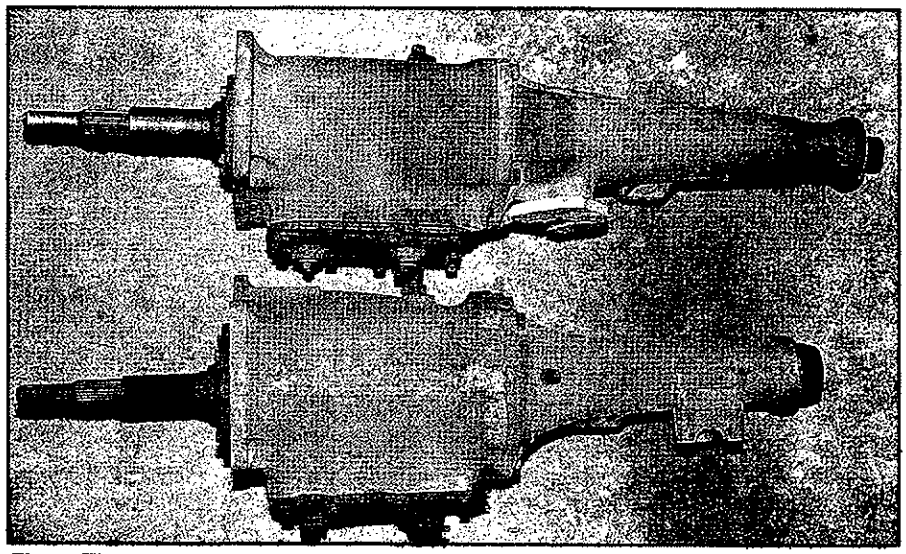


Fig. 2. The top trans is a pre-1970 B-body unit: note the single shifter mounting area well forward on the extension housing. Below is a typical '66-up A/F-body unit, which only had one shifter location for all years.

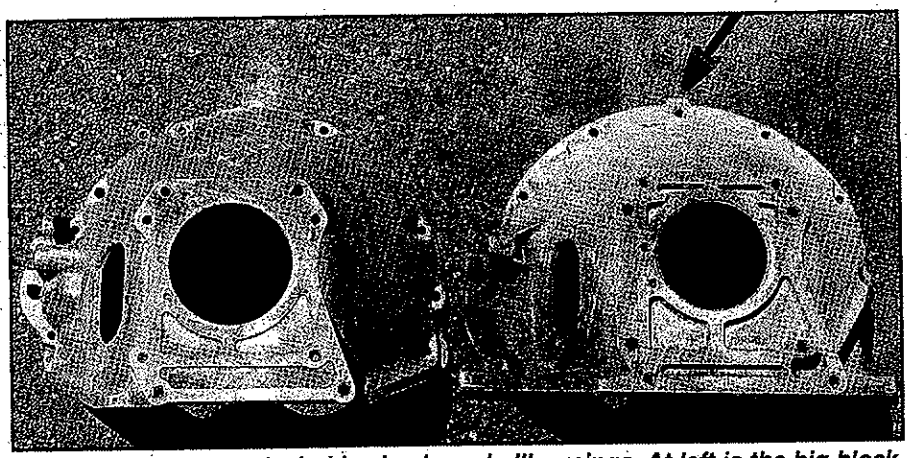


Fig. 3. These are two desirable aluminum bellhousings. At left is the big block piece, right is smallblock. Note dual trans bolt patterns (for A-833 and A-230 3-speed), which means that a junkyard 3-speed car does have the housing you need. How to tell which is which at a glance? Well, the bottom pan surface of the BB unit is bevelled, and doesn't bulge out as does the SB housing. For us, though, there's one sure (and easy) way: find a top-center bolt hole? (Arrow). It's a small block piece, for sure.

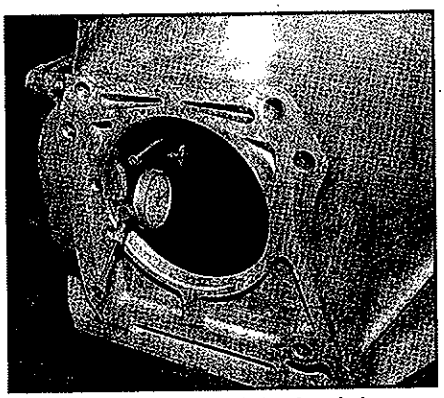
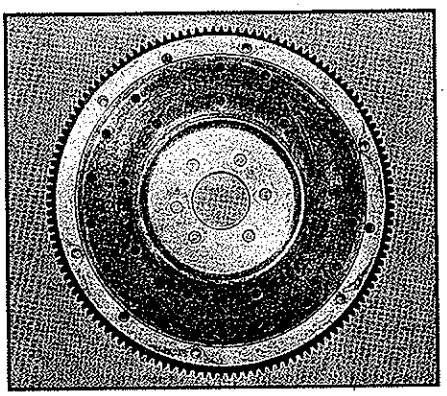


Fig. 4. No matter which clutch housing you use, be sure to check (and correct) any concentricity and parallelism errors. See any Mopar service manual for the procedure.



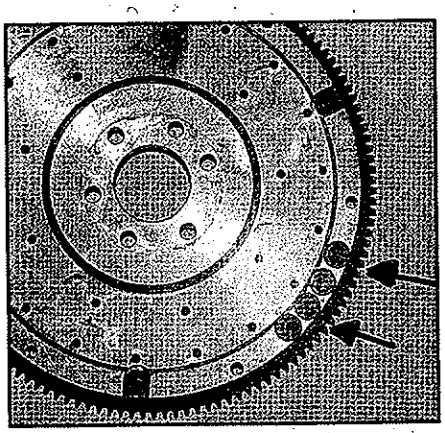


Fig. 5. OEM or aftermarket, be sure you're getting the right flywheel. A light aluminum 'wheel, like this specimen (top), is good for cars with a favorable torque to weight ratio. Note riveted wear surface. Bottom, the back of this 'wheel shows lots of balance weights (arrows). It's a 360 unit.

strong. The Viper box is expensive and won't bolt to any of our muscle-era engines. The Warner T-10 can't handle a healthy big block, and the 3-speeds? C'mon. Some even had crash-box first gears. Since we're limiting the scope of this series to stock-type TransPlants, the 833 is the obvious choice.

The A-833 was introduced in 1964 in two versions: a long-extension unit for the big cars with a 2.66 first gear, and a 6-cylinder version with 3.09 low, initially used behind slant sixes in A-body cars. (Not to worry, the slant-six version was just as beefy as the 426 unit.) Both of these trannys used bolt-up companion flanges on the output (for the ball-and-trunion U-joint) and small speedo pinions. Despite the 3.09-low unit's 6-cylinder designation, this gearset can be useful for launching heavy cars, or those with high (numerically low) axle ratios.

As the 1960s progressed, the A-833 underwent almost annual changes. Over the years, several other gearsets were designed, the output was changed to sliding spline, interlock and synchro designs were changed, and aluminum cases were offered. Shifter vendors were flip-flopped (from Hurst, to Inland, then back to Hurst). The intricacies of the A-833s internals, including gear ratios, etc., have been covered in these pages (Mopar Action Tech Special No. 3, which is still available for $5.50 postpaid. See coupon on page 86) But,

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there are several factors affecting swapability, so let's check 'em out:

CASE LENGTH and SHIFTER LOCATION

This is probably the no. 1 detail to check when you're shopping the swaps. There were two distinct case lengths (see fig. 2) with the shorty unit designed for A and F-bodies, and the longer unit for B, C, and E-body vehicles. Later big trannys carried two shifter locations, one of which is necessary for E-body and later ('71-up) B-cars.

FRONT PINION BEARING RETAINER O.D.

This is probably the no. 1 trouble spot. There are three different bearing retainer diameters. All early, and many later, transmissions used the small, 4.35-inch retainer o.d. Hemi transmissions used a larger, 4.80-inch unit, while the later, aluminum overdrive versions used a huge 5.12-inch version.

Why is this so important? Well, if your transmission has a larger pilot than your clutch housing, it simply won't fit. Almost as bad, if the retainer o.d. is too *small*, there will be no practical way for the transmission to properly center (pilot) itself to the housing.

These are several fixes. First, most clutch housings designed for the small pilot can be machined for the mid-size retainer. Warning: this must be done by someone with proper machining equipment and skill, so that concentricity is maintained. If you've scored an overdrive unit, you can simply get the correct, stock clutch housing,assuming you have a smallblock. There is no stock housing to mate the o.d. trans to a big block.

Another out is to swap the bearing retainer itself. This is only feasible on transmissions equipped with the smaller (#307) input bearing, identified by the 3.7″ bolt circle of the retainer. These retainers are clearly listed in the current Mopar Performance catalog.

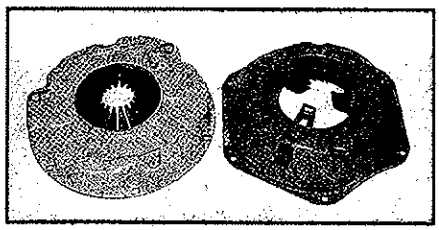

Fig. 6. Through the decades, the vast majority of RWD muscle Mopars were equipped with the simple and reliable Borg and Beck pressure plate (right). The only drawback? Mega pedal pressure. Consider using, instead, a modern diaphragm pressure plate (left).

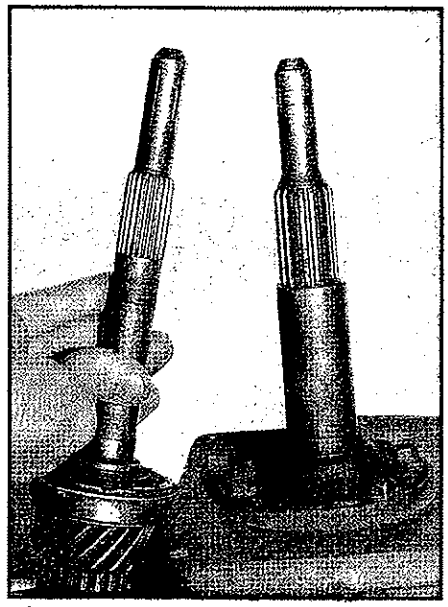

***Fig 8. The vast majority of A-833s used the 1″x 23-spline input shaft (left). Hemi boxes used the super-beefy 1-3/6 x 18-spline unit (right). This required a special bearing retainer and release bearing.* Both, however, fit the same pilot bushing.**

CLUTCH/HOUSINGS/FLYWHEELS/CRANKSHAFT

Chrysler has produced a dizzying array of housings over the years. Up until the 1969-'70 standardization years, most were cast iron, and were drilled for a single transmission application. There were versions for flywheels with varying ring gear tooth counts, direct-drive and gear-reduction starters, and drilled for clutches ranging from 9-1/8″ to 11 inches.

By the early '70s, thankfully, the selection of common housings was pared down to a useful two: one for big blocks, and one for smallblocks, (fig. 3)

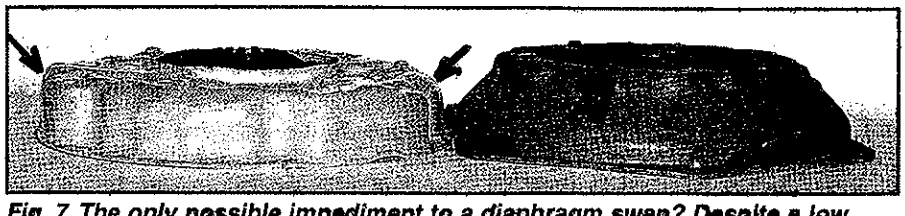

Fig. 7. The only possible impediment to a diaphragm swap? Despite a low profile, the "corners" are "square" (arrows). On some bellhousings this can be a point of interferenee (see text).

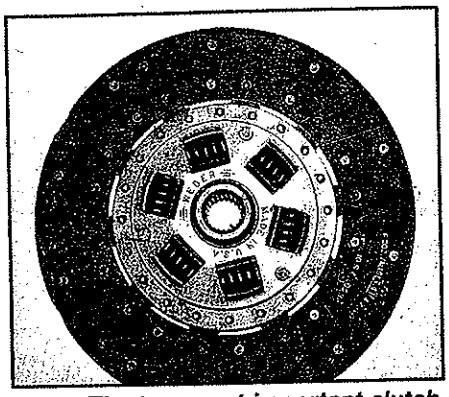

Fig. 9. The two most important clutch disc parameters are: Is it the right diameter? Does it have the correct drive spline? (This one's the common 1" x 23-spline configuration.)

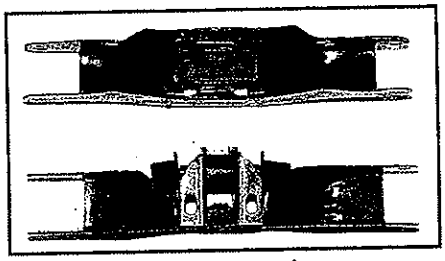

Fig. 10. Trans crossmembers were produced with two different mount systems. The late, spool-type setup (bottom) is preferred for it's fail-safe design.

with multi-trans bolt patterns drilled. Plus, they were cast of weight-saving aluminum, and used the ubiquitous corporate starter. Flywheels were nearly all 130 tooth, and all clutches were 10-1/2" (or the interchangeable 10.95" scalloped unit). Obviously, these housings are the most desirable for swapability, although, as we'll see, the best plan for a swap is to simply procure an entire setup from one source. Doing this usually provides you with not only the housing itself, but the pan and dust seal as well.

Whatever housing you wind up with, be sure to check its concentricity with the crankshaft (fig. 4). This procedure is outlined in virtually every service manual, and a kit of offset dowels, used to correct any error, is available as Mopar Performance part number P4120383.

By 1970, heavy-rod 440s began to appear, marking the first time that flywheels were drilled for external balance. What this means, simply, is that all the weight needed to balance the engine's reciprocation assembly could not be fitted to the crankshaft's counterweights, so some was hung on the vibration dampener, and some on the flywheel. The implications are clear: if your engine is externally balanced (i.e. all 360s, cast-crank 340s, most 400s, all heavy-rod and cast-crank 440s) GET THE RIGHT FLYWHEEL, whether the

Continued on page 70

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(Continuedm from page 39)

OEM piece, or the much safer SEMA-approved aftermarket unit (fig. 5).

One more point: before any swap to a manual trans is contemplated, be sure your crankshaft is actually reamed for a pilot bushing! Like, put one in—first! (For more on this, see Tech Topics, Mopar Action April, '96 issue).

Chrysler used only two types of clutches in the musclecar era: and odd-ball 3-bolt Auburn type on most 273s, and the common Borg and Beck 3-finger, 6-bolt type on virtually everything else. The B&B (fig. 6) is a good unit, and some versions had centrifugal weights to increase high-RPM holding power. Most aftermarket clutch supplies can provide virtually anything you need in the way of a Borg and Beck setup.

Still, there are two other clutch designs worthy of your consideration: the Long type, which is basically the Ford design, is one. It can be identified by the forged levers (as opposed to the B&B's stampings) and a *nonsymmetrical* six-bolt attachment pattern. It's this pattern that precludes the Long's utilization on our Mopars, but you might want to consider McLeod's unique Long/B&B version, which is Long internals in a custom, symmetrical-pattern cover. You could also have the flywheel redrilled for the Long pattern.

A second design, one which FWD Mopar aficionados will be intimately familiar, is the diaphragm type. Identified instantly by the zillion-finger setup and no coil springs (again, fig. 6), this clutch has several advantages, but chief among them is light pedal pressure for equivalent clamping force. When this design was introduced decades ago, a chief drawback was the tenancy of the clutch pedal to stay on the floor during high-rev shifts—not a pleasant experience. Luckily, today's diaphragm have this trait engineered out, and killer versions, most notably from Centerforce, are easy to find. Therefore, the diaphragm clutch is probably the way to go, and can use the stock release bearing.

One warning: diaphragm pressure plates, when viewed in perspective (fig. 7) are more nearly rectangular in profile, and may interfere in some hous-

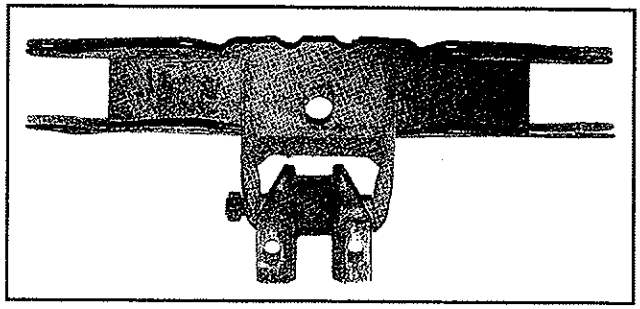


Fig. 11. In some instances, the trans x-member for A-833 use had an offset mount. These, too, are available (used) with either mount system.

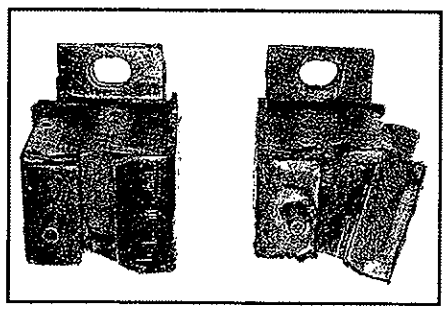
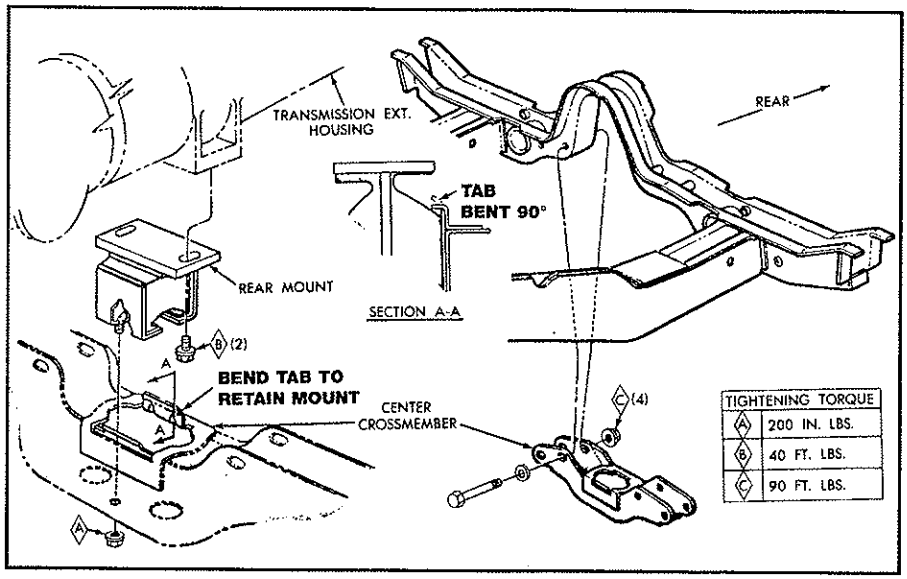


***Fig. 12. Why avoid the early biscuit mount? A picture is worth a thousand words. However, many failures can be prevented by proper installation. You do remember to bend the tab over, (below)* don't you?**



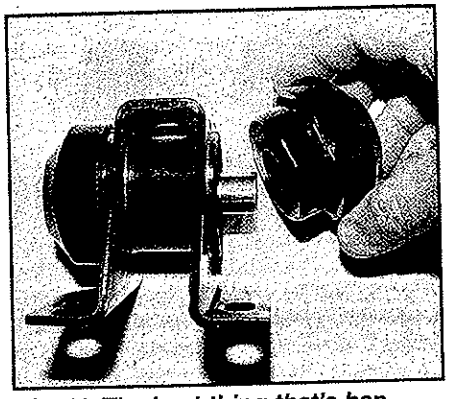


Fig. 13. The best thing that's happened to trans mounts: the Energy Suspension urethane inserts. Wish they made these for engine mounts, too.

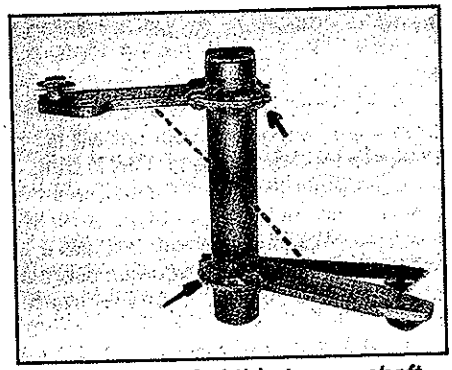


Fig. 14. We beefed this torque shaft with two welded pieces (arrows) that change the design from a basically butt-welded setup to a full-circle design. Another approach is add gussets (dotted lines). Always check for clearance before making any irreversible modifications.

ings. Personally, the only clearance problem we've found is with the true 11″ units. All 10-1/2″ have fit *for us.* Obviously, we haven't tried all variations. Caveat emptor!

INPUT SHAFT/RELEASE BEARING

This is a pretty straightforward consideration. Chrysler 4-speeds have been built with only two different input shaft configurations: a 1″ x 23 spline version used on 97% of the A-833s built (fig. 8), and the 1-3/16″ 18-spline "Hemi" shaft. Both fit the same (stock) pilot bushing, and all that's necessary to swap from one to the other is a mating clutch disc (fig. 9).

Note, however, that all 18-spline transmissions used a unique large-tube input bearing retainer, and therefore require a special clutch release bearing/sleeve assy. (available as Mopar Performance p/n P4529064). Keep in mind also that you can't just swap input shafts (technically called the main drive pinion) from trans to trans, as there were internal differences that prevent this.

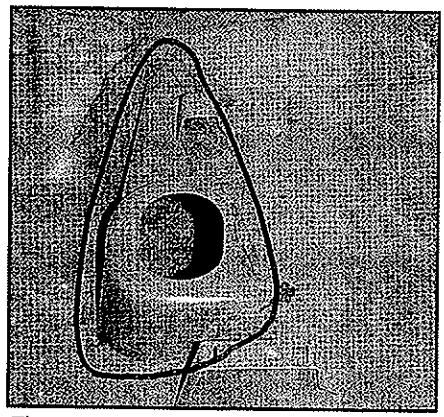


Fig. 15. If your car didn't come with a manual-trans floor shift (3 or 4-speed), you'll need to find and install one of these tunnel kits (circled). This one's OEM in a '67 B-body. This piece provides clearance for the shifter mechanism itself, and the linkage rods.

All other setups can use the usual release bearing, Mopar p/n 2405077.

TRANSMISSION MOUNT AND CROSSMEMBER

This is pretty simple. There have been only two mount systems (see fig. 10). Some versions used trans crossmembers that were offset to properly locate the mount to the trans's mount pad (fig. 11). Since the biscuit type insulators are failure-prone (fig. 12), the later, spool-type mount is preferred, and can be fitted with the Energy Suspension urethane inserts (fig. 12) for greater durability and freedom from oil rot. The spool setup was first utilized on '69 C-bodies, and was eventually used across the board, with A-bodies being

Fig.16. '64-'65 factory Hurst shifters used this simple bolt-on lever setup (right). After the Inland disaster, Hurst supplied this rubber-isolated slip-in setup (left) through 1971. Best idea for these: grind away the weld (arrows) and discard the piece marked "X" and the rubber trash. Then, drill through the shifter and lever, and bolt up with hardened 3/8" bolts and locknuts. Solid!

the last to benefit from this upgrade.

In nearly all cases, a crossmember from a later version of your car will fit most earlier permutations. This is true, for sure, for both A- and B-body vehicles. For example, a spool-type X-member from a 1976 Duster will bolt into a '67 'Cuda. The moral: if you can score a spool-type crossmember for your swap, use it.

CLUTCH LINKAGE

The clutch linkage, in our description, begins with your foot on the pedal, and ends where the bearing presses the clutch's levers.

Many of the wearing parts, i.e., the plastic bearings, release bearings, boots, clips, etc., are still available from Mopar and/or Mopar Performance. Some of the forks are also still available

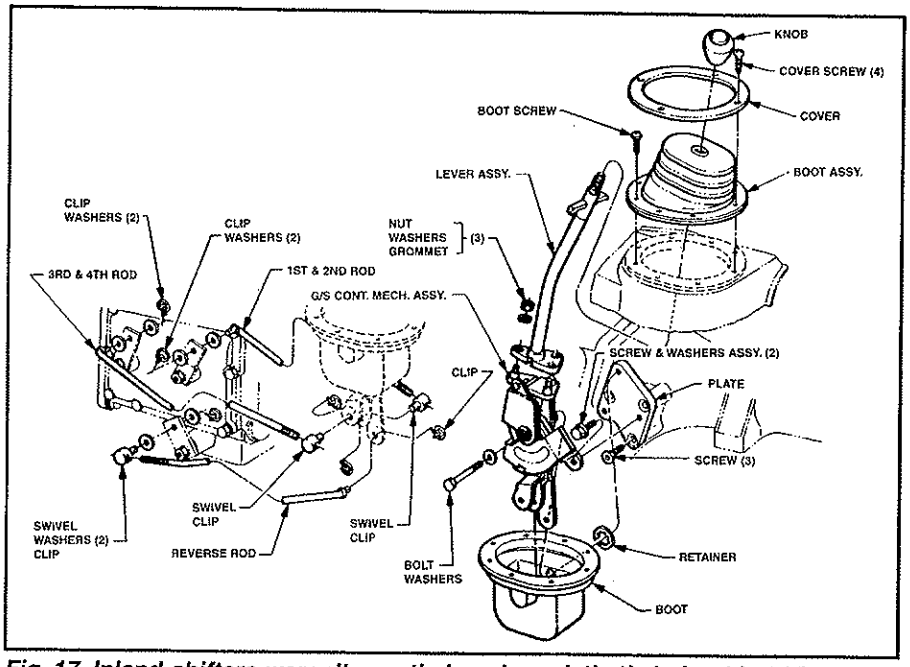


Fig. 17. Inland shifters weren't exactly loved...and, that's being kind. They were used in '66, '67, and early '68. The only improvement is to discard the rubber grommets and bolt the stick up solid.

from the same sources are a few torque shafts, while other torque shafts are in the repro catalogs (Year One, etc.) Whatever torque shaft you need, consider beefing it (fig. 12).

Still, if you are converting a car from automatic, there are going to be pieces that you simply must obtain used. These include mainly the pedal setup, one or both of the torque shaft mounting brackets or studs, and the rod from the pedal to the shaft. The easiest way to handle this is by purchasing a complete changeover setup from one of the Mopar-specific used-parts vendors, such as:

- **Stephens Performance** (AL, 205-247-1332)
- **Johnny Dees** (TX, 512-741-7791)
- **Frank Parks** (GA, 706-857-CUDA)
- **Kramer Automotive** (PA, 412-285-5566)
- **R & R Salvage** (MO, 417-678-5551)

Just tell these fine fellows what you're swapping into what, and they'll hook you up.

Here's an interesting thought: Suppose you want to swap a 4-speed into a Mopar for which there was no such OEM option? Well, truth be known, such vehicles are few and far between. '89 Diplomat (M-body)? No problem, the F-body's nearly identical. Find an early 4-speed Aspen or Volare rusting under a tree. '80 St. Regis (R-body)? Stuff from a '70s B-body will be mighty close. Worse case, maybe the oval hole in the firewall (for the clutch rod) might need to be nibbled out. Poor baby.

A low-buck upgrade for the clutch linkage is covered in this issue's Tech Topics.

SHIFTER/LINKAGE/FLOOR PAN

Unless you are swapping from a car with 3-on-the-floor, the first piece you'll need is the floor pan tunnel kit (fig. 15). This is necessary to clear the bulky shifter mechanism, and since, in most cases, the shift linkage for all forward gears passes *above* the trans crossmember decades ago, fiberglass repros of these were available from Hurst, and OEM steel stampings were a normal Mopar item. Today, the used-parts vendors and junkyards are, amazingly, the only source (like, how'd the repro guys let this one slip by?)

Installation is relatively simple, but some care must be taken. The procedure involves cutting the floor pan about 1″ smaller all around than the adapter. Then, install the trans and bolt it up, along with the shifter, rods, and lever. Now, position the adapter so that the shift lever is centered in the opening. Trace the outline on the floor pan, and

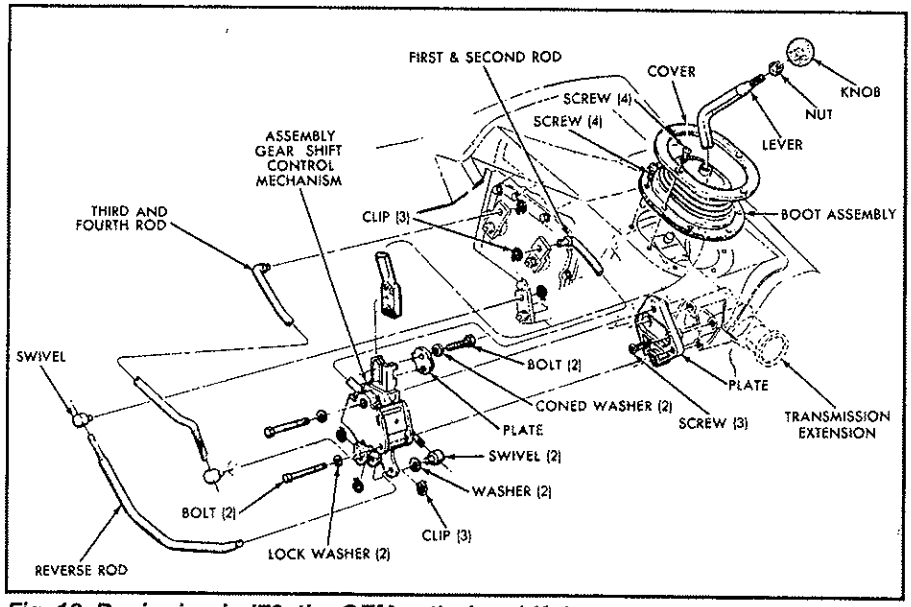


Fig. 18. Beginning in '72, the OEM setlp for shift lever attachment was changed to a thru-bolt arrangement very similar to the present-day aftermarket Hurst stuff.

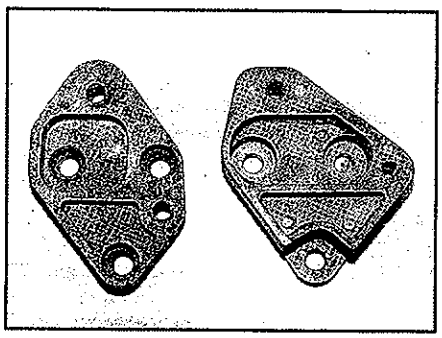


Fig.19. There were at least 6 different shifter mounting plates. Some repros are available (see text.)

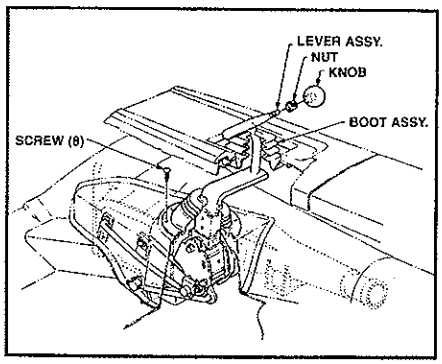


Fig. 20. Console setups required two boots one to seal the floor tunnel piece (clearly visible here) and another to seal the finish plate. This is a 1969 B-body setup.

trim a final opening about 1/2" in from your line. Now, weld securely and seam-seal. Done!

Of course, to install the shifter, you first must procure one. There were three main OEM types: The original '64-'65 Hurst, identified by the bolt-on shift lever (fig. 16), the universally disdained Inland unit, used in 1966, '67, and early '68 (fig. 17), and the later-style, slip-in stick Hurst used from mid-'68 through '71 (again, fig. 16). A special sub-group would be the cool pistol-grip levers used beginning in 1970. Both the slip-in Hurst setup and the Inland were rubber-isolated, resulting in, well, a rubbery feel. In '72, Chrysler reverted to a bolt-on arrangement with a tapping plate instead of the beefy forging on the pre-'66 setup (fig. 18). Drilling and thru-bolting the slip-in setup is a great idea. (See fig. 16 for instructions.)

Each of these shifter mechanisms requires its own dedicated mounting plate (fig. 19, some repros available from Year One, etc.), as well as rods and a lever correct for the application. In other words, there's no way a stick from, say, a '65 A-body is gonna bolt into your '71 Road Runner's console. Again, the keyword, since virtually all of this stuff is discontinued, is to buy the assembly as complete as possible, and be sure you and your chosen vendor

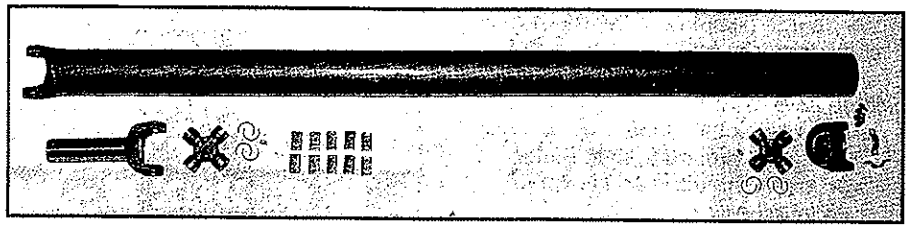


Fig. 21. Mopar Performance's D-I-Y propshaft kit is complete with Ujoints and the slip yoke. Even balance weights are included! One end comes pre-welded.

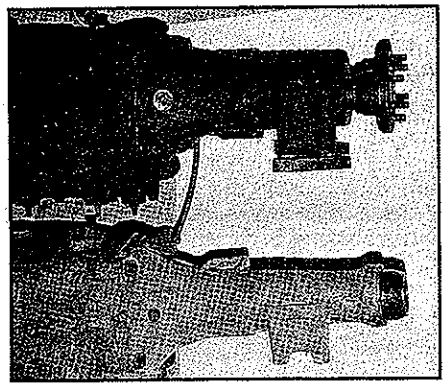


Fig. 22. Early transmissions used the bolt-up ball-and-trunnion deal (top). The only reason for swapping to this would be finding a complete bolt-in swap setup with the right driveshaft. Otherwise, go with the later slip-yoke deal (bottom).

come to a meeting of the minds regarding the intended application. (The external transmission levers, for the most part, are still available from Mopar.) Trying to find one rod here, one lever there, is a near-impossible task.

If you have a console car that's being converted from TorqueFlite, you will, of course, need a new top finish plate. Again, it's used or nothing, but new rubber boots are pretty easy to find.

Two interesting sidebars on shifters: One, quite a few Mopar-specific setups are still available new directly from Hurst, and, while these aren't clones of the original OEM stuff, they fit and work great.

Second, it's possible to fabricate a welded transplant wherein an original '66-'68 Inland lever controls a Hurst mechanism, keeping a dead-stock look while greatly improving precision.

PROPSHAFT

Okay, the trans is in and bolted up, but, your driveshaft won't fit. You have several outs. You can take your shaft to a local driveshaft shop, and have it shortened, or whatever, as required. Or, you can simply buy one of the cool MP driveshaft kits (see fig. 21) and drop *it* off at the local shop. Of course, you'll need to tell them the length you'll need. Here's how to determine this dimension: With the car at rest, normal ride load and height, install the slip yoke in the trans. Slide it in so the front of the yoke flange is just touching the boot seal. Then, with a helper and a good tape measure, record the dimension from the *center* of the U-joint hole in the slip yoke to the flat mating surface on the axle's companion flange. This is the center-to-center dimension; make absolutely sure your shop is aware of this fact.

Up until the '65-'66 era, Mopars used ball and trunion front U-joints. Unless you have one of these cars, and have a

totally complete, correct, change-over setup, *with* the correct driveshaft, we can see no reason to use anything but the later slip-yoke arrangement. Both type output are illustrated in fig. 22.

There are literally hundreds of different length 'shafts, but, *just for reference,* here are some common measurements. Finding that your numbers match ours is a sure confirmation of accuracy.

(Note: all are for A-833 trans.)

Car	Wheelbase (in.)	Axle	C/C Length (in.)
A-body ('67-'76)	108	8-3/4, 8-1/4	48.96
A-body ('67-'76)	111	8-3/4, 8-1/4	51.96
Barracuda ('70-'74)	108	8-3/4	43.60
Challenger ('70-'74)	110	8-3/4	45.60
B-body ('68-'70)	115.8	8-3/4	51.50
B-body ('68-'70)	115.8	DANA	50.39
B-body ('68-'70)	116.5	8-3/4	52.07
B-body ('68-'72)	116.5	DANA	50.96
B-body ('68-'72)	115.0	8-3/4	50.68

SPEEDOMETER DRIVE

All '66-up A-833s take the late, large speedometer drive setup. This should present no problems whatsoever. All needed pinions, cables, adapters, seals, etc. are readily available from Mopar.

CONCLUSION

More so than any other topic we've ever dared to cover, swapping manual transmissions opens a Pandora's Box of, literally, a million permutations. This fact, combined with the reality that almost none of the needed parts are available new, led us to stray from our usual (here's the part numbers; here's how you bolt it together) vein. What we've attempted to do, instead, is educate you as to what you should look for when you go swap meet or used-vendor shopping. The key item to remember is this: buy it all as a package if possible. This way, the clutch should fit the flywheel, the trans should fit both, etc. If you do this, and you are careful to buy the correct parts for your body and engine type, you should experience little trouble. ★

RACE TECH

(Continued from page 13)

this excessive stretching and relaxing and effectively stop it. If a lot of this motion occurs, the bolt will fail out of fatigue. Three failures for three different reasons. Any reason is not the hot setup.

The amount of stretch required depends on the size and material of the bolt we are using. Why does a high strength ARP rod bolt get torqued to 50 instead of 45? Easy. The ARP has (and can) hold more load, therefore it must be stretched out a little tighter. The standard high strength bolt has a strength rating of about 190,000 psi. This means that the bolt will hold that many pounds per square inch of its thinnest area. Let's assume that we have the 3/8" bolt of your 440 rod and its smallest diameter is 3/8". This equals an area of .11 square inches. Multiplying 190,000 psi by this gives us a fastener that will hold about 21,000 pounds maximum. In reality the bolt has a much smaller area because it's necked down slightly. Some of the new bolts have strength ratings of 265,000 and some mega bolts are over 300,000 psi. Sharp readers will probably figure correctly that these super bolts require more tightening torque also.

All this sounds cool, but what's it got to do with Loctite? Plenty. For us to stretch the bolt into its nice elastic zone, we must tighten it up. Generally we need to tighten it to about 75% of its yield strength. To make sure that we get it stretched properly we need to accurately measure exactly how tight we get it. Obviously this is where the torque wrench comes in. Actually the absolutely correct way to check this is to use a stretch gauge instead of a torque wrench. If we lean too hard on the bolt and blast it into the plastic zone, it's nothing more that a time bomb waiting to blow up. Now here's the Loctite part. The measured torque or turning resistance on our wrench is affected by the friction of the threads. All fasteners have a specification for torque versus stretch. See chart 1 for this. Notice how the torque can vary a lot just by using different lubricants on the threads. The actual stretch, which by now we know is the whole purpose of using a bolt, is essentially the same even though the torque is very different. Notice the chart does not include a section for Loctite on the threads. That's the problem with using it. How do we know its slipperiness? Does a bolt require more or less torque with red Loctite to attain the desired stretch? I have no idea and frankly neither do you. It may go into the plastic zone or not even into the elastic zone. Either way is asking for a problem. I guess that you could use a