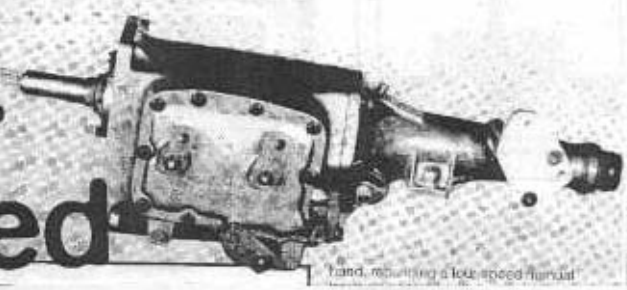
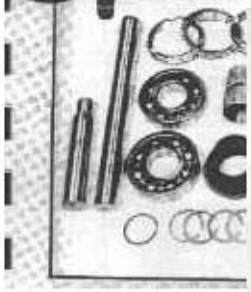
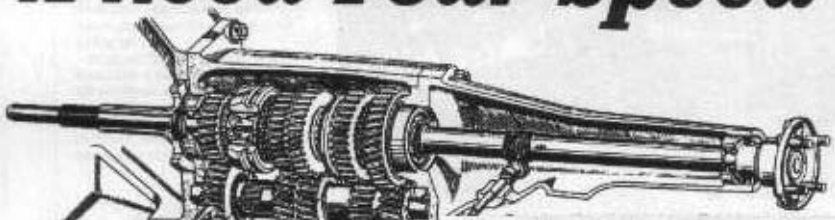
Built Four Speed



hand, rebuilding a four-speed manual



A Need Four Speed



limited
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3-speed, carryin
stick this side
Naturally, Chry
cleaned house
classes, but were o
stickshift w/in column.
1964 saw the gap in
plugged for good. That
the year that the A-833
troduced. It was design
anything that a race H

TRANS-PLANTS

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

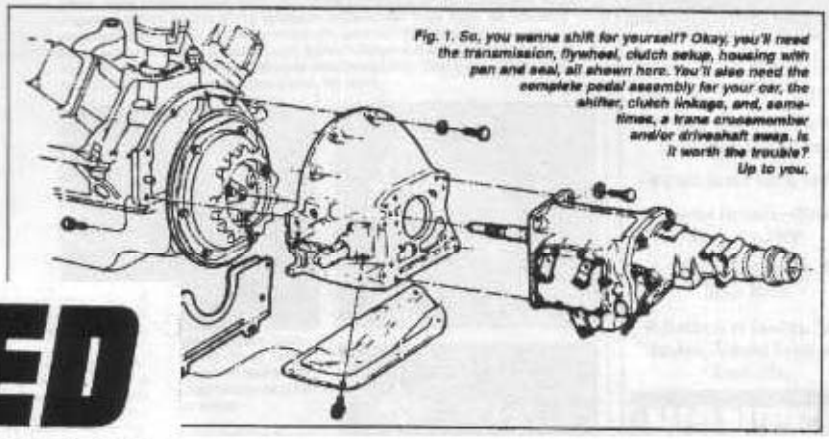


Fig. 1. So, you wanna shift for yourself? Okay, you'll need the transmission, flywheel, clutch setup, housing with pan and seal, all shown here. You'll also need the complete pedal assembly for your car, the shifter, clutch linkage, and, sometimes, a trans crossmember and/or driveshaft swap. Is it worth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

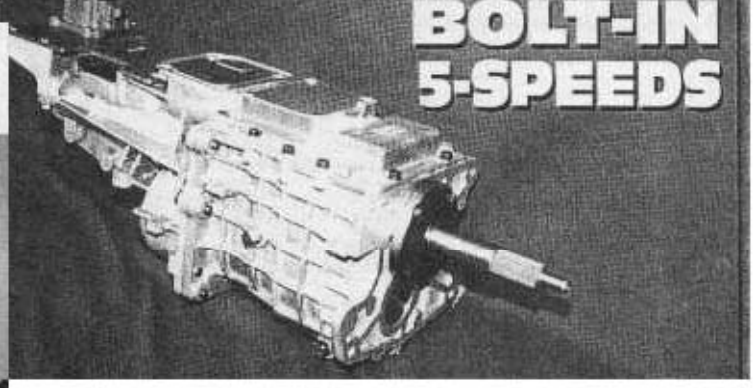
4-SPEED FOR SPORTSMEN

Chrysler's all-new, full-synchro gearbox challenges the toughe
and those rodders who ask the perennial question: "What'll I us

by BOB GREENE

BULLETPROOF PIST

A, B, & E-BODY BOLT-IN 5-SPEEDS



In the Clutch

By Jeff Smith

Photos by Jeff Smith and courtesy of manufacturers

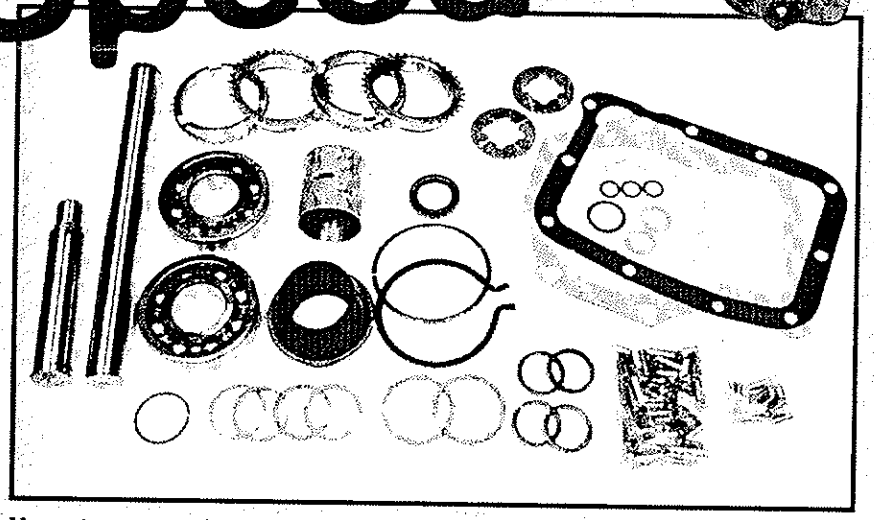
This is the new age of manual transmissions. The new darling of the street set is the T-56 six-speed, and there is a passel of new five-speeds to choose from, most of which sport some kind of overdrive top gear. Automatics have their

This is an exploded view of a complete clutch assembly. From left to right, you have the flywheel, clutch, pressure plate, and throwout bearing with clutch fork. What we didn't show is the pilot bushing that fits inside the crankshaft that supports the nose of the transmission input shaft.

Everything Basic You Need to Know About Clutches

place, but 21st-century performance machines are increasingly sporting manual transmissions. That means clutches are back in the spotlight. Just like a high-performance cam or

Built Four Speed



Mopar tranny specialist Brewer's Performance Motor Parts stocks the works for an A-833 rebuild. Aside from the rebuild kit, we ordered new counter and reverse shafts (*left*) to take the dragstrip punishment and keep tranny noise to a minimum—as if we'd even hear it in the Duster.

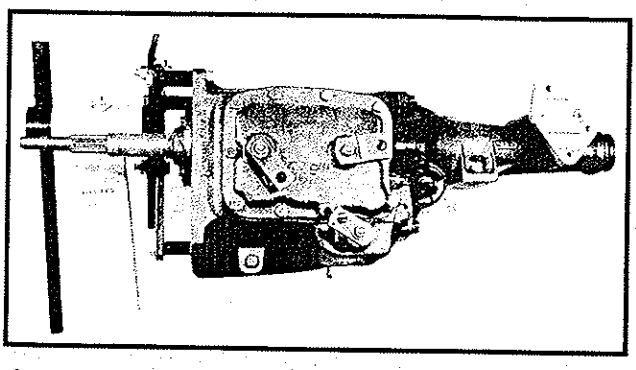
BY STEVE DULCICH

Photos by Steve Dulcich

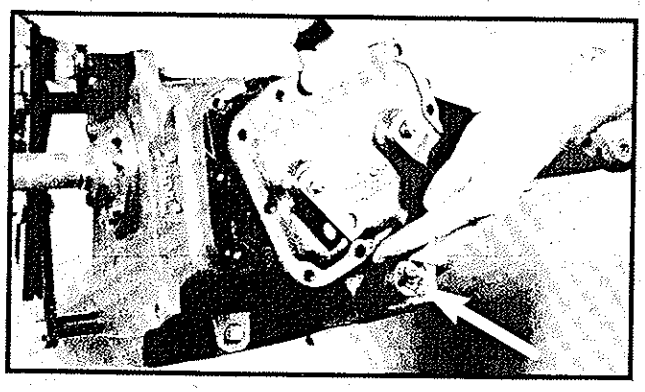
When bolting together our budget Duster (Nov. '99), *Car Craft* Editor David Freiburger came up one throw short with the Duster's stock three-speed tranny. The three-speed was offed, and a seasoned short-extension A-body A-833 four-gear was wrangled under the floorboards. Play the low-buck game long enough and eventually even the best get bit—the four-speed turned out to be a bogus buy. Locked levers meant that, at best, the internal linkage was fragged or, at worst, gears were grenaded. We don't get teary-eyed about trashed parts, but to save our budget the agony, we pulled out the wrenches for an in-house rebuild. With the correct factory service manual at hand, rebuilding a four-speed manual tranny is no tougher than wrenching on other major drivetrain components.

The hardest part is scoring the parts to do the rebuild—Pep Boys won't have a kit for a 30-year-old Mopar tranny. This is where it pays to get hooked-up with a specialist in the type of gearbox you're dissecting. For Mopar 'boxes, one of the best sources we know of is Brewer's Performance Motor Parts. We ordered up a rebuild kit, a couple of new shafts (countershaft and reverse), and the all-important synchro stop rings. Stung again, we didn't realize that our trans was one of the oddball small-output shaft (904 auto–size) 'boxes, so we ended up ordering the wrong rear bearing, bushing, and seal. Parts scrounging netted us a new rear seal (N.O.S. at our local dealer), a PN 207 rear bearing at NAPA, and a small-yoke bushing from a 904 auto at a local trans shop.

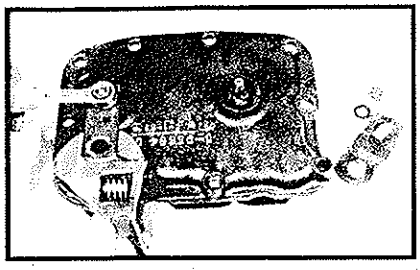
We'll show you how we tore it down and bolted it back together without any of the obscure special tools shown in the service manual. The procedures are pretty much the same for any of the many A-833–based gearboxes used by Mopar from 1964 to 1990. If Freiburger manages to grenade it (he'll try), we'll undoubtedly be reading all about it.



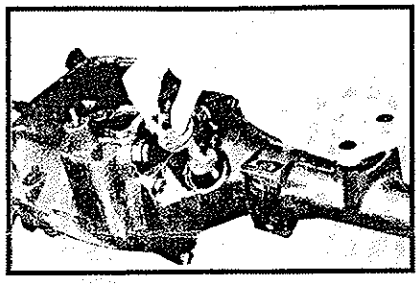
1 Rather than rolling it around like pizza dough on the benchtop, mount the tranny on an engine stand for the rebuild. Hang it with at least three bolts, and make sure to position it so there is clearance for the countershaft to be driven out the front.



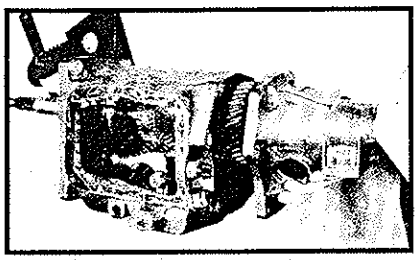
2 Begin by removing the side cover after the Reverse shift lever is pulled (*arrow*). Leave the two forward shift levers on the cover or the internal shift mechanism could fly apart.



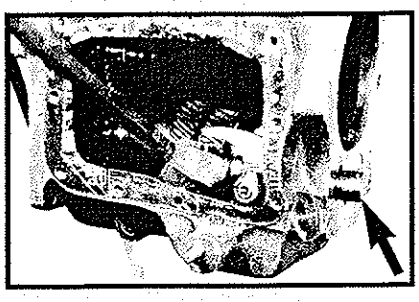
3 Unbolt the shift levers from the cover and remove the shift mechanism.



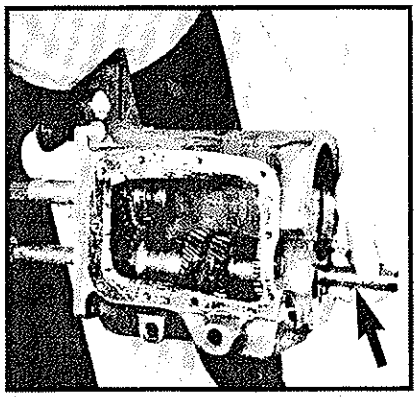
4 The speedo gear comes out next. The clever swap-meet tape "protecting" the end of the speedo adapter hid stripped-off threads where the cable hooks. No biggie: Common slush-box speedo adapters interchange.



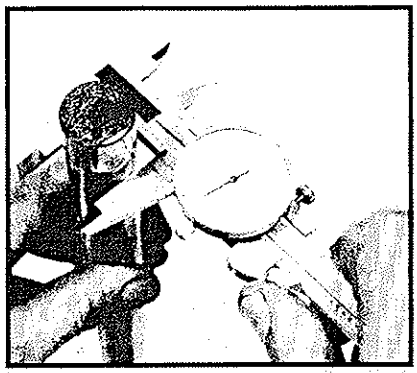
5 The rear extension assembly comes off next, complete with the mainshaft and all the speed gears and synchros. Move the front (Third-to-Fourth) synchro forward, set the Reverse gear to the center of its shaft, and pull the trans apart. Fortunately, all these gears looked cherry.



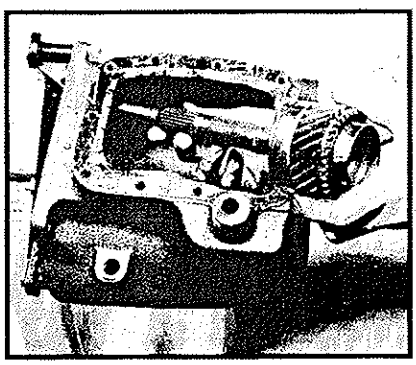
6 The service manual calls for shaft-pressing tool C-3688 to remove the Reverse shaft (*arrow*) and gear. We wedged ours out with a rusty crowbar. If it's stuck, a setup similar to the factory tool can be rigged or a long brass drift angled in. Slide out the Reverse shift mechanism too.



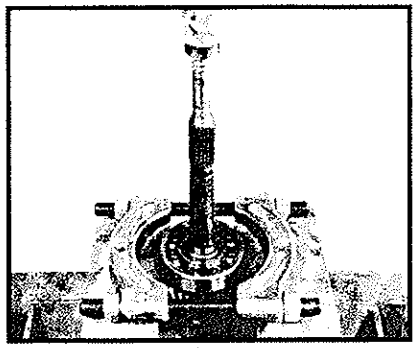
7 The countershaft (*arrow*) comes out to let the countergears drop down from the pinion gear. A 1⅜-inch tube 9⅛ inches long will keep the bearings in place as the countershaft is driven out, but it's not really needed yet since all the bearings are going to be replaced.



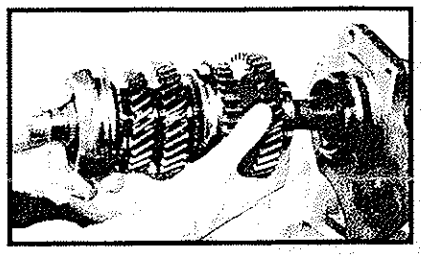
8 If the trans is noisy in every gear but a direct 1.0:1, a worn countershaft and its bearings are usually the culprits (this goes for most any manual trans). The shaft is hardened only a couple of thousandths deep, and you can actually see the difference in the metal if it's worn through the hard layer. A couple of thou wear, or a maimed bearing surface, and it's time to trash it. If a new shaft is unobtainable, hard-chroming and centerless grinding can save the old part.



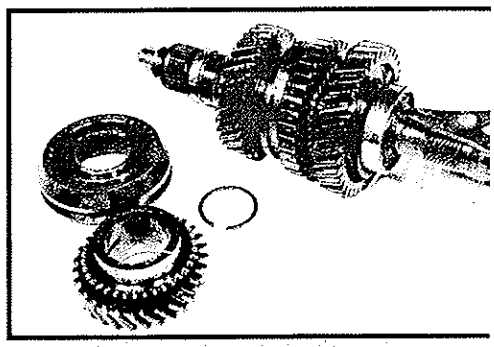
9 With the countergears sitting on the bottom of the case, remove the bearing retainer and snap ring, then slide out the pinion. Now reach in and lift out the countergears.



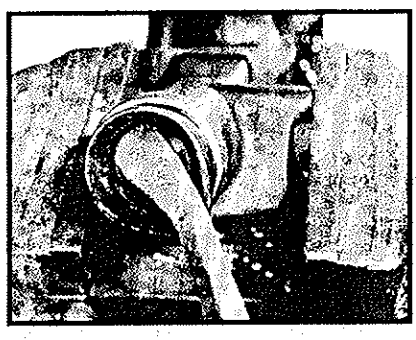
10 Remove the shaft snap ring and press off the pinion bearing.



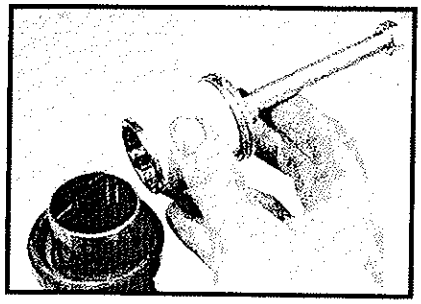
11 Moving on to the tailshaft, remove the gearset and mainshaft after releasing the retaining ring at the front of the extension.



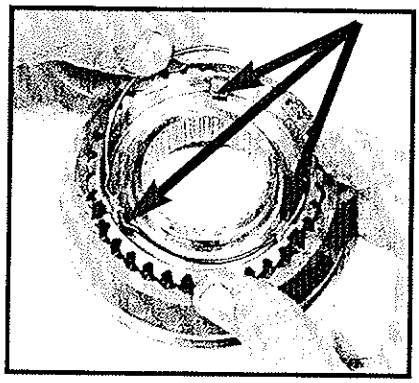
12 Unloading the gears from the mainshaft is a matter of pulling snap rings and sliding the gears off. At the front, the Third-to-Fourth synchro and Third-speed gear come off. At the rear, the bearing is pressed off, followed by First gear, the First-to-Second synchro, and then Second gear. Make sure you keep track of the order of the parts, or have a detailed service manual handy.



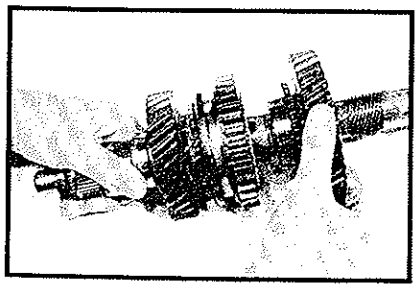
13 Our Reverse shaft remover also works well on the rear seal.



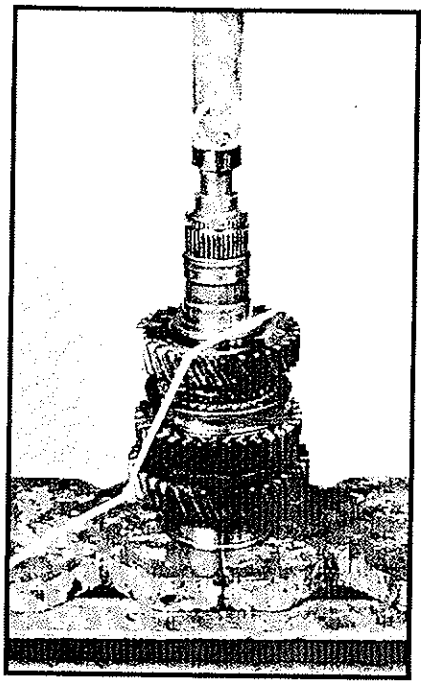
14 The rear tailshaft bushing was worn down to the steel backing. We didn't have the special tool (PN C-3974), so we made this bushing driver out of a socket, a long ½-inch bolt, and some washers. A nut inside the socket holds it together. The washers need to be slightly smaller than the bushing's od to hammer the old bushing out. A couple of winds of masking tape protect the new bushing's inner diameter and have to be a loose fit inside the bushing. Line up the oil hole, hammer in the bushing, then install a new seal.



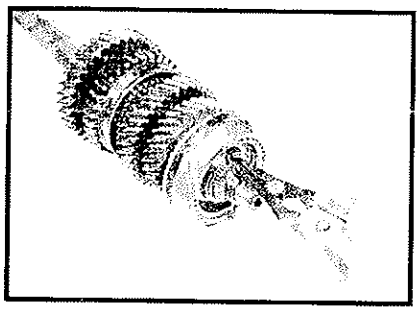
15 To begin reassembly, we cleaned up and reassembled the synchros. Make sure the inner hub is facing the right way and is matched to the correct outer sleeve. Lay the synchro hub on top of a stop ring to hold the parts in alignment, load in the three synchro struts (*arrows*), and wind in the front and rear springs, centering on two different struts. The new stop rings go in as the gears are loaded on the shaft.



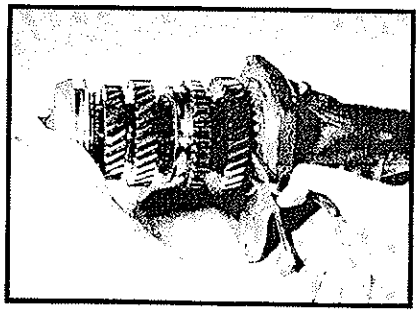
16 The gears and synchros were cleaned, lubed with gear oil, and reloaded on the mainshaft. Make sure that the lugs or slots in the stop rings line up with the struts on the synchro hub so they seat properly.



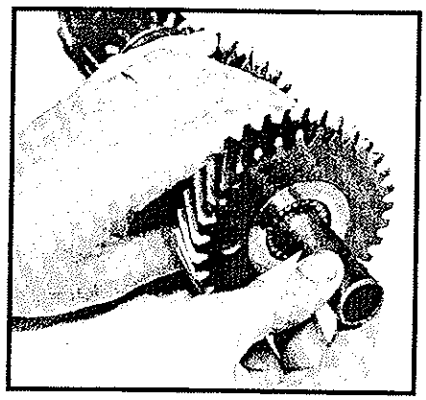
17 With all of the components loaded to the back of the mainshaft, the new bearing is pressed on (outer snap-ring groove forward with the large PN 308 bearing). To keep the gears from sliding back with the shaft upright, the assembly was temporarily tied back with nylon ties and then loaded into the press. Make sure the press platform supports the bearing at the inner race since pressing the bearings by loading the outer race will trash 'em.



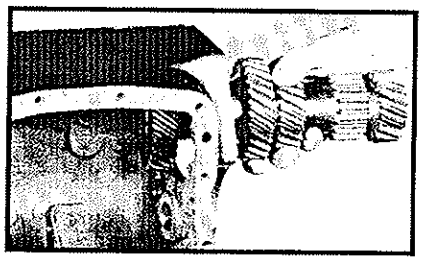
18 The Third gear and the Third-to-Fourth synchro load from the front of the shaft.



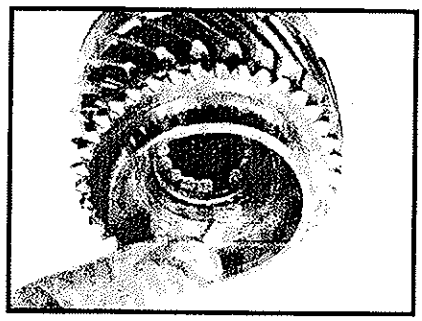
19 The loaded mainshaft slides into the extension and is held in place by the lock ring behind the bearing.



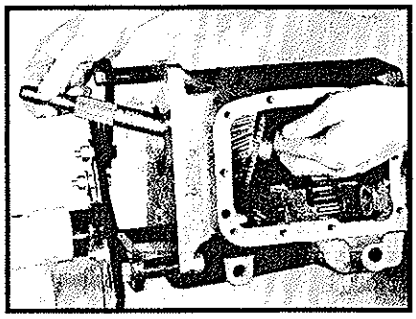
20 The countergear bore is loaded first with the center spacer, and then with two gangs of new needle bearings with spacer washers between them and at each end. Heavy grease holds the bearings in place. An arbor tool (*arrow*) is needed to keep the bearings from falling out when driving in the countershaft. The arbor needs to fit the id of the bearing packs and be just long enough to hang the thrust bearings at each end. We used to use a sawed-off broom handle shimmed out to the correct diameter with wraps of tape, until we found a jack handle with exactly the right diameter (1⅝ inch), which we hacksawed to length (9⅛ inches).



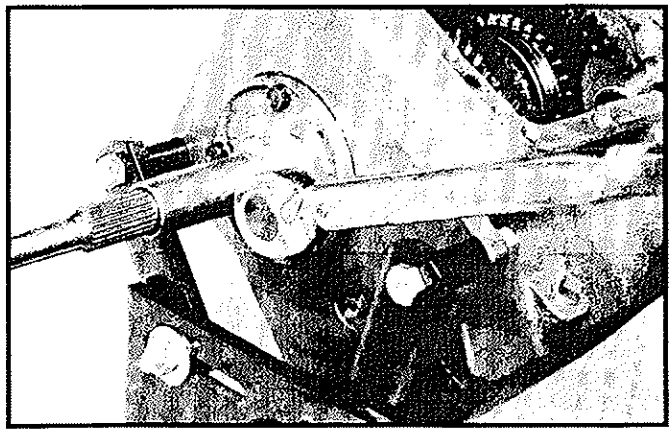
21 The new thrust bearings were pasted at each end of the gear cluster with grease, while the arbor sticks out just enough to center them with the bearings. The outer tangs on the thrust washers are lined up with the slots in the case, and the cluster is dropped in position at bottom of the tranny.



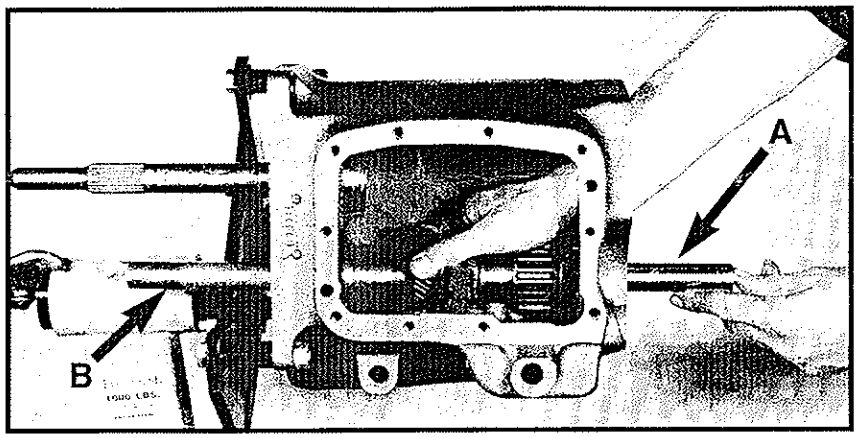
22 A new bearing is pressed onto the front of the pinion (outer snap-ring groove forward) and locked down with a snap ring. Then, new rollers are loaded in the flip side and held in with grease.



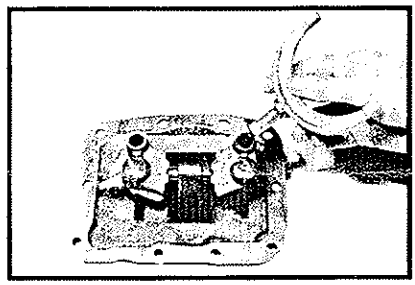
23 The pinion is installed from the rear on this tranny. With large-bearing trannies, the pinion goes in from the front.



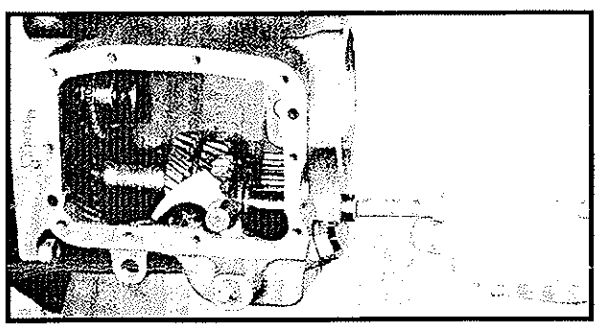
27 A new seal is installed in the front bearing retainer and lubed (lip to the tranny side), the snap-ring is installed on the bearing, and the retainer torqued in place. Use sealant on the bolts to keep oil from drooling out.



24 Next, the countergear cluster is lifted to mesh with the pinion, and the countershaft is pushed in. Make sure the thrust bearings are lined up. As the countershaft (*A*) goes in, the arbor (*B*) slides out, so the bearings are always held in place. A Woodruff key goes at the end of the shaft to keep it from spinning in the case. Some hammer-and-drift work is required to seat the shaft once it reaches the opposite side of the case. Seal the bellhousing side of the bore flush with silicone once the shaft is in.



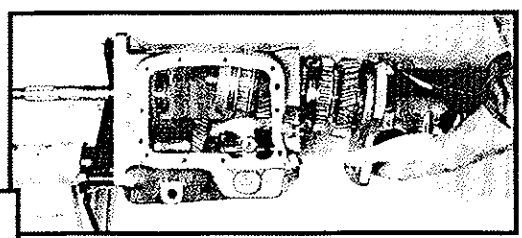
28 The side cover linkage is reassembled with new O-rings and grease on the shift-lever shafts. This pre-'71 trans uses a ball detent–type lockout system, while later units use a more complex and less reliable scissor (double-lever detent) mechanism. The Third-to-Fourth shift fork can go on, but not the First-to-Second.



25 Now for Reverse. Start with the shift mechanism, a new O-ring, and grease. Line up the gear with its collar engaged in the shift fork and install the shaft. Finish off with the reverse detent parts and the back-up light switch.

29 Before bolting up the side cover, spin the trans by the input shaft and squirt some gear oil over each gear. The side cover gasket gets a coat of grease, as do the business ends of the shift forks, and then the cover is installed. The First-to-Second shift fork has to be hooked into the synchro and the cover lined up. Except for the two long bolts on each side of the reverse lever, the bolts are shouldered to align with the cover. One has an extra-long shoulder, which acts as a dowel (*arrow*). Bolt down the side cover, fill with 8½ pints of 80W-90 gear oil, and your four-gear is ready for abuse! ●

26 Now it all goes back together. To gain clearance, pull the pinion shaft as far forward as it'll go, slide the Third-to-Fourth synchro forward (don't overextend it), and set the Reverse gear to the center position on the shaft. Coat the new gasket with grease, and install the extension. The extension should seat fully without forcing, unless something (like a roller bearing or stop ring) has fallen out of position. Bolt up the tailshaft housing and flip both synchros back to Neutral.



TORQUE SPECS

Back-up light switch	15 lb-ft
Drive pinion retainer	30 lb-ft
Extension housing	50 lb-ft
Side cover	15 lb-ft
Reverse detent retainer	50 lb-ft
Reverse detent plug	24 lb-ft
Shift lever nuts	18 lb-ft

SOURCE

BREWER'S PERFORMANCE MOTOR PARTS

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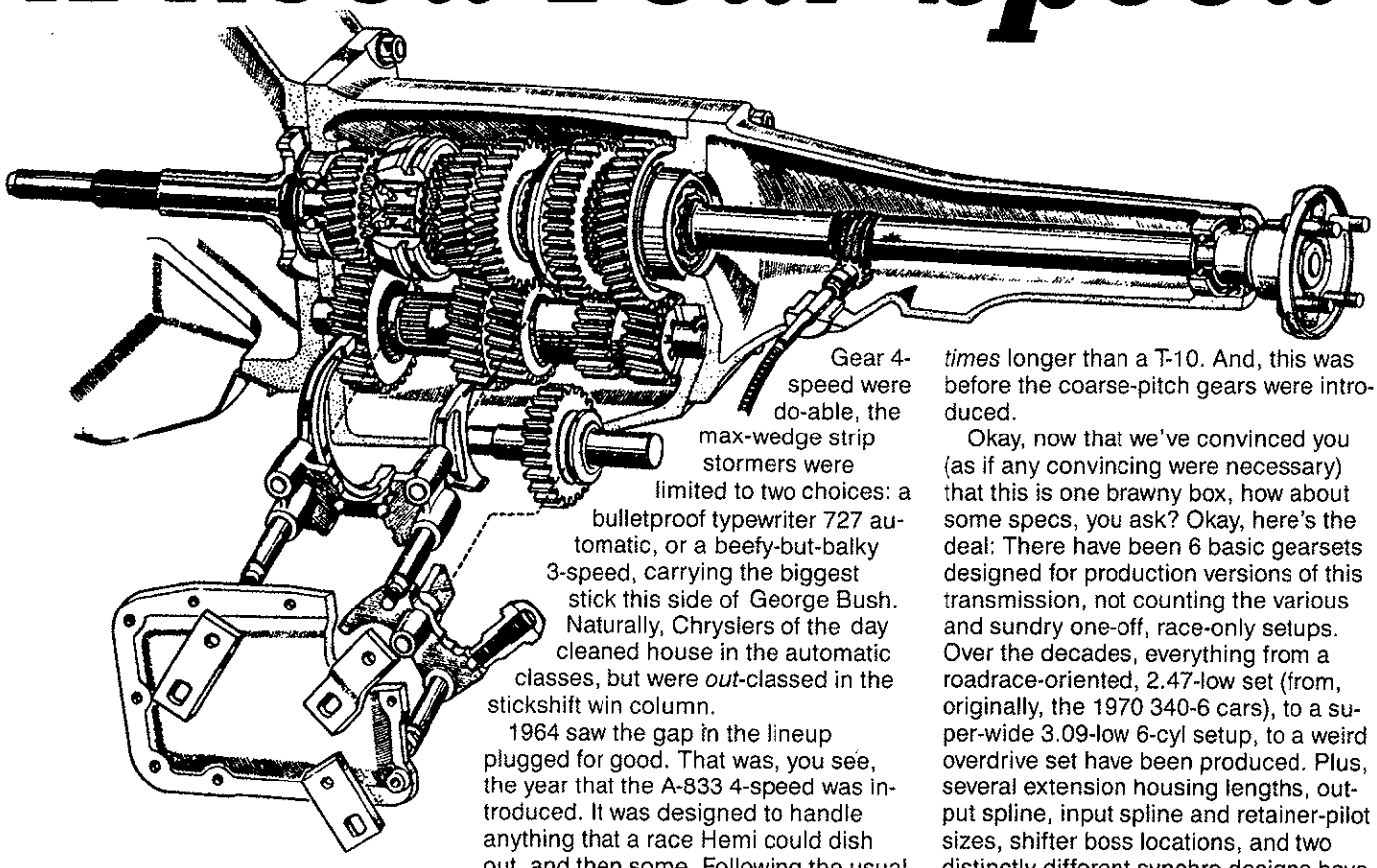
TECH

A Need Four Speed



Through Chrysler's A-833 4-speed with gun and camera or, how to check out, rebuild and beef up your manual box.

Story and photos by Richard Ehrenberg

1993. If you don't have at least 5 speeds on the business end of your shift lever, you're, like, a zero. Hard to imagine a time when cars had only *three* forward speeds. But, for the fastest Mopars of 1963, that was the case. While lesser-motor'd Mopes with the flimsy Warner Gear 4-speed were do-able, the max-wedge strip stormers were limited to two choices: a bulletproof typewriter 727 automatic, or a beefy-but-balky 3-speed, carrying the biggest stick this side of George Bush. Naturally, Chryslers of the day cleaned house in the automatic classes, but were *out*-classed in the stickshift win column.

1964 saw the gap in the lineup plugged for good. That was, you see, the year that the A-833 4-speed was introduced. It was designed to handle anything that a race Hemi could dish out, and then some. Following the usual Chrysler scenario, the company was late getting into the 4-speed game, but, boy, when they made their move, it was an immediate gold standard.

Using the Warner T-10 as a comparison, Chrysler engineers Dale Slaubaugh, Dale Reeker, and their teammates increased the mainshaft-to-countershaft measurement by .25 inches, and widened all gears, some by as much as 30%. These changes, as well as larger synchros, beefier bearings, etc., combined to produce a trans capable of handling a conservative 50% more torque than a T-10.

Other upgrades include the fine, rolled splined where the synchro clutch gears are fitted to the mainshaft, a beefy case with thick walls and gradual radii, and 4 rows of generous dimension needles on the countershaft gear. This resulted in a countershaft deflection of less than .004" at—get this—nearly 500 foot-pounds input. The expression "Where's the Beef?" was certainly *not* created for this torque monster.

Durability testing of the earliest, 1964 versions, revealed that, behind a max-wedge, a basic A-833 would live *15 times* longer than a T-10. And, this was before the coarse-pitch gears were introduced.

Okay, now that we've convinced you (as if any convincing were necessary) that this is one brawny box, how about some specs, you ask? Okay, here's the deal: There have been 6 basic gearsets designed for production versions of this transmission, not counting the various and sundry one-off, race-only setups. Over the decades, everything from a roadrace-oriented, 2.47-low set (from, originally, the 1970 340-6 cars), to a super-wide 3.09-low 6-cyl setup, to a weird overdrive set have been produced. Plus, several extension housing lengths, output spline, input spline and retainer-pilot sizes, shifter boss locations, and two distinctly different synchro designs have found their way into A-833s. In addition, there were different side cover/interlock/fork arrangements, as well as speedo pinion setups. A virtual potpourri of hard parts.

What we're gonna do here is discuss most of the sub-systems that make up and A-833, and show you what to look for in a rebuild, point out common trouble spots, help you identify various parts, and, generally, keep you informed about what's hot and what's not. In short, we'll dissect a few A-833s, and bring you up to the minute on parts availability. As a bonus, we'll take a look at the latest lubrication recommendations from the factory engineers themselves, and, as a whipped-cream dessert bonus, we'll explore the latest in hot clutches.

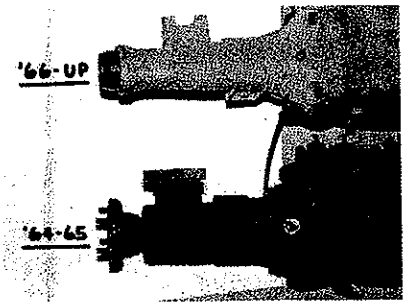
As per our standard fare, what we're *not* gonna do here is walk you through a complete rebuild of somebody's grenaded gearbox. We won't insult your intelligence by repeating what's been printed in virtually every Mopar RWD service manual for the last 29 years!

So, rev that mill, sidestep that clutch, and let the games begin.

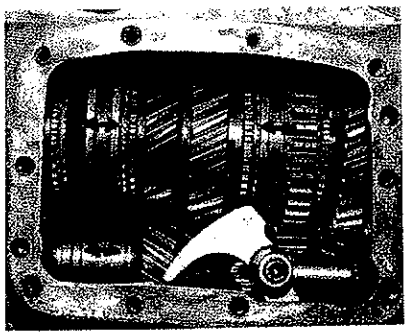
SWAP MEAT

One of the best places to score that A-833 (as well as parts) is that local swap meet. But, before you can be as swift a trader as the 833 is a shifter, you need to educate yourself as to what to look for, What case length do you need? Which shifter position? What input spline, etc.?

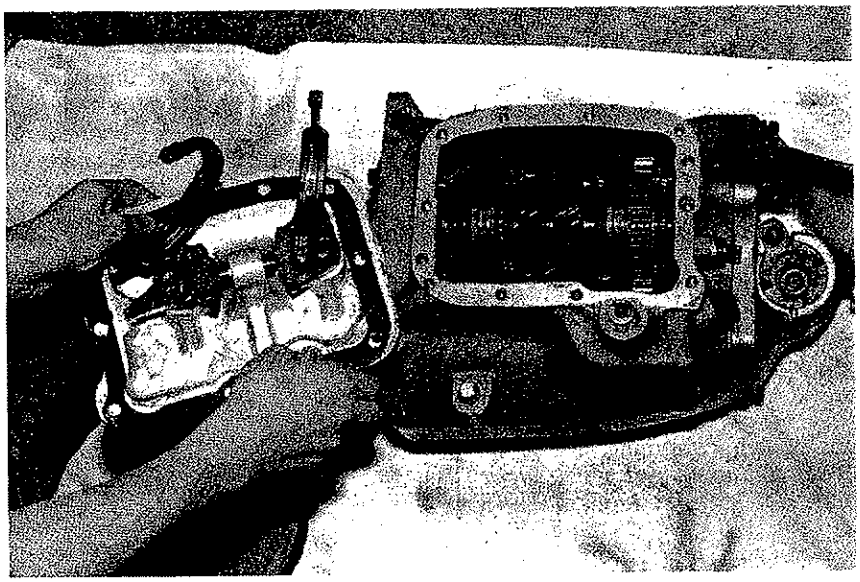
Next, you'll want to at the very least, take a peek inside your potential purchase. Does it have the ratios you want (see *Rational Ratios).* Are the synchros and gears in useable condition, or are you buying a basket case or, for that matter, just a case?



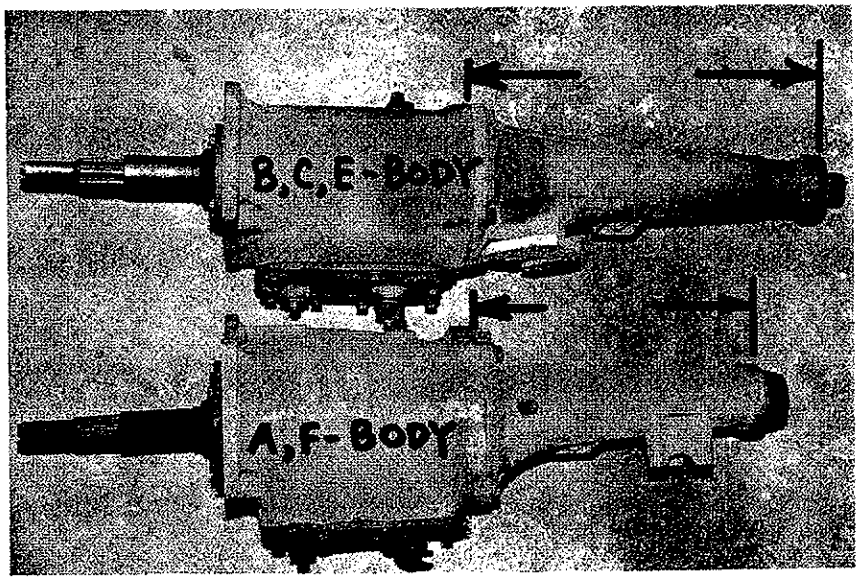
Another most-basic item to consider is the output setup. '66-up units will have the now-common sliding spline configuration (top), while the '64-'65 units are fitted with the companion flange for the ball and trunnion front U-joint, as well as their small, early-style speedo pinion setup. You can't reconfigure a trans from one output style to another without changing the extension housing* and mainshaft—*major surgery!



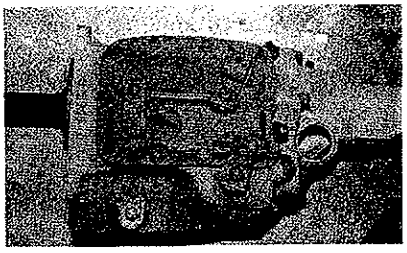
Once inside, check the synchro sliders (clutch sleeves, upper arrows) for easy gear-to-gear operation. Also, check the cluster (countershaft gear, bottom arrow) for excessive end-play, which would be anything over 0.029". Also, be sure to inspect gears, especially clutch gears, for damage or excessive wear. (See "Synch or Swim" section for more on synchros.)



Most swap meet sellers won't be adverse to you taking a peek inside. Inspect the gear teeth (especially the synchro/slider clutch gears), check interlock operation, and check the cluster for excessive end-play. Of course, count the teeth to see if the box has ratios you can live with.



To verify swapability, the most basic dimension to check is extension housing length. On a '66-up B/E-body trans (as well as that occasional C-body piece) the dimension, from the case to the seal-mating surface, will be 16.38 inches. The "shorty" A/F-car trans will dimension out at 12.62 inches. Since on the big box, there are several permutations, be sure that the shifter and engine-mount bosses are where you need them. You might get lucky and score a DC/MP aluminum case, or you might consider using the now-common overdrive aluminum piece. The OD case requires a huge pilot hole in the clutch housing, as well as a special shorty countershaft. This is needed since the shaft floats in the case (for gear-rattle suppression), so the front of the case must be fitted with a cupped plug to prevent oil leakage.

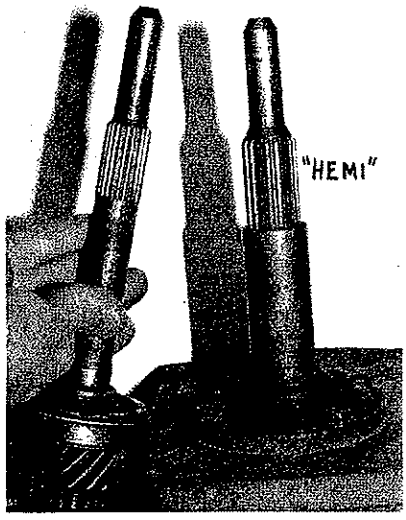


Finding an inverted 3-4 shift lever is the immediate tipoff to an "overdrive" 833. Of course, there's nothing to prevent an unscrupulous seller from flipping the lever, so, if you aren't sure, pop the side cover. See "Rational Ratios" for gear-tooth counts.

Four Speed

IN-PUT

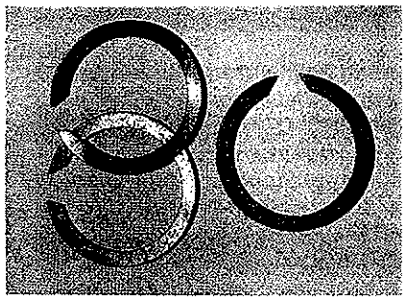
Main drive pinions, commonly referred to as input shafts, were available with two different splines. Hemi shafts (right) which were also used on most 440 cars, utilized a beefy spline measuring 1-3/16" o.d., with 18 teeth, while the weaker wedge cousins made do with a 1-inch, 23-spline configuration. While it's true that, all else being equal, fine splines are stronger (due to the increased root diameter), here, the larger diameter of the Hemi shaft much more than compensates.



RING DING

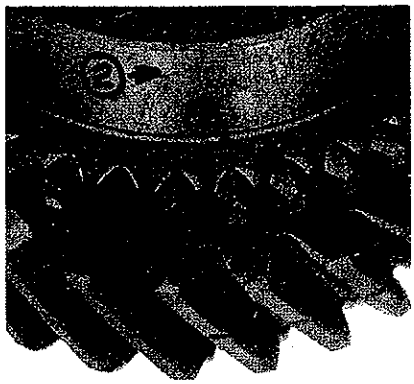
Before you even think about disassembling an A-833, be sure to lay in a small supply of the selective snap rings which are used to adjust clearances. They are available as follows:

0.086" thick 6025754
0.091" thick 6025755
0.094" thick 6025756
0.097" thick 6025757

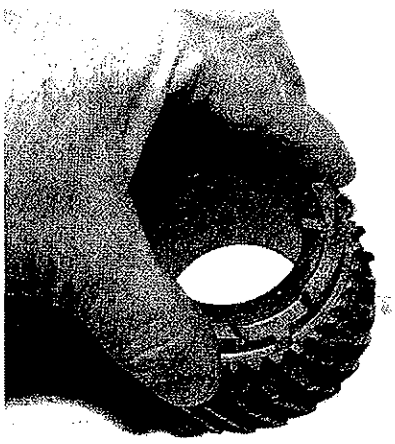


SYNCH or SWIM

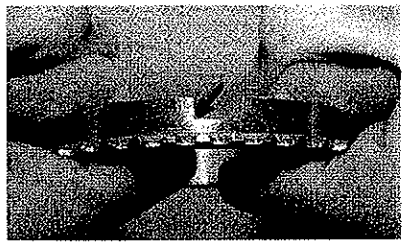
In a fully synchronized trans, such as the A-833, actual gear wear is usually minimal, since all the actual shifting between forward speeds is accomplished by sliding the synchro sleeves. Hence, the gears are most likely to show abuse on the dog teeth, where the slider makes contact (arrow #1). The teeth



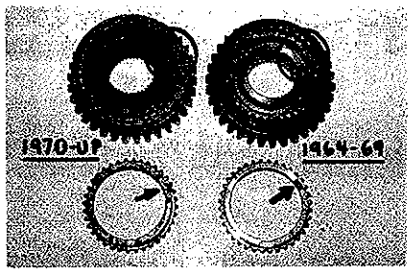
should be sharp, as shown, with a small amount of rounding being generally okay. If you are wondering what contagious disease this gear is afflicted with, it's a brand new gear, coated with Cosmolene. Arrow #2 indicates the actual brake drum area of the gear. This surface should be smooth and free from scoring, galling, or grooves.

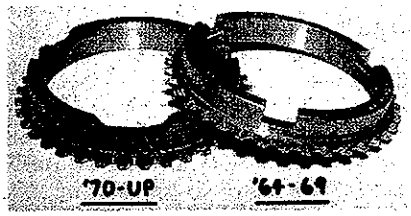


Synchro stop-rings (brass rings) can actually be tested. All that's required is applying a light downward pressure while twisting the ring. With little more than a light press, the ring should seize onto the gear. If this fails, try a new stop ring. Still ng? Time to hunt up a new gear. Apply this test to all 4 speeds, but expect to see the majority of trouble on 2nd and 3rd gears. Like, how often do you power-shift First?



Early-style (pre-'71) stop rings were prone to breakage at the sharp corners. Sometimes these cracks were almost invisible, so the test method is simple: try to pry 'em open.





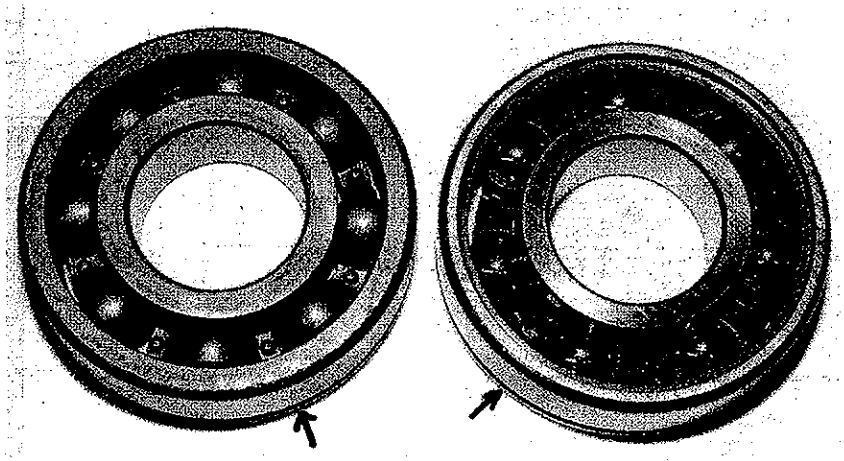
There were two distinctly different synchronizer designs. The early design, which utilized the more-fragile stop rings, can be identified by the wide-vs.-narrow struts (circled, top) and the sharp-cornered notches in the rings (lower right). Close-up of the rings clearly shows the different ring designs. Late synchros will bolt-in to earlier transmissions, as long as the matching rings are used. Note that some early '70 transmissions used the old style synchronizers, and that, 25 years later, any synchro could be in your transmission, so check before you order. The following parts are available:

Early synchro stop rings . .2801381
(package of 4) P4529833
Late synchro stop rings. . .3515023
(package of 4) P4529834
1-2 Synchro, late type 4130095
3-4 Synchro, overdrive. . . .4377401
(Note: this synchro can be used on non-overdrive transmissions, as long as the original clutch gear (the innermost piece) is recycled from the original synchro. The overdrive synchro has larger internal splines, but the slider, etc., is identical to the '70-up non-overdrive piece.)

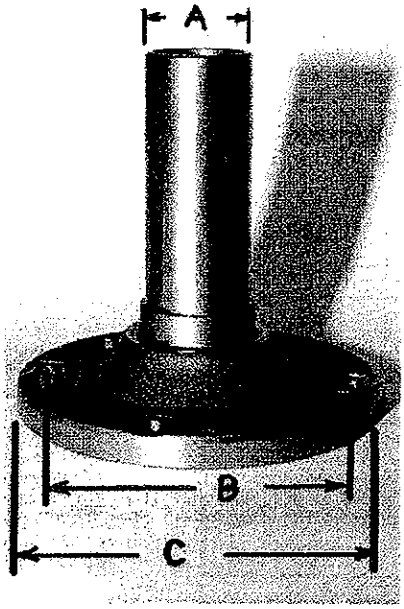
Continued on page 56

A Need Four Speed

Continued from page 40



BEARING UP



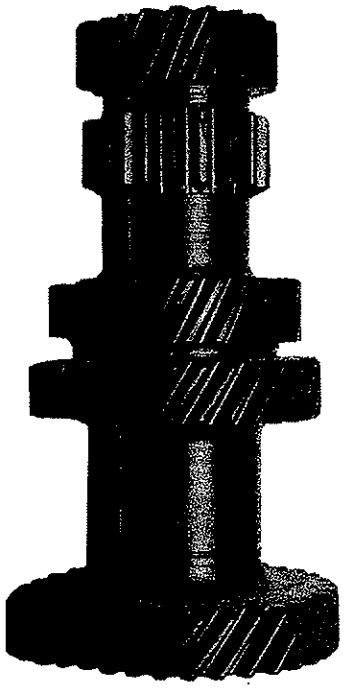
A much-abused, oft-broken part that has long been unavailable has recently resurfaced through Mopar Performance: the input bearing retainer. All the popular versions, and even some not-so-popular, are available again, as per this chart:

Input bearings were of either of two sizes, with the "307" bearing (shown), being more common. MRC, the Mopar supplier of choice for 30 years, has changed from an 8-ball configuration (left) to a newer 7-ball arrangement. While a quick assessment might lead to the conclusion that more balls is better, in this case, the newer design has bigger balls, for added capacity. Of course, the age-old question of more balls vs. bigger balls isn't going to be answered so simply, right? If you look carefully, you'll see that both of these bearings are equipped with external snap-ring grooves, which make them useable for input bearings, identified by industry no. 307-L. This groove, while not needed for the center bearing, doesn't preclude you from using them in that application. New Mopar bearings are readily available, with or without a snap ring, input retainer gasket and seal: #307-L Bearing (3.14" o.d.): P4529698 w/gaskets & seal; 3410048 bearing only. #308-L Bearing (3.54" o.d.): P4529699 w/ gaskets & seal; 4446326 bearing only. Note: for whatever reason, the kits are much cheaper than the individual bearings.

"A"-Input spline size	"B"-Bolt circle	"C"-Outside diameter	Part number	Notes
23	3.70"	4.35"	P4529694	Orig '64
23	3.70"	4.80"	P4529695	
23	4.16"	4.80"	P4529696	
23	4.16"	5.125"	3878596	Overdrive
18	4.16"	4.80"	P4529697	Hemi

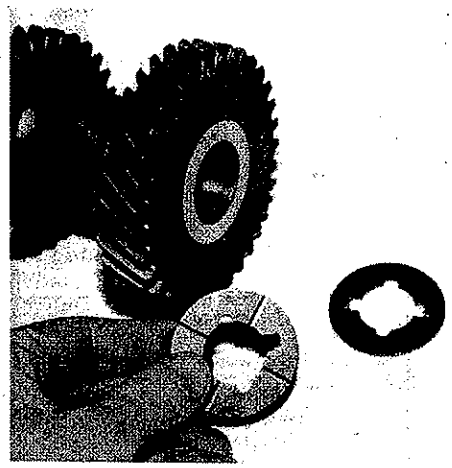
Note: All the 23-spline retainers use the standard clutch-release bearing (2405077), while the 18-spline Hemi boxes use 2823570. Also, in a reverse-scenario, the overdrive retainer is priced *much* lower than the MP offerings.

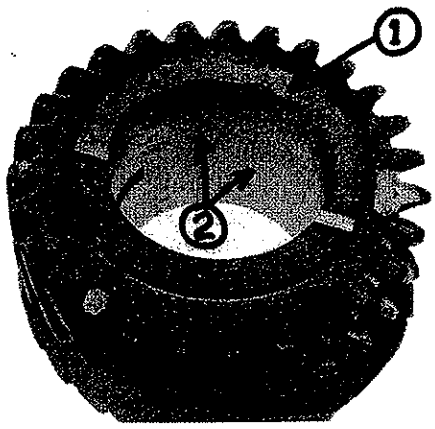
RATIONAL RATIOS: NO-FEAR GEARS



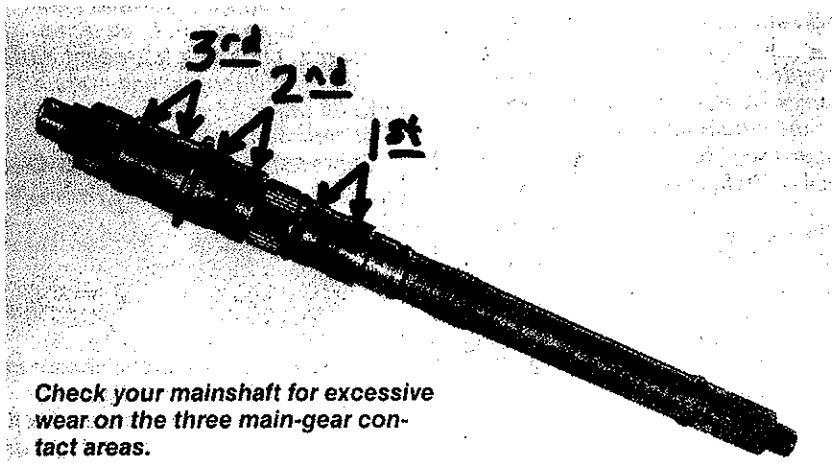
Countershaft gears (cluster gears) were manufactured in a bewildering array of ratios, pitches, etc. Your best shot at replacing a cluster would be searching the aftermarket gear houses, as well as NOS Mopar purveyors (with, of course, the correct part number in hand). Luckily, A-833 clusters were extremely rugged, in fact, we've seen 200,000-mile transmissions with no meaningful gear wear. In fact, the only place that the gears typically wear at all, is inside, where the 4 rows of rollers ride. Inspect this area carefully.

Sometimes the thrust surface will have some wear, but, more typically, only the thrust washers will be gone. New ones are available as part number 2538207.





As with the countershaft gear, main gears can sometimes show wear on the thrust (1) and interior bearing surfaces (2), in addition to cone and dog-tooth wear shown in the first photo in "Synch or Swim." Check these carefully for excessive play on your mainshaft. Note that Hemi gears have Oilite bushings on the inside.



Check your mainshaft for excessive wear on the three main-gear contact areas.

A-833 GEARSET SPECIFICATIONS

DESIGNATION	RATIOS			TOOTH COUNT MAIN SHAFT				TOOTH COUNT COUNTERSHAFT GEAR				NOTES
	1st	2nd	3rd	1st	2nd	3rd	Drive Pinion	1st	2nd	3rd	Direct	
1964-up 6-cyl	3.09	1.92	1.40	35	32	27	22	17	25	29	33	1
1964-up 8-cyl	2.66	1.91	1.39	35	34	29	24	17	23	27	31	
1966-70 Street Hemi	2.65	1.93	1.39	33	30	26	21	16	20	24	27	2
'70 Trans Am & '71-'74 8 cyl	2.47	1.77	1.34	35	34	29	25	17	23	26	30	4
'71-'74 Hemi & Hi-Perf	2.44	1.77	1.34	33	30	26	22	16	20	23	26	2
'75-up Overdrive	3.09	1.67	0.73	35	30	18	22	17	27	37	33	3

Numerous ratios have been produced for A-833s. This chart details the production versions only. Parts availability is poor, some overdrive parts are all that remain in the Mopar system.

NOTES:
1—Was used on '64 to early '66 6-cyl + 273 cars, and again in some mid '70s 318 cars.
2—Coarse-pitch gearset, Oilite bushed.
3—"Overdrive" was accomplished by "fooling" the driver by swapping 3rd and 4th. Third was actually overdrive.
4—First trans with new style side cover.

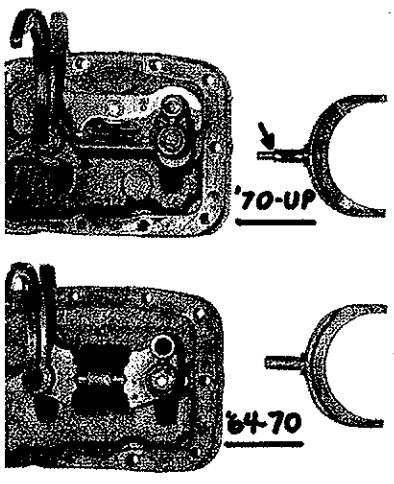
Continued on page 58

A Need Four Speed

Continued from page 57

ON THE SIDE

There have been only two basic types of side cover/interlock/fork assemblies. The early type (bottom), can be recognized in a flash: it uses a double-ball arrangement to prevent the trans from being shifted into 2 gears at once, and the forks are made of brass. *This setup is generally considered to be the better of the two. The only problem is the occasional broken fork, and they are disco'd. Luckily, the steel forks used in the later arrangement (top) can be used in the early side covers by simply cutting off the small-diameter protrusions (at arrow.) The 1-2 fork is available as 4130068, the 3-4 piece is 3410038. Note that 1970 was the changeover year, with both interlock/side cover types in production. If you should find an aluminum side cover, don't let it get away. To the best of our knowledge they were used only on 1965 A-990 race Hemi cars.*



HOT HOOKUP

Clutches are a rather subjective item; everybody seems to have a favorite. Muscle-era Mopars virtually all came equipped with a typical 3-finger Borg and Beck unit (right), while most '60s GM cars were equipped with diaphgram pressure plates (left.) The diaphragm units are well known for their pluses: high torque capacity, clean release, and reasonable pedal pressure. Why then, weren't they used on Mopars? Simple, they had a nasty habit of hangin' on the floor during high-rev shifts. Not a pretty picture, indeed. The pressure plate on the left, though, solved that problem. It's a Scheiffer Rev-Lock unit, circa 1970. We have been using them successfully, even on 7500-rpm 340s, since that time. One problem, though: since Hurst owned Scheiffer, and Hurst was sold off quite a while back, Scheiffer seems to have disappeared. Luckily, a left-coast outfit, Midway Industries, has stepped in to fill the void, with a fabulous line of clutches by the name of Centerforce. *Here a new Centerforce pressure plate is shown next to a new FWD Mopar Turbo II stocker. The Centerforce clutch has readily visible centrifugal assist weights, which provide additional clamping pressure at high revs, in addition to preventing stuck-pedal-itis.*

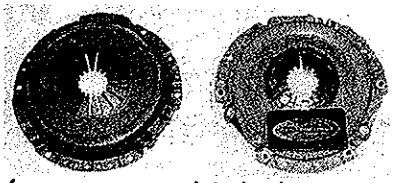


Photo: Dave Zelkowski

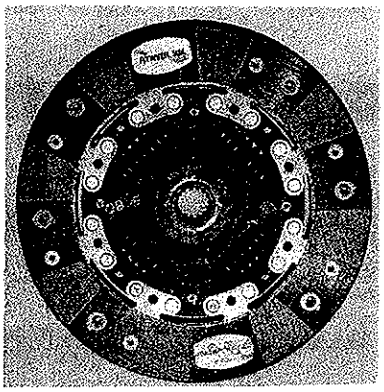
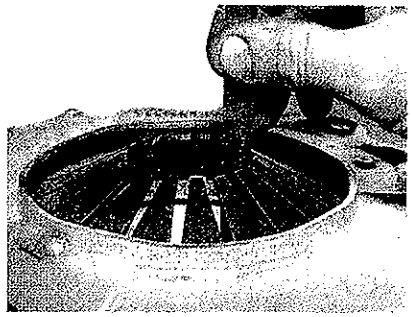
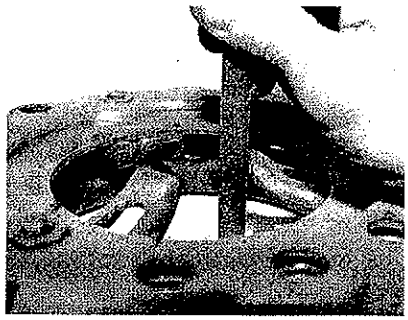
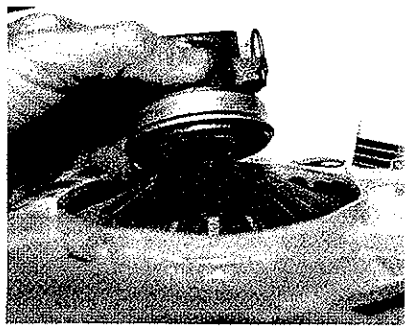


Photo: Dave Zelkowski

In addition to the trick pressure plate, Centerforce has a slick disc that's metallic-faced on one side only, hence it's moniker: Dual Friction. *This gem provides the smooth engagement that the asbestos discs are known for, as well as the high-temp benefits of the sintered metal. Used in conjunction with the Centerforce pressure plate, torque capacity is increased by an incredible 90%. Using these two Centerforce pieces, we've been able to launch a heavy 4-door Lancer with a tire-frying 260-hp mill, for over 25,000 miles with zero problems. A testimonial? You betcha!*







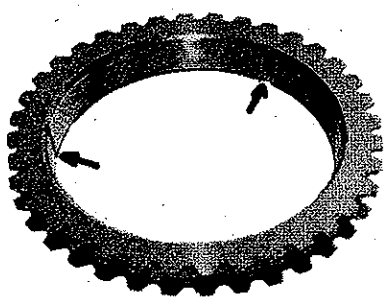
Want proof that the diaphragm unit will bolt into your 340 or 440? Well, besides the bolt pattern being correct, the finger height is the same, and...the finger diameter is just right for the stock release bearing. The only case we've seen where a diaphragm wouldn't fit is in a 1967 Hemi Coronet R/T, which was originally equipped with an 11" Borg & Beck pressure plate. The boxier design of the diaphragm plate caused interference inside the clutch housing. Every other swap we've done has gone without a hitch. Note, though, that Midway's catalog claims to fit that application, so they may have solved that problem. Midway produces the Dual-Friction disc in every conceivable spline, even the Hemi (1-3/16"x18) and the newest FWDs (15/16"x17).

Source:

Centerforce Clutches: Midway Industries, 7171 Patterson Dr., Garden Grove, CA 92641, (714) 898-4477

BOOB LUBE?

Synthetic lubes are all the rage these days, in fact, we have been using synthetic motor oils for about a decade. As Tony the Tiger says, "They're G-R-E-A-T!" Several friends had told us about similar success using synthetics in late-model transaxles, so, recently, we tried various synthetic brews in two different A-833s. One was a fresh rebuild, one a well-worn, 1965 piece. The outcome? In a word, disaster: Gear Clash City, as if the synchro brass rings were worn or broken. Almost undriveable, in fact. Researching this with our friends at Chrysler Engineering, we came up with an explanation: since the synthetics are much more slippery, a way is needed to bleed off the lube trapped in the brass ring's circumfrential grooves, so that there can be some metal-to-metal braking action. In the later FWD transaxles this is accomplished by



three notches cut by the factory (check the photo of a stock 1990 A-568 stop ring.) Unfortunately, while it would certainly be possible to duplicate these notches in an A-833 ring, it is NOT recommended, for potential breakage reasons. What has worked for use for almost 30 years is the factory-recommended S.A.E. 140 gear oil. Lately, though, this stuff is scarcer than hen's teeth, but the readily-available S.A.E. 85W-140 seems to be nearly as effective, and a lot more pleasant in very cold weather.

ENGINE SWAP SERIES

TRANS-PLANTS

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

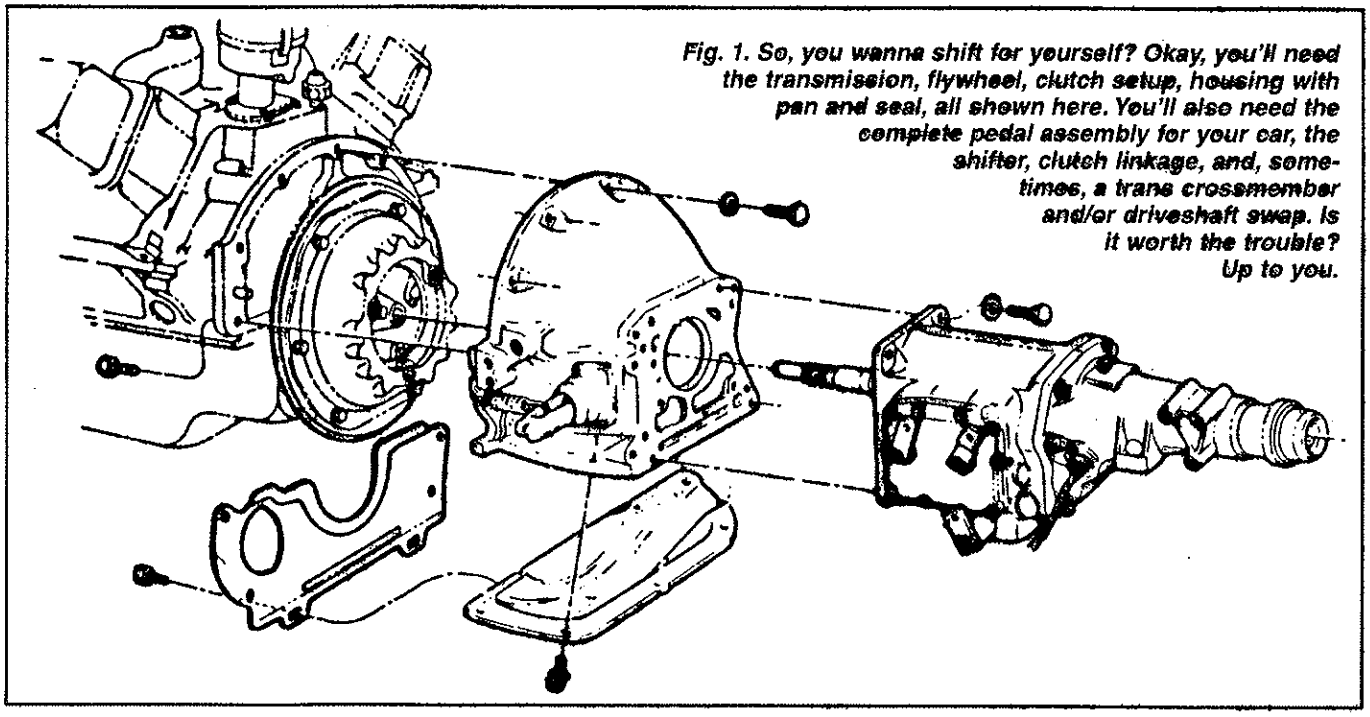


Fig. 1. So, you wanna shift for yourself? Okay, you'll need the transmission, flywheel, clutch setup, housing with pan and seal, all shown here. You'll also need the complete pedal assembly for your car, the shifter, clutch linkage, and, sometimes, a trans crossmember and/or driveshaft swap. Is it worth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

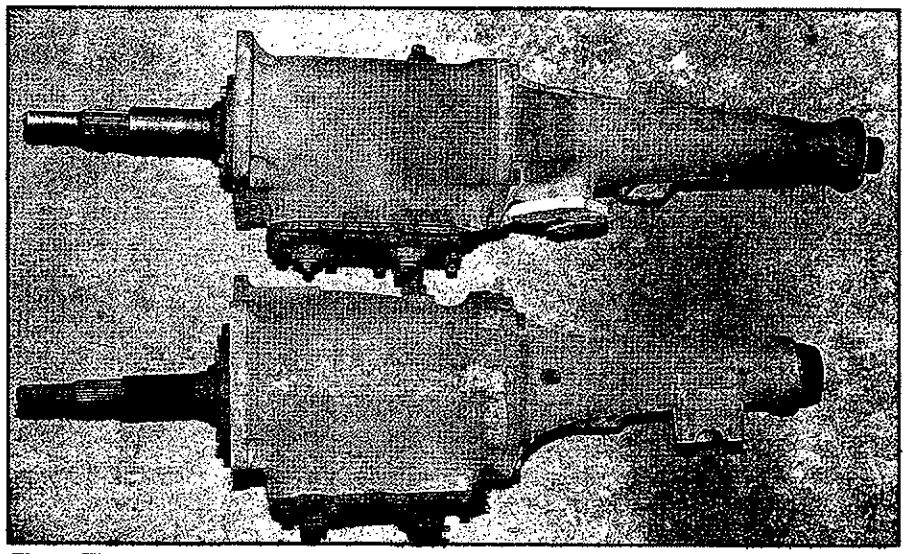


Fig. 2. The top trans is a pre-1970 B-body unit: note the single shifter mounting area well forward on the extension housing. Below is a typical '66-up A/F-body unit, which only had one shifter location for all years.

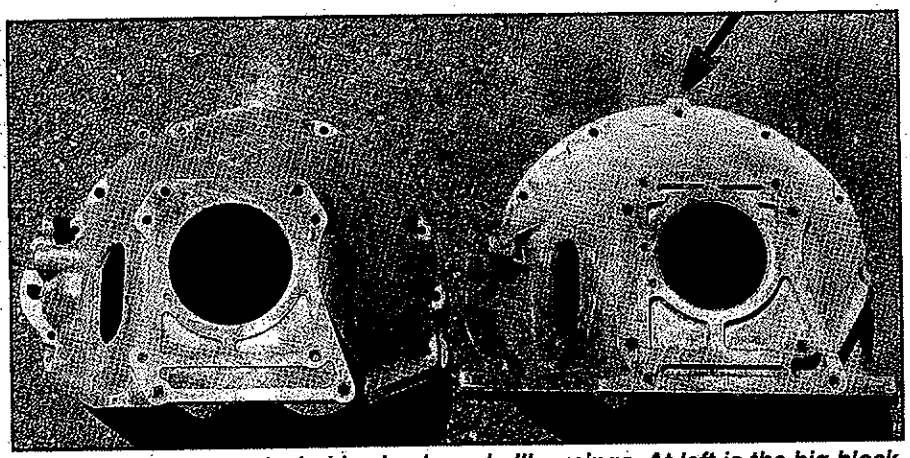


Fig. 3. These are two desirable aluminum bellhousings. At left is the big block piece, right is smallblock. Note dual trans bolt patterns (for A-833 and A-230 3-speed), which means that a junkyard 3-speed car does have the housing you need. How to tell which is which at a glance? Well, the bottom pan 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.

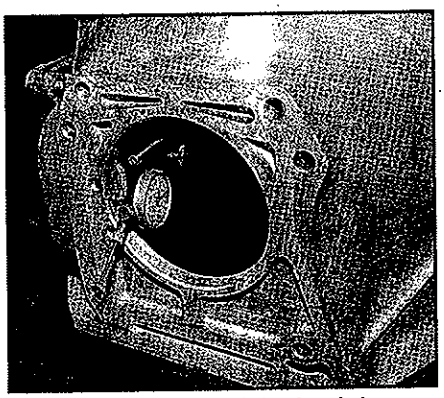
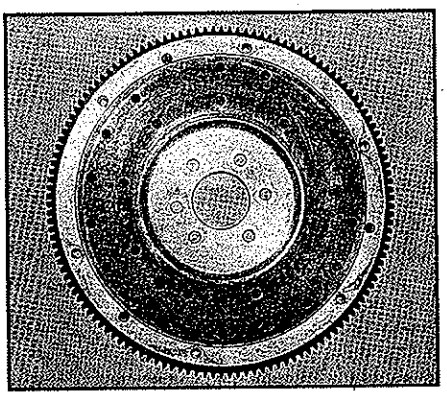


Fig. 4. No matter which clutch housing you use, be sure to check (and correct) any concentricity and parallelism errors. See any Mopar service manual for the procedure.



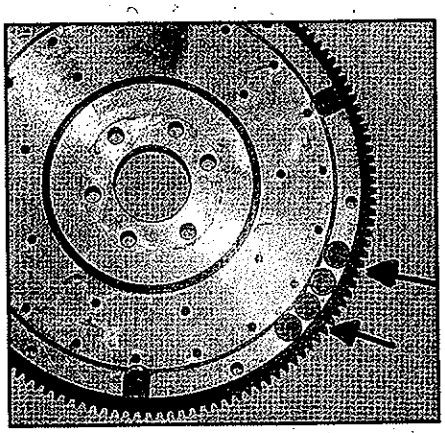


Fig. 5. OEM or aftermarket, be sure you're getting the right flywheel. A light aluminum 'wheel, like this specimen (top), is good for cars with a favorable torque to weight ratio. Note riveted wear surface. Bottom, the back of this 'wheel shows lots of balance weights (arrows). It's a 360 unit.

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.

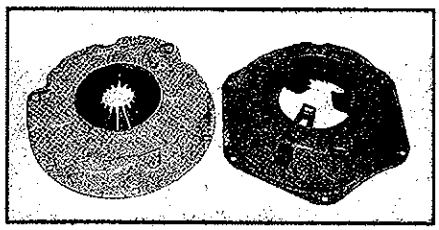

Fig. 6. Through the decades, the vast majority of RWD muscle Mopars were equipped with the simple and reliable Borg and Beck pressure plate (right). The only drawback? Mega pedal pressure. Consider using, instead, a modern diaphragm pressure plate (left).

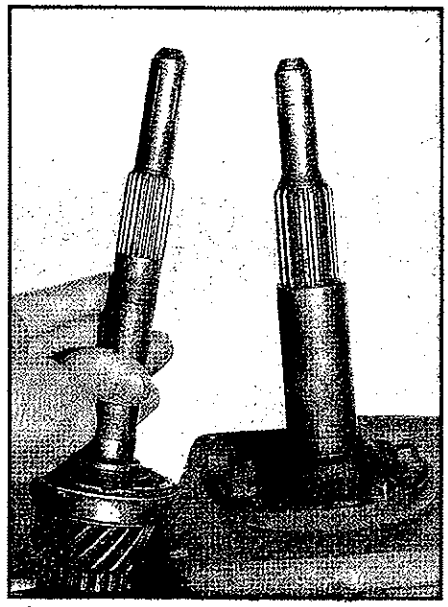

***Fig 8. The vast majority of A-833s used the 1″x 23-spline input shaft (left). Hemi boxes used the super-beefy 1-3/6 x 18-spline unit (right). This required a special bearing retainer and release bearing.* Both, however, fit the same pilot bushing.**

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)

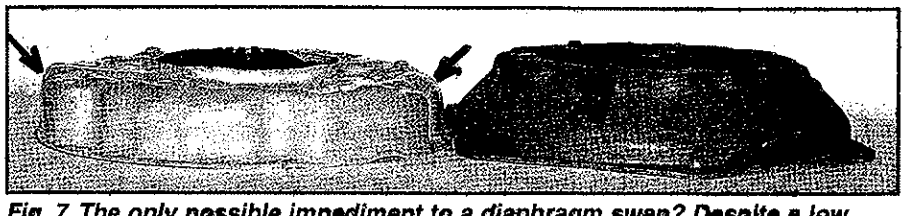

Fig. 7. The only possible impediment to a diaphragm swap? Despite a low profile, the "corners" are "square" (arrows). On some bellhousings this can be a point of interferenee (see text).

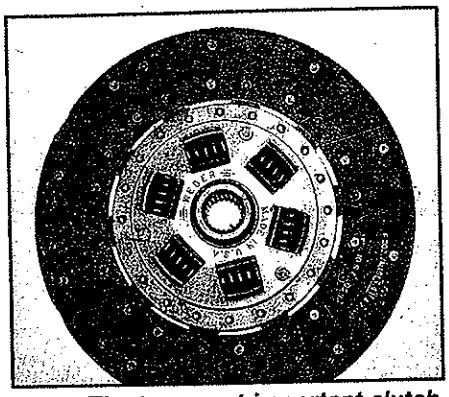

Fig. 9. The two most important clutch disc parameters are: Is it the right diameter? Does it have the correct drive spline? (This one's the common 1" x 23-spline configuration.)

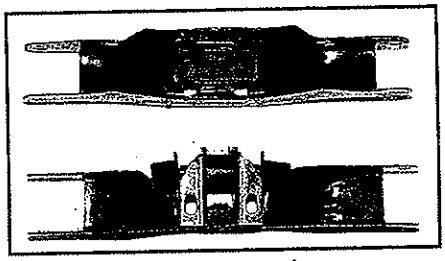

Fig. 10. Trans crossmembers were produced with two different mount systems. The late, spool-type setup (bottom) is preferred for it's fail-safe design.

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-

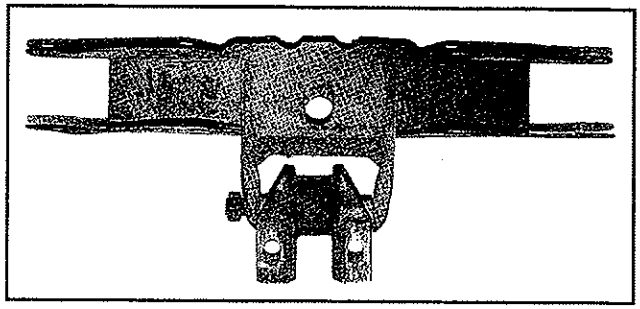


Fig. 11. In some instances, the trans x-member for A-833 use had an offset mount. These, too, are available (used) with either mount system.

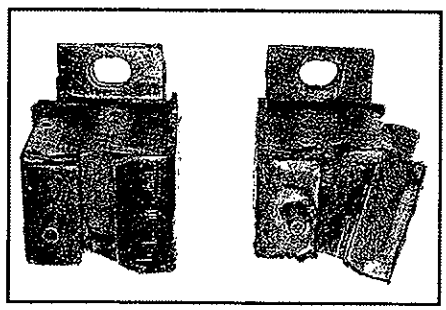
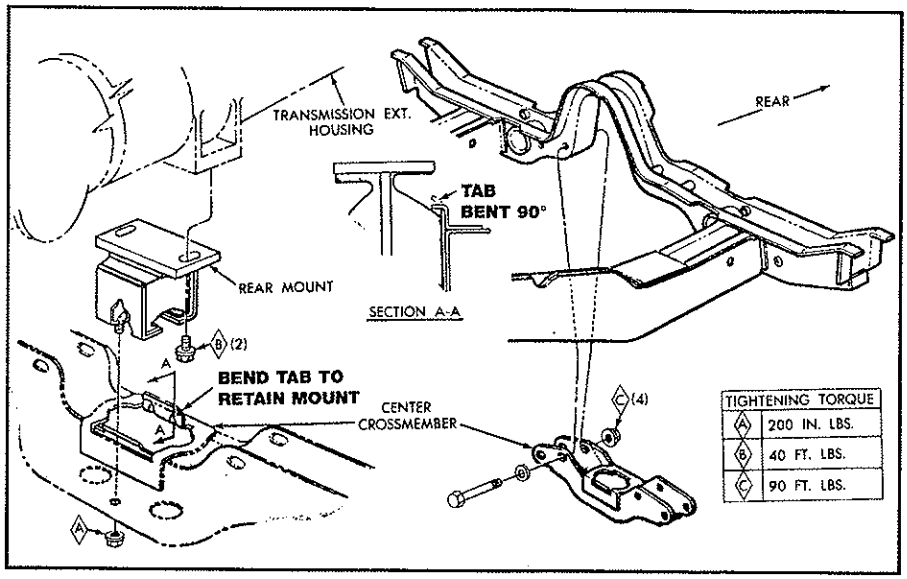


***Fig. 12. Why avoid the early biscuit mount? A picture is worth a thousand words. However, many failures can be prevented by proper installation. You do remember to bend the tab over, (below)* don't you?**



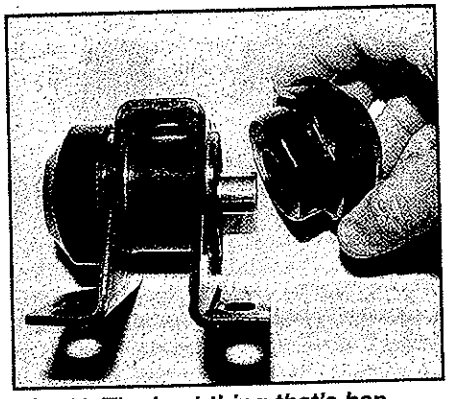


Fig. 13. The best thing that's happened to trans mounts: the Energy Suspension urethane inserts. Wish they made these for engine mounts, too.

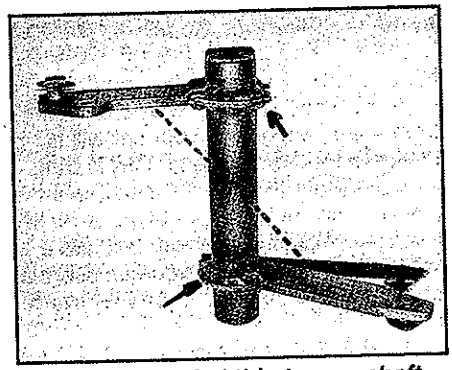


Fig. 14. We beefed this torque shaft with two welded pieces (arrows) that change the design from a basically butt-welded setup to a full-circle design. Another approach is add gussets (dotted lines). Always check for clearance before making any irreversible modifications.

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.

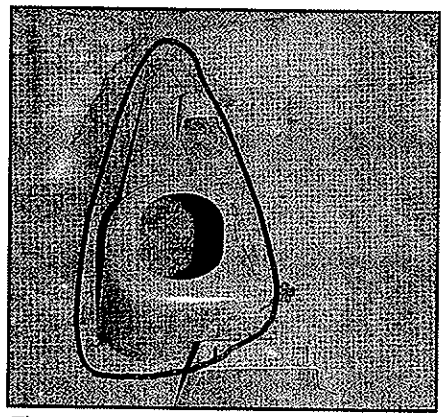


Fig. 15. If your car didn't come with a manual-trans floor shift (3 or 4-speed), you'll need to find and install one of these tunnel kits (circled). This one's OEM in a '67 B-body. This piece provides clearance for the shifter mechanism itself, and the linkage rods.

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

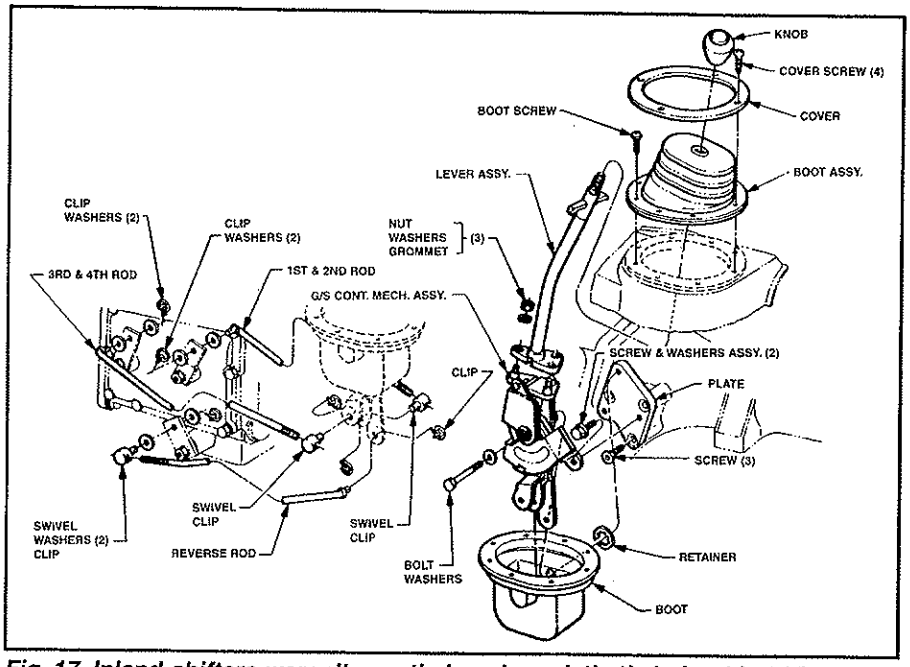


Fig. 17. Inland shifters weren't exactly loved...and, that's being kind. They were used in '66, '67, and early '68. The only improvement is to discard the rubber grommets and bolt the stick up solid.

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

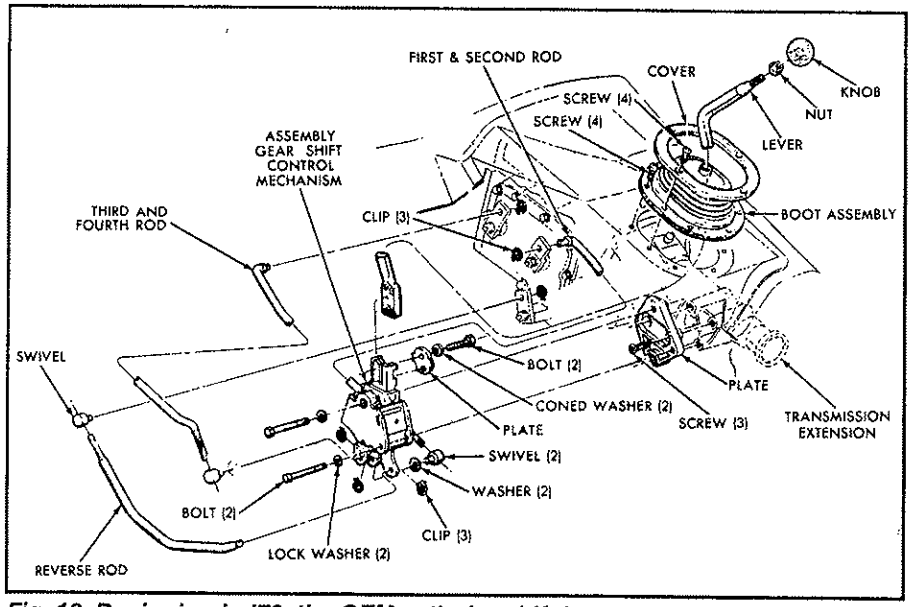


Fig. 18. Beginning in '72, the OEM setlp for shift lever attachment was changed to a thru-bolt arrangement very similar to the present-day aftermarket Hurst stuff.

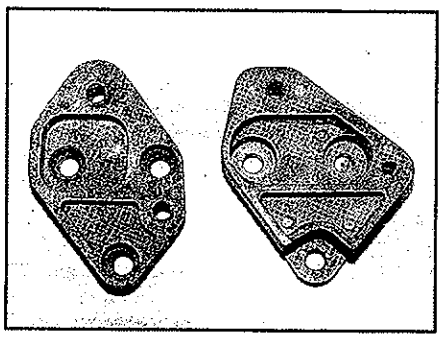


Fig.19. There were at least 6 different shifter mounting plates. Some repros are available (see text.)

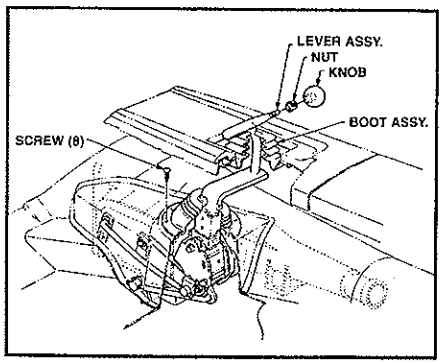


Fig. 20. Console setups required two boots one to seal the floor tunnel piece (clearly visible here) and another to seal the finish plate. This is a 1969 B-body setup.

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

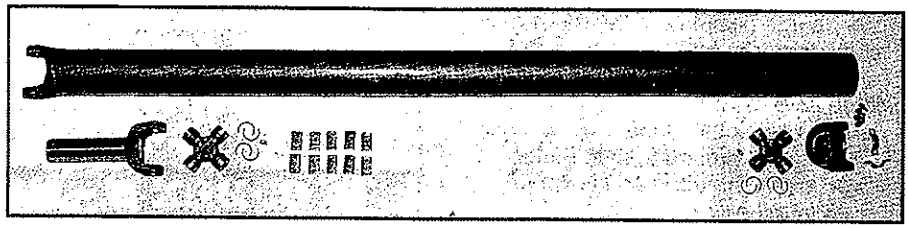


Fig. 21. Mopar Performance's D-I-Y propshaft kit is complete with Ujoints and the slip yoke. Even balance weights are included! One end comes pre-welded.

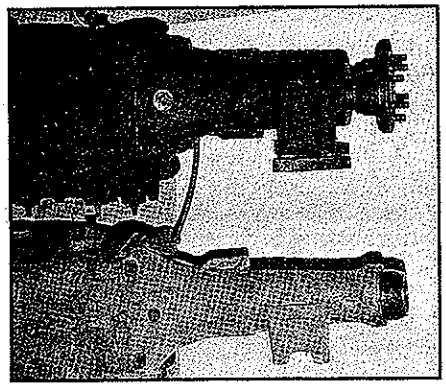


Fig. 22. Early transmissions used the bolt-up ball-and-trunnion deal (top). The only reason for swapping to this would be finding a complete bolt-in swap setup with the right driveshaft. Otherwise, go with the later slip-yoke deal (bottom).

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

Martin

4-SPEED FOR SPORTSMEN

Chrysler's all-new, full-synchro gearbox challenges the toughest 426 ever built, and those rodders who ask the perennial question: "What'll I use for a 4-speed?"

by BOB GREENE

Deep beneath the shining sheetmetal of Detroit's lineup for 'sixty-four is what could well be the story of the year, an engineering achievement of prime importance to performance enthusiasts in general and hot rodders in particular. Given the identification number A-833, the subject of our concern promises to be a boon to those who have watched engine development zoom far ahead of its vital complement, the 4-speed manual transmission.

Realizing the desperate need for a really husky 4-speed box suitable for competition, the Chrysler Corporation dedicated a major section of their vast transmission facilities during the past year to the perfection of just such a compo-

As an engineer in the transmission department, Dale Reeker, right, helps design-in gearbox strength; as a member of the RamChargers, he has the ironical job of trying to prove himself wrong. When Dale throws a shift, everybody pays attention, including Engineer Dale Slaubaugh, left, HRM Editor Bob Greene. Test stand includes elaborate dyno, control panel.

nent. We personally inspected every piece of it at their Central Engineering Staff laboratories in Detroit, from the smallest needle bearing to the massive cluster gear, then participated in brutal "shell 'em if you can" acceleration tests with Development Engineer Dale Reeker (member of the national champion RamChargers drag race team) – and, brother, this box is going to be around for a while!

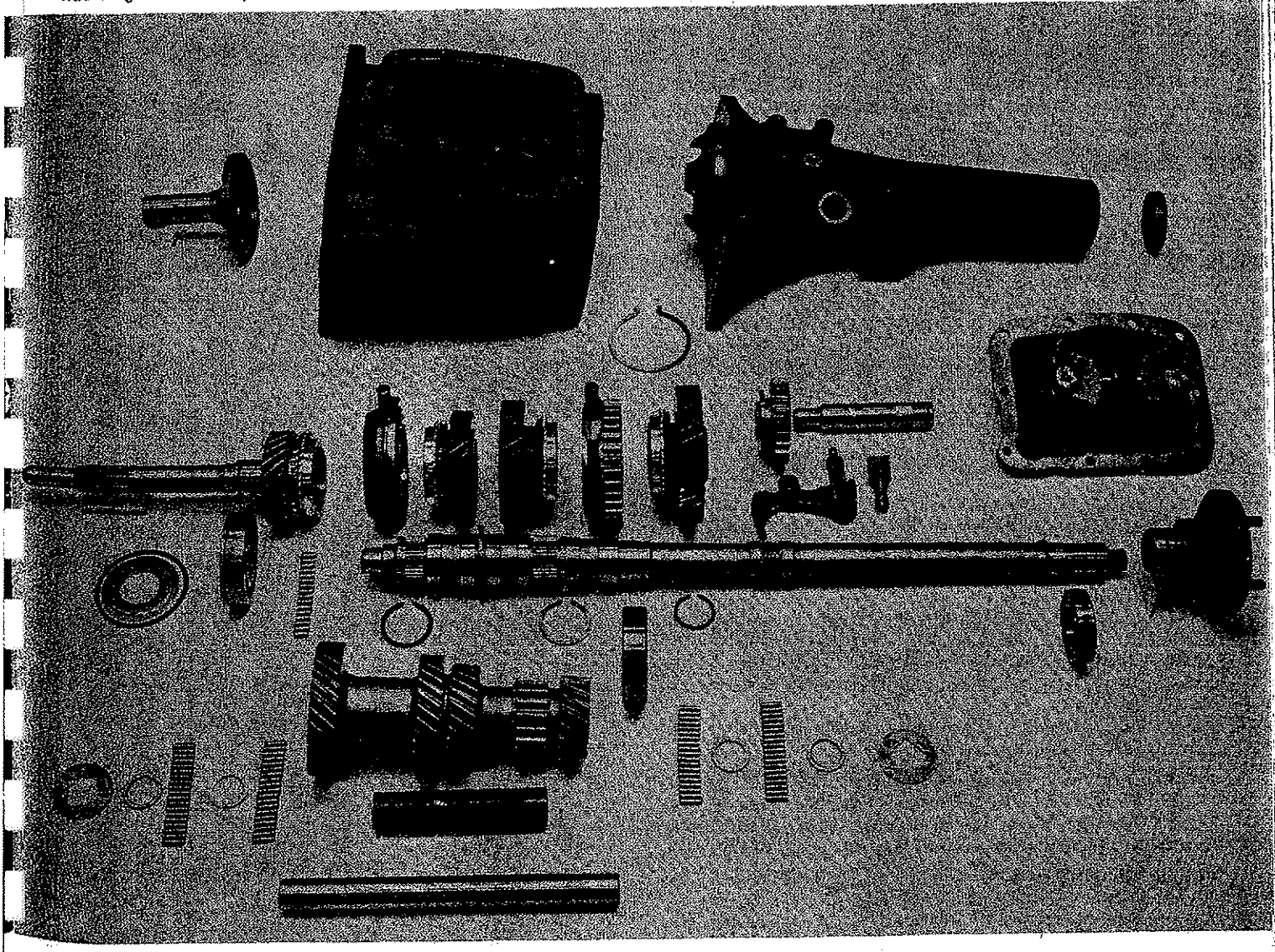
Prior to 1961, when engine displacement and public opinion were not nearly so positive as they are today, the Borg-Warner 3-speed manual transmission, designated the T-85, was generally used by the industry to cover the needs of the growing group of sports-minded drivers who spearheaded the revival of the shift-for-yourself movement. Subsequent demands called for a 4-speed and, with the necessary orders in sight, B-W accommodated by making a very clever modification to their 3-speed, moving the reverse gear in their T-85 model outside the case proper and thereby making room for the necessary fourth gear inside. Known as the T-10, this is the 4-speed that Chrysler and others are currently using as an optional transmission for high performance application.

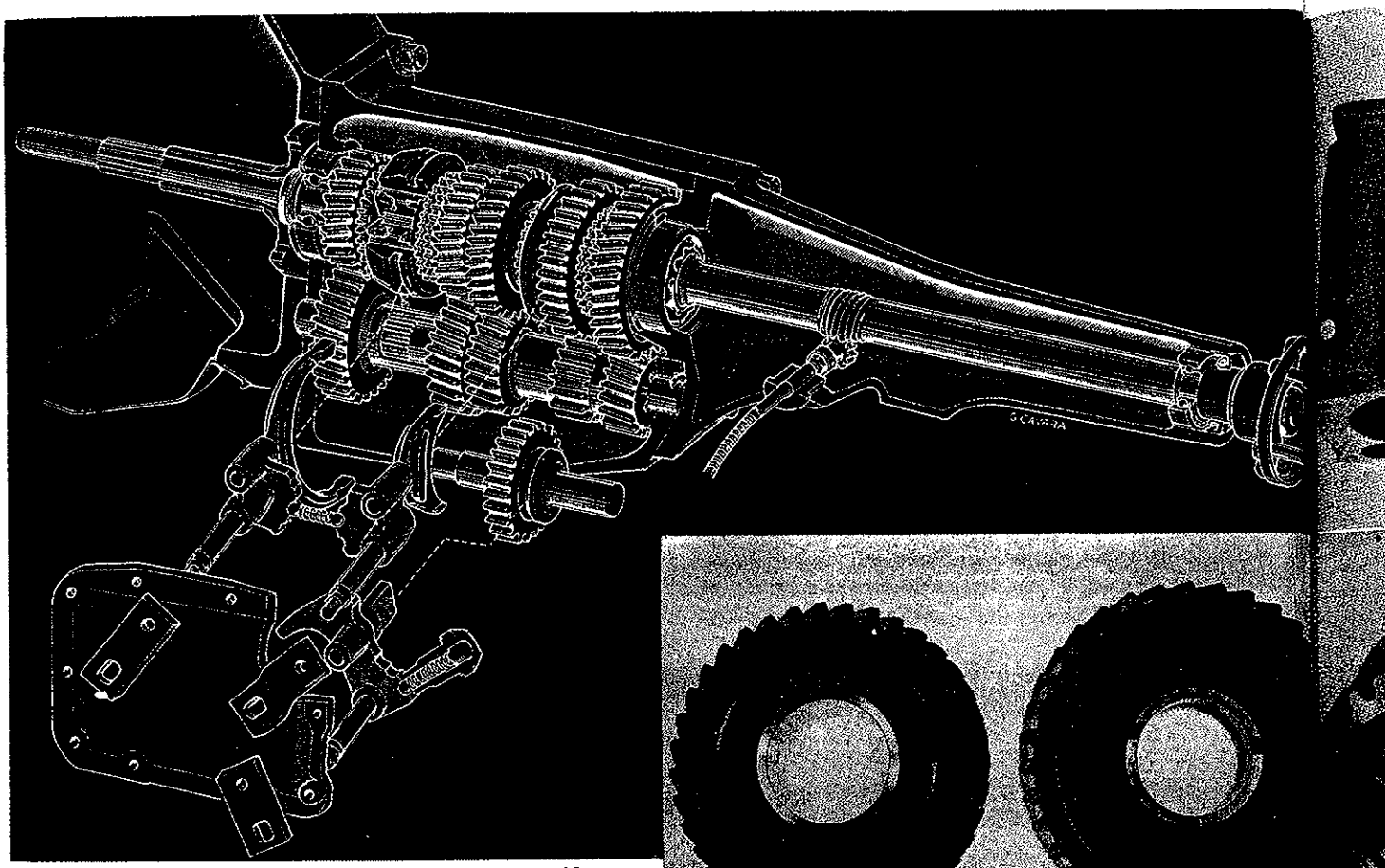
But with the rapid succession of bore and stroke increases that skyrocketed engine displacements from somewhat over 300 cubic inches to today's "hairy" 426's (NASCAR, USAC, and NHRA limits), it became increasingly clear that a bigger box with more capacity was in order to withstand the extreme torque output of modern competition engines, especially at the drags.

Starting from scratch and designing toward a fully synchromesh 4-speed that could easily handle the full brunt of the hottest 426, Chrysler engineers realized that the gear case itself had to be physically larger for several reasons, most important of which concerned an engineering axiom that reads to this effect: Using the same gear ratio, doubling the center-to-center distance between the countershaft and the mainshaft increases by the square (4 times) the transmission's torque capacity. Obviously the larger diameter gears would be stronger; in the instance of the new A-833 gearbox, moving the center-to-center distance out from 3¼ to 3½ inches resulted in a 16% increase alone. Plus additional torque carrying capacity was gained by making all forward drive gears 15-30% wider. Further benefits from the larger gear case, and subsequently stronger gears, included the possibility now of using lower (numerically higher) starting ratios; low gear, for example, has been changed from the former 2.2:1 to 2.66:1 for the biggest Chrysler Corporation engines, while the smaller 6-cylinder

(Continued on following page)

The whole kit and caboodle spread out in pretty much the way it goes together. The A-833 was designed to withstand not only the wildest 426 but quite a bit more. Forward gears (1st through 4th) shown in center are all synchromesh; cluster has larger diameter, wider teeth. Box is available in all '64 Chrysler product cars except the New Yorker and Imperial.



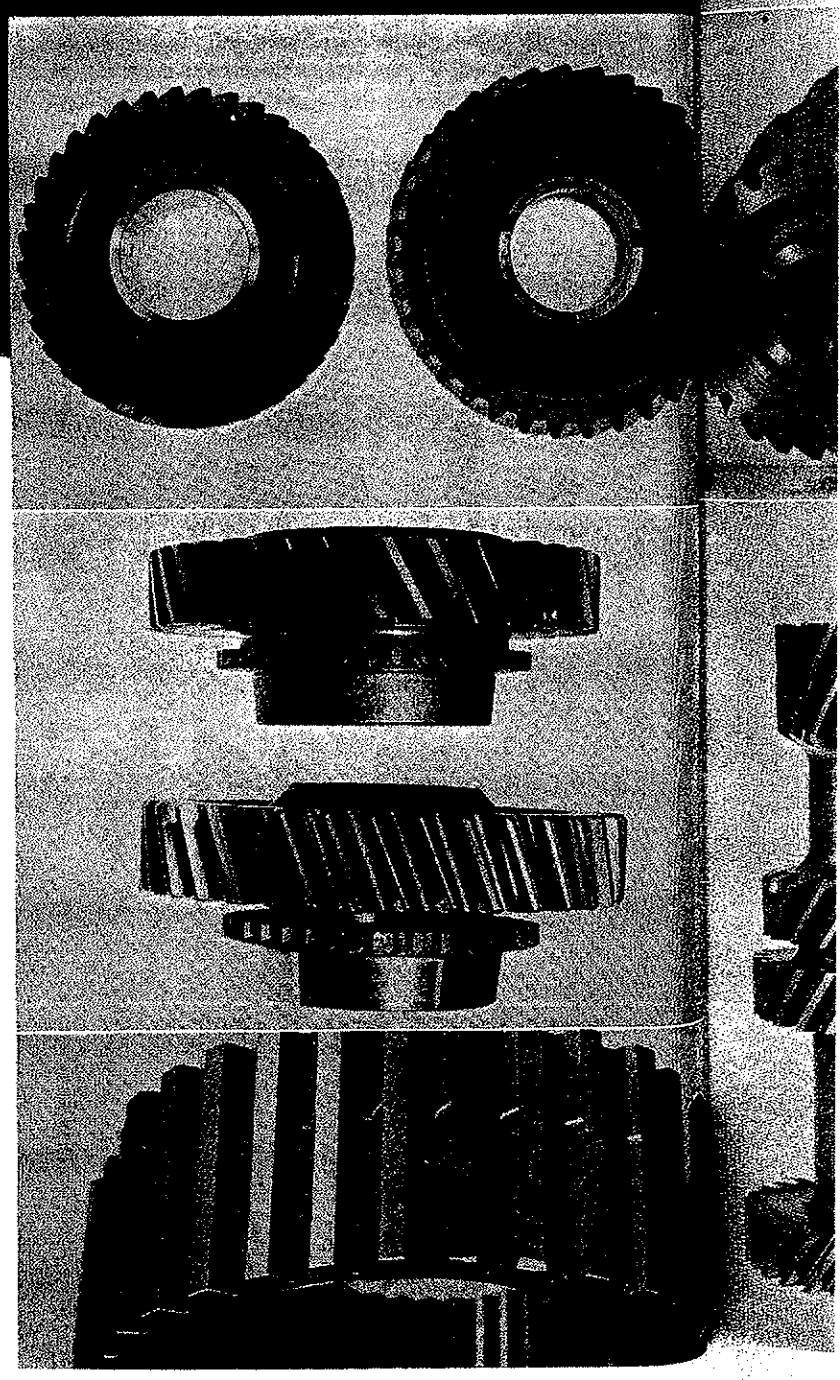


New optional 4-speed will undoubtedly be much in evidence in big Dodge, Plymouth drag machines. Note reverse gear is now incorporated inside case proper. All gears are helical cut (except for reverse) for quieter operation, more contact.

4-SPEED FOR SPORTSMEN

engine can take advantage of a 3.09:1 low. Before leaving the gear case, it is interesting to note that the housing itself, the tailshaft assembly, and the clutch housing have heavier walls and more gradual radii throughout to prevent breakage due to ever-present driveline vibrations encountered under maximum performance conditions. An additional bonus for the hot rodder is apparent when the A-833 4-speed or the still-popular T-85 3-speed are ordered with one of the maximum performance 426 SuperStock or RamCharger V8 versions for 1964; both come standard with an NHRA-approved cast steel clutch housing, thus eliminating the labor and expense of installing a separate shield. Considerable importance, too, is placed on the exterior fittings; Hurst shift linkage is standard equipment on the A-833 box!

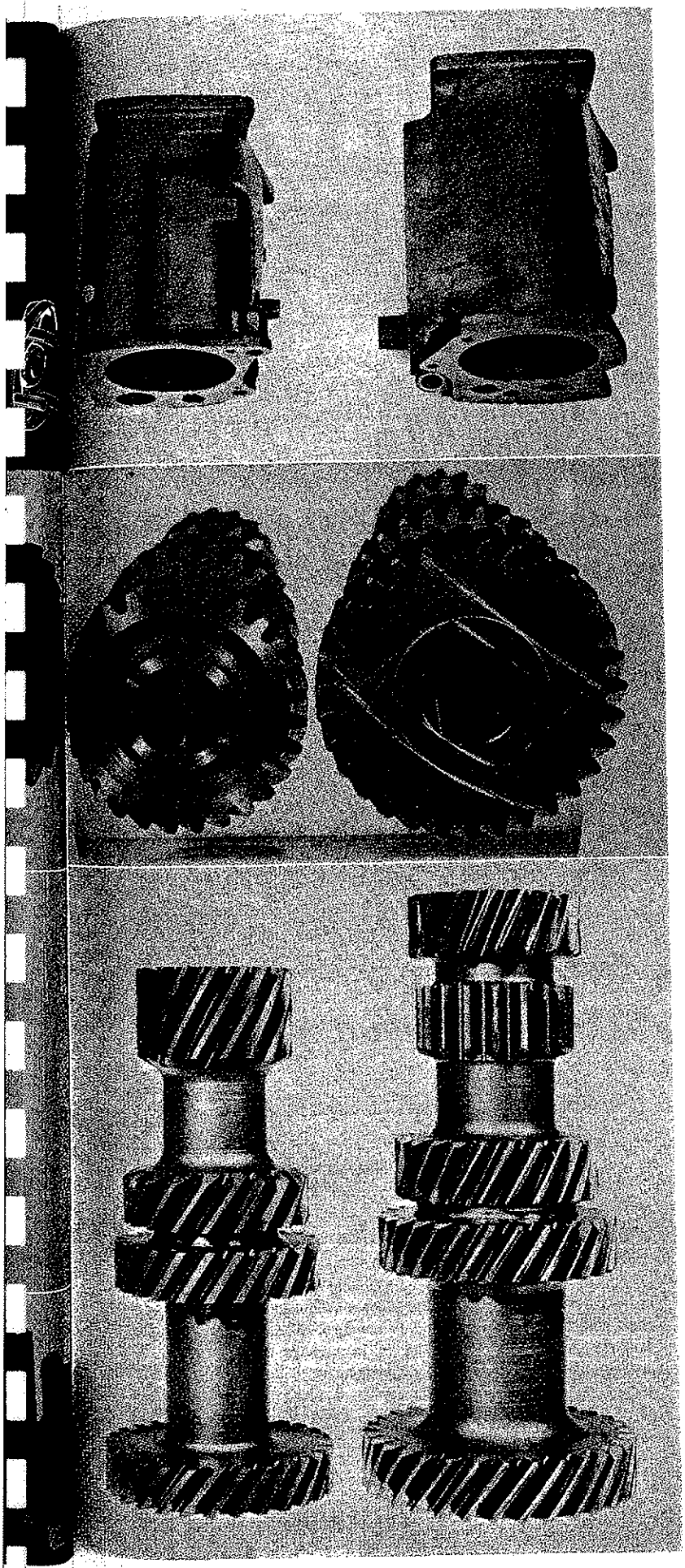
Looking inside the gearbox, starting with the mainshaft, we find simplicity of construction has resulted in fewer parts. The clutch gears are now carried on the mainshaft by fine rolled splines (more contact area) rather than the big square splines often used in the past. You will see, too, in the included close-up photo, that the contact area on the



TOP RIGHT – This comparison view between A-833 (right) and T-10 low speed gears shows very noticeable increase in diameter as well as extra width at the base of gear teeth.

CENTER RIGHT—Another view of A-833 low gear (bottom) and T-10 counterpart. As evidenced here, all forward drive gears are 15-30% wider, increasing life span many times.

BOTTOM RIGHT—Extreme close-up of clutch gear shows partial relief or undercut (known as torquelock feature), prevents climbing out of gear when engine is decelerated.



RATIO CHART FOR A-833 AND T-10 4-SPEEDS					
TRANS.	1st	2nd	3rd	4th	REV.
A-833 (6)	3.09	1.92	1.40	1.00	3.00
A-833 (V8)	2.66	1.91	1.39	1.00	2.58
T-10 (318 V8)	2.54	1.89	1.51	1.00	2.61
T-10 (361-838)	2.20	1.64	1.31	1.00	2.26

Chart indicates T-10 ratios currently used in Chrysler product cars compared to the new figures on the A-833 4-speeds. The B-W T-85 3-speed will again be the standard unit in '64.

clutch gear (the half on which the clutch sleeve rides during 1st and 3rd gear engagement) is undercut to prevent the possibility of gear jump-out during deceleration. For conversation sake, this is called the "torquelock" feature.

We attempted photographically to show the obvious size and beef of the backbone of the gearbox, the cluster gear. Improved tooth configuration is also evident, plus the fact that there are fewer teeth per inch due to larger gear diameter, permitting a more gradually radiused root to prevent stress concentrations and induced breakage. Cluster gear needle bearings are likewise 20% larger in diameter for increased capacity and durability. Final tests showed that the concentration on strength paid off – deflection of the cluster gear is less than .004 inch (the thickness of an average human hair) at full design torque load, 480 lb-ft-plus! How about ratios? Good news here, as you will notice by the included chart, with a perfectly even spread between all gears.

The bronze synchro rings have come in for their share of attention; metal has been added to the cross-section of the minimum areas of the rings for a 25% increase to reduce cracking. Whereas 50 to 75 torture shifts have been known to break the old synchros, the new ones have not even shown *signs* of failure after 100 cycles (complete shift sequences through all gears).

The testing of the transmissions, I might add, is one of the most fascinating phases of the entire development program. Besides enthusiastic in-the-field tests under the most strenuous competition circumstances by the RamChargers racing team, and around-the-clock grinds by test engineers at the Chelsea proving grounds, Chrysler has an equally torturous series of devices at their Central Engineering Staff laboratories. Approaching the transmission test room, your ears tell you that there just has to be a grand scale drag race going on inside – the roar of engines straining to peak, then a snap-shift to the next gear and roar again – but a look inside reveals a strange new automated drags, with row upon row of engines driving through transmissions under test, into huge dynamometers in an endless race to oblivion. Beside each test stand is a fully-instrumented control panel recording the number of cycles, torque load, rpm, and all pertinent data to tell the story on transmission durability. This is what it told: The new A-833 4-speed, when used behind the biggest and most powerful current production engines, has a gear and bearing life expectancy at least 15 times that of current available 4-speeds!

Even the RamChargers had to nod in concurrence. ■■

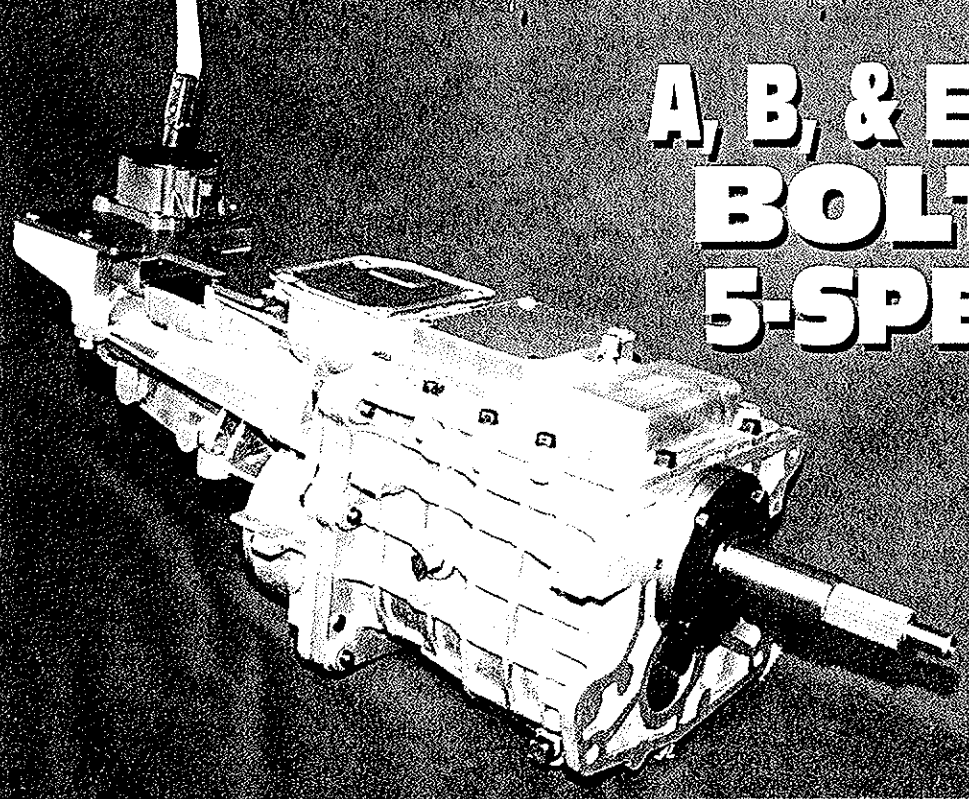
TOP LEFT—The A-833 case (right) beside T-10 model. Note more gradual radii around bolt holes, and larger exterior. New box, complete, is only 21 pounds heavier (dry) and will clear any floor pan that clears the T-10. The length of both is the same (28.7 inches from front of transmission case to face of prop shaft flange), except for 6-cylinder version of A-833 which is only 23 inches because of shorter tailshaft.

CENTER LEFT—End view of T-10 (left), A-833 clusters.

BOTTOM LEFT—Note larger body, radii of A-833 (right).

BULLETPROOF PISTOL

A, B, & E-BODY BOLT-IN 5-SPEEDS



Over the last several years, there have been several five speed and six speed conversion kits offered for transplanting modern stick transmissions into our old Mopars. All have had their pros and cons, but the one thing they all have in common is that they are very expensive and require extensive modifications to successfully install. Such is not the case any longer.

Well known engineering whiz Shafi Keisler has just released a ground-up developed from scratch five speed designed specifically for installation behind Mopar big and small blocks. The Keisler 5-Speed Manual Transmission Conversion Kit is the first true bolt-in operation for bringing your old muscle car into line with modern quick shifting exotics that any average Joe can do in the comfort of his garage with basic automotive tools.

Being a Mopar guy himself, Keisler wanted a five speed conversion for his own cars. He wanted the application to be of very high quality, be durable, affordable, and easy to install. None of the existing kits offered this. Having led a program to design conversion kits for European cars before, Keisler took matters into his own hands to solve this dilemma. The years of research that went into this project resulted in a conversion kit which can put a Pistol Grip shifted five speed behind your engine regardless of whether it currently has a four speed or an automatic.

The main ingredient in the Keisler kit is the Tremec TKO 5-speed transmission, which has been significantly modified for this particular application. The TKO is the super high performance version of the Tremec 3550, which was factory equipment in the limited edition big block 1997 Mustang Cobra R. This tranny is not to be confused with the common T5 Mustang five speed, which is far too weak to sustain big block horsepower and torque.

Keisler offers the TKO in two versions of overdrive; 0.68:1 and 0.83:1. The latter version has a 4515 steel alloy gear set, boosting the torque capacity to 475 ft/lbs in fifth gear alone. Capable of handling over 425 ft/lbs of torque in fifth gear, the TKO is ideally suited for most Mopar engines and offers the best all-around combination for street/strip driving. The gear ratios in the TKO are much better suited for the muscle car than those found in a stock Chrysler 833 four speed, so your car will leap out of the hole and clip through the gears much faster.

As an example of how much improvement you'll net, let's say you have a car with an 833 four speed and a 3.55 geared rear end. To get out of the hole at the same rate as an identical car equipped with the TKO transmission, you'd need to change to a 4.40:1 rear end gear ratio! And with the fifth speed overdrive, highway cruising is a breeze as well. This one genuinely gives you the best of both worlds.

The TKO has other advantages. The Keisler transmissions are modified to accept a stock Pistol Grip shifter and Hurst handles found in 1968-69 cars. The throw in the shifting is short, making for fast gear changes. And unlike other aftermarket transmissions, such as a Richmond 6 speed, the TKO is a mostly silent operator. No annoying gear whine when cruising!

Ingredient number two in Keisler's kit is a reworked original Chrysler bellhousing. Keisler found that original used bellhousings were far too irregular to meet the exacting specifications needed to handle the TKO. To remedy this, Keisler reprocesses each bellhousing using full CNC machining for complete accuracy, fit, and finish. All is designed for proper alignment to insure long driveline life, proper shift engagement, and a low noise level. For those wanting something more stout, Lakewood safety bellhousings can also be reworked to fit this application.

Next up is the pilot shaft bearing. Who among us hasn't cursed that aggravating

OL GRIP 5-SPEEDS

stock bronze pilot shaft bushing? The factory units were extremely prone to decay simply due to heat and age, which frequently resulted in them magically disappearing. Keisler solved this matter completely by using a sealed needle roller bearing which will last virtually forever.

The transmission crossmember, which has always been a sticky point with most conversions, is a breeze with this kit. Keisler furnishes a precision made steel tranny crossmember which is zinc chromate plated for good looks and rust resistance. Even a vulcanized rubber transmission mount is included in the deal.

Since the output shaft spline of the Tremec tranny is larger than anything Chrysler offered, Keisler had to fabricate a new driveshaft. The 3" lightweight steel alloy driveshaft comes ready to install from yoke to u-joint. And this bad boy is balanced to handle up to 10,000 rpm use!

The coolest part of the Keisler kit is the shifter assembly, which mates any standard two bolt shifter, such as the Hurst Pistol Grip, to the transmission and puts everything in the right place. Keisler also makes an adapter for the round shaft Hurst handles used in 1968-69. If this isn't enough, they also make new handles for both console and non-console applications. This conversion does not require any modifications to the console or structural unibody crossmember, or even the shifter boot! For most applications, this thing will look like a stone stock four speed from the cockpit!

The kit also includes a Mopar dash compatible speedometer cable, a wiring harness which will allow you to hook up a neutral safety switch if converting from an automatic and handle the back up lamp chores, and a very detailed installation manual.

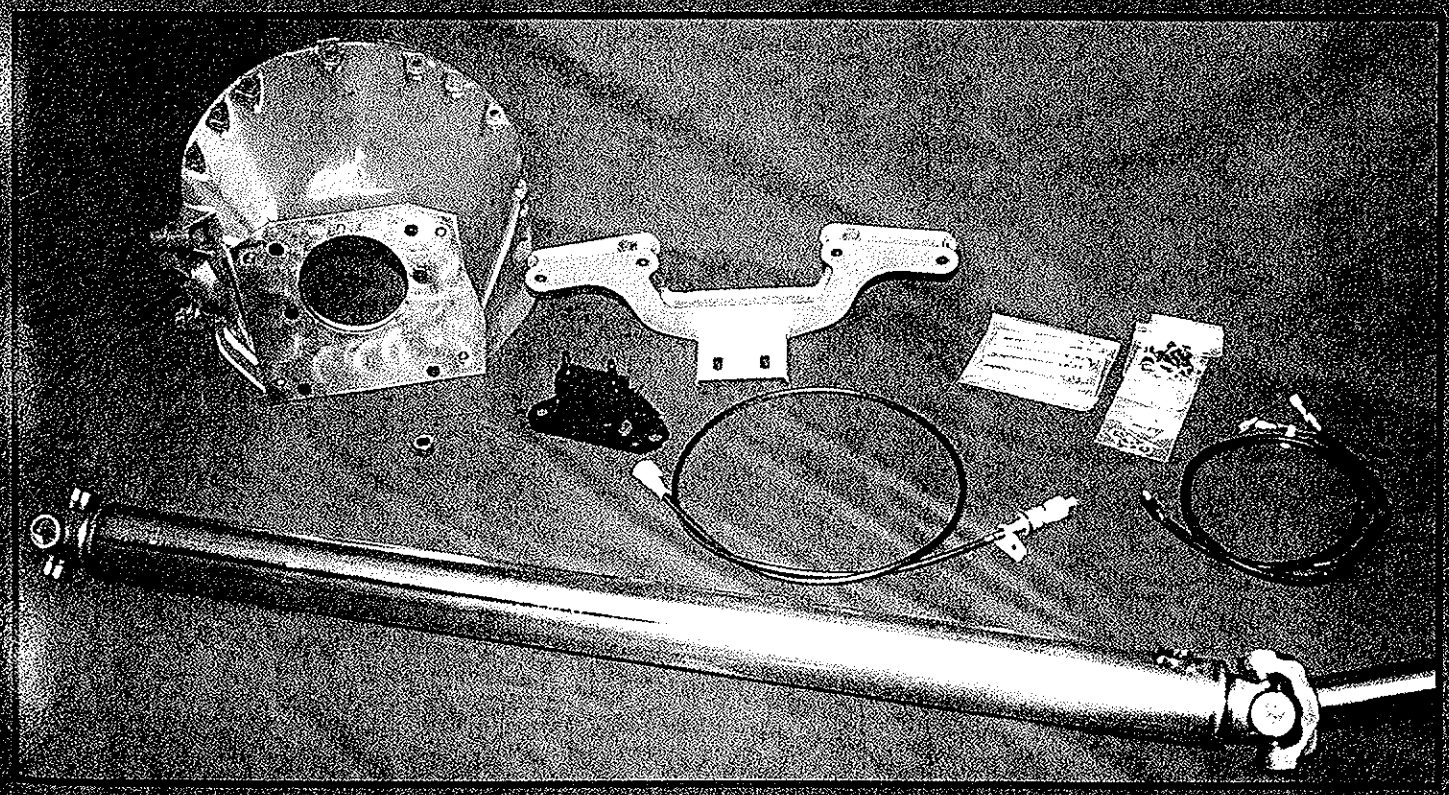
Although Keisler's conversion kit can be used with the stock flywheel, he strongly recommends the old flywheel be dynamically balanced to optimize performance. They also offer new replacement steel or lightweight aluminum flywheels. Of course, if you're converting from an automatic, you're definitely going to need a flywheel of some sort.

The TKO transmission uses the huge GM input shaft, which is much larger than the one found on a Chrysler 833. Therefore, Keisler offers variations of the McLeod performance clutch assembly to suit any need. All come with all components properly matched and include Kevlar discs and multiple discs for super long life and lighter pedal effort. New throwout bearings are also supplied.

Greatly illustrating how well engineered this conversion is, is the hydraulic clutch system. Keisler has designed a modern high tech hydraulic clutch actuation system featuring a concentric slave cylinder, which elimintates the need for the clutch fork, Z-bar, and the mounting brackets needed to support the Z-bar. This is a tremendous aid when converting from an automatic transmission and a great labor saver even if you're already running a stick.

The Keisler 5 speed kit has proven itself well, having been installed in a 620 horse Hemicuda since last summer. The big Hemi's done its utmost to break the transmission, and so far, the whole system has performed flawlessly and without any breakage. This formula works. And best of all, the Keisler kit is reasonably priced, can be installed without hacking up your car, and again, if you can change a basic four speed out, you can do this job yourself. There's not much more one could ask for!

For more information, contact Keisler Automotive Engineering and Electric, 3657 Wildwood Rd., Maryville, TN 37804, or call 865-982-8198. ✪

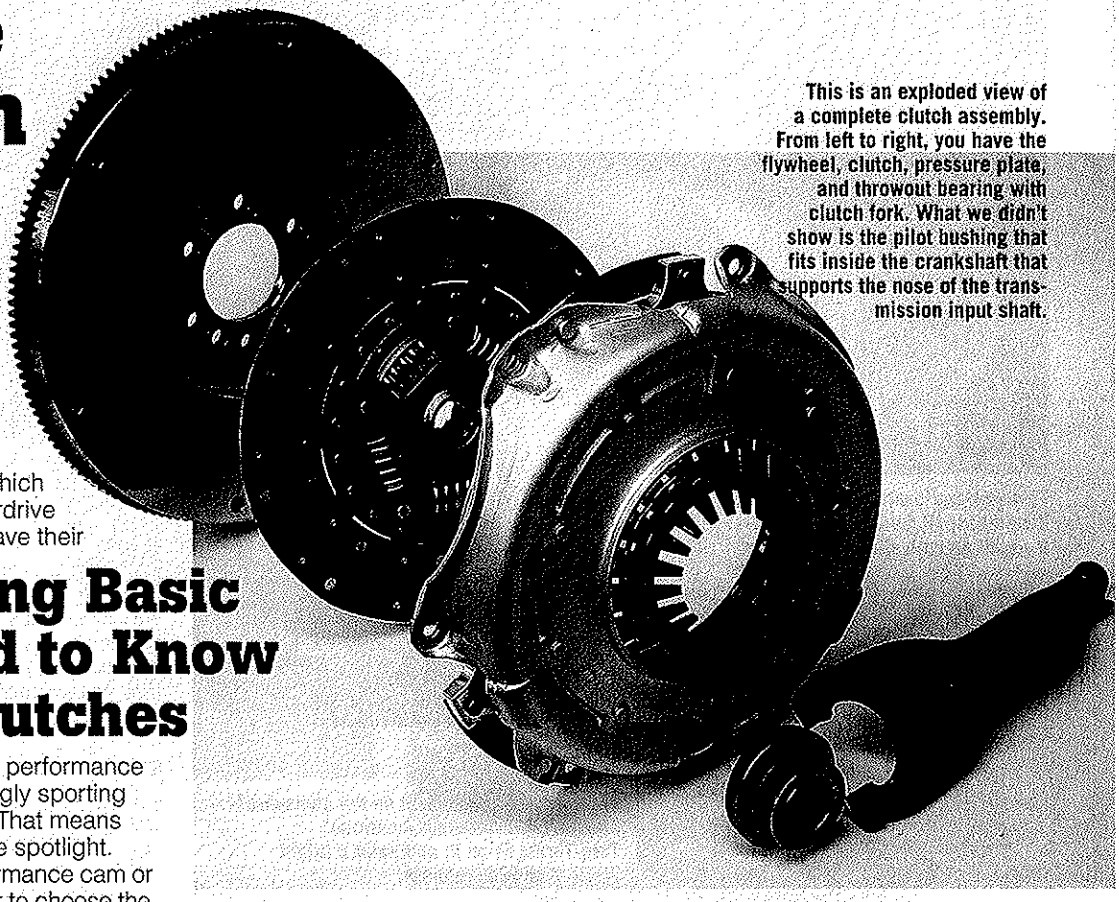


In the Clutch

Everything Basic You Need to Know About Clutches

By Jeff Smith

Photos by Jeff Smith and courtesy of manufacturers



This is an exploded view of a complete clutch assembly. From left to right, you have the flywheel, clutch, pressure plate, and throwout bearing with clutch fork. What we didn't show is the pilot bushing that fits inside the crankshaft that supports the nose of the transmission input shaft.

This is the new age of manual transmissions. The new darling of the street set is the T-56 six-speed, and there is a passel of new five-speeds to choose from, most of which sport some kind of overdrive top gear. Automatics have their place, but 21st-century performance machines are increasingly sporting manual transmissions. That means clutches are back in the spotlight.

Just like a high-performance cam or carburetor, it's important to choose the proper clutch and pressure plate that's matched to your application. The good news is there are literally dozens of different clutch assemblies available to choose from. That's also the bad news because that offers plenty of opportunity to choose the wrong one.

Let's take a look at some clutch basics first, and then we can jump into selecting the best clutch and pressure plate assembly for your car. For this story, we'll concentrate on the clutch disc and pressure plate. Flywheels are part of the system, and weight does play a big role. Suffice to say that those trick lightweight aluminum flywheels may seem like a great idea by reducing the mass the engine has to accelerate. But for a typical street car, that reduced mass also makes light acceleration from a dead stop very difficult. We'll save the rest of that story for a later issue.

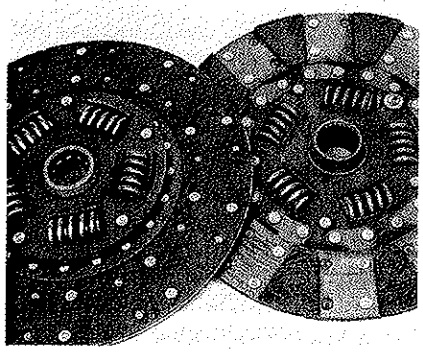
Basics

A clutch only has two basic functions—to momentarily disengage the engine from the transmission and to be able to transfer maximum engine torque without slipping. The clutch must also be capable of performing this job for thousands of miles of easy street operation where a small amount of slippage is necessary to make the engagement of the clutch as hassle-free as possible.

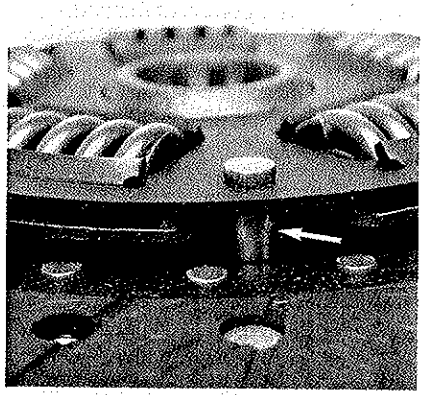
To achieve this compromise between performance and street civility, all clutches operate within three basic parameters: The clutch designer must juggle clamp load, coefficient of friction, and surface area to meet his goals. For example, you can have a clutch with a relatively high coefficient of friction (like a sintered iron race clutch), but it will be a nasty, grabby, terrible clutch for street use. You could increase the clamp load, also called static pressure. Static pressure is the amount of base pressure exerted by the pressure plate ring on the clutch disc when the clutch is engaged. The problem with high static load pressure plates is that this also increases the pedal effort, making it a chore to push in the clutch pedal. This takes a toll on linkage parts.

Alternatively, you could use a larger-diameter clutch. This increases the surface area, which will increase holding capacity, especially if the clamp load is the same. For example, a GM 11-inch clutch disc has a roughly 16 percent larger surface area than the smaller GM 10.5-inch assembly. This increased size does work well, but the tradeoff is the larger clutch requires a larger-diameter flywheel that is heavier and is also roughly 1-inch-larger diameter, requiring more power to accelerate. As an example, Centerforce tells us one of its top-of-the-line 11-inch street clutches can connect up to 620 lb-ft of torque, while a 10.5-inch disc is rated around 530 lb-ft of torque capacity.

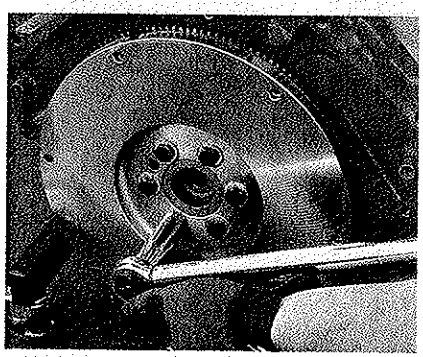
So the key is to carefully balance these three variables to create a clutch and pressure plate combination that can hold all the power your engine makes while not requiring superhuman strength to push the clutch pedal in at a stoplight. You also want a clutch with the right friction surface



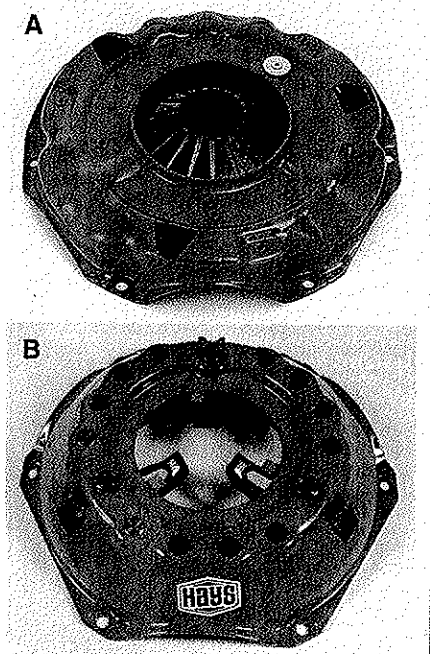
Disc material selection changes the coefficient of friction—or how well the facing grabs the flywheel and pressure plate. The organic compounds (*left*) generally are less aggressive and offer easier engagement. The metallic compounds (*right*) can withstand more heat and offer greater holding power but are difficult for daily street driving. Many companies like Centerforce and Hays offer discs that compromise by using both materials, one on each side.



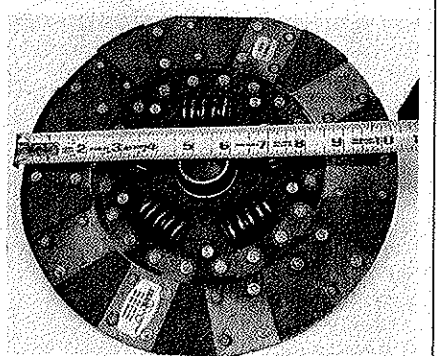
This is a side view of the spring hub that helps cushion the engagement. The limit pins (*arrow*) prevent the hub from rotating too far. If you see flat spots on the limit pins, you've got problems and should replace at least the disc.



Always have the flywheel machined when installing a new clutch disc. This ensures the disc will perform as it should. Also torque the crank bolts and use thread locking compound rather than star washers. ARP makes great bolts for virtually all applications.



There are three basic pressure plate designs: the diaphragm (*A*), which is the most popular and easiest on the leg; the Borg & Beck (*B*); and the Long style (*C*), which can offer adjustable centrifugal assist.



Comparing a 10.5-inch to an 11-inch clutch, the larger clutch disc offers roughly 16 percent more surface area. This allows the same clutch facing to hold additional torque without resorting to higher static pressure or a more aggressive metallic material.

that offers a pleasant engagement action each time you use it, and one that will deliver durable performance over a reasonable lifespan. Let's start by looking at the clutch disc.

Discs

All street clutches are designed to provide easy engagement for normal street driving. From a dead stop with the engine running, the disc is required to slip slightly as the transmission and everything downstream accelerates up to engine speed. There are lots of things happening when this occurs. A typical street clutch disc is made up of a hub, a drive plate (where the facings are attached), two friction material facings, several springs, and four drive limit pins. The springs are located in the hub, which rides on the input shaft. Inside the hub face are six to eight small coil springs. These springs are designed to cushion the engagement by absorbing a portion of the impact load as the disc is squeezed between the flywheel and the pressure plate. If these springs are too weak, they can bottom out, which allows the hub to hammer the limit pins. If this occurs, it can cause clutch chatter. The evidence of this is found when you inspect the pins and find flat spots. The fix is generally a disc with stiffer springs.

An additional cushion, if you will, is something called the Marcel spring, which is a very thin wafer-like spring that is placed between the clutch facings and the disc. It also acts to cushion the engagement as the disc is loaded by the pressure plate. This may not sound like much, but if you've ever driven a car with a race clutch without the Marcel spring, you've noticed they grab very quickly and can chatter like crazy. Clutch chatter problems with street clutches are usually related to the disc (rather than the pressure plate) and can sometimes be traced to a flat Marcel spring that allows the disc to skip across the flywheel creating the chatter.

Clutch face material is perhaps the most important factor in choosing a clutch disc. Aftermarket companies like Centerforce, Hays, McLeod, and Ram all offer several choices of clutch discs based on the clutch facing coefficient of friction. Over a decade ago, Centerforce made the Dual Friction concept popular, with a metal

When installing a new clutch and pressure plate, always install a new ball stud and release arm as well as a new throwout bearing. A badly worn ball stud (*inset photo right*) can lead to binding problems that can cause untold grief.

The Marcel spring is that thin, wafer-looking spring placed between the two clutch facings that helps cushion the engagement of a typical street clutch. Race clutches eliminate this spring, which makes the disc engagement much harsher—that's fine for racing but not good for the street.

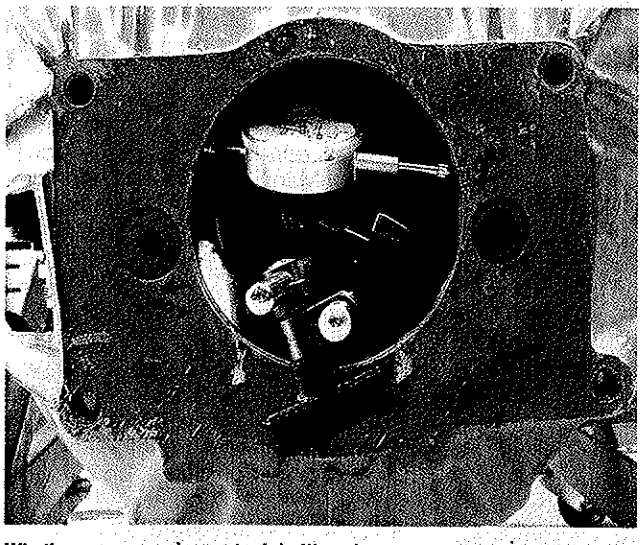
matrix material placed in segmented pucks on the flywheel side of the disc. This idea has spread to many aftermarket clutch companies because it combines the more aggressive metallic facing that has a higher coefficient of friction with a more conservative organic facing on the pressure plate side of the disc. The combination of the two facings can hold increased power levels without slippage.

The advantage to the metallic facing is directly related to its temperature capabilities. In most cases, as a friction material temperature rises in an organic compound, the coefficient of friction decreases. This is also true of metallic linings, but they do offer higher temperature capacity. It is possible to mount segmented metallic facings on both sides of a street clutch, but this also creates a much more aggressive connection between the flywheel and the transmission.

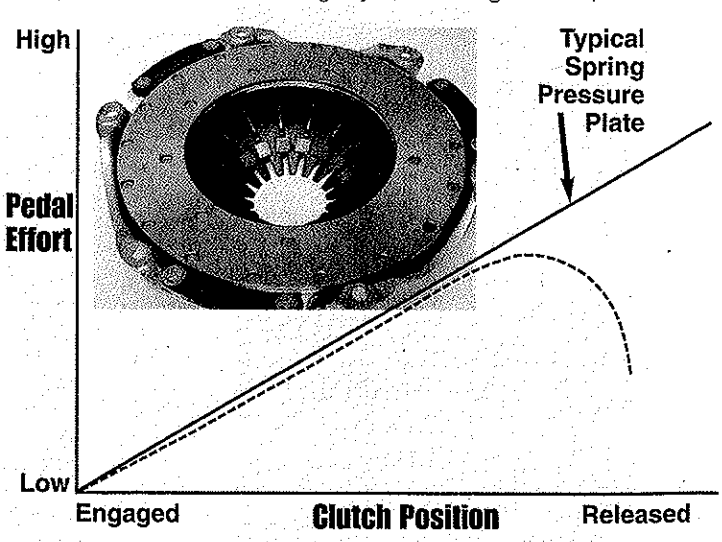
Heat is by far the biggest enemy of any clutch material. Heat is generated anytime you have two surfaces sliding past one another, so there is always heat in a clutch system. The key is to not exceed the clutch disc's temperature ceiling. As a clutch slips, much of the heat is transferred to the flywheel, which acts as a giant heat sink. But if you abuse the clutch by creating more heat than the flywheel can absorb, the temperature quickly spikes in the clutch disc lining. This excessive heat then melts the resins that bond the clutch lining material. These resins rise to the surface of the disc and create a glaze that drastically reduces the coefficient of friction. This creates even more slippage, and pretty soon you have a dead clutch disc that will barely move the car. That's when it's time for a new clutch disc and pressure plate.

Pressure Plates

The pressure plate's job is to apply the clamp load to squeeze the clutch plate firmly between the pressure plate and the flywheel. In the performance world, there are basically three types of pressure plates: the Long style, the Borg & Beck,

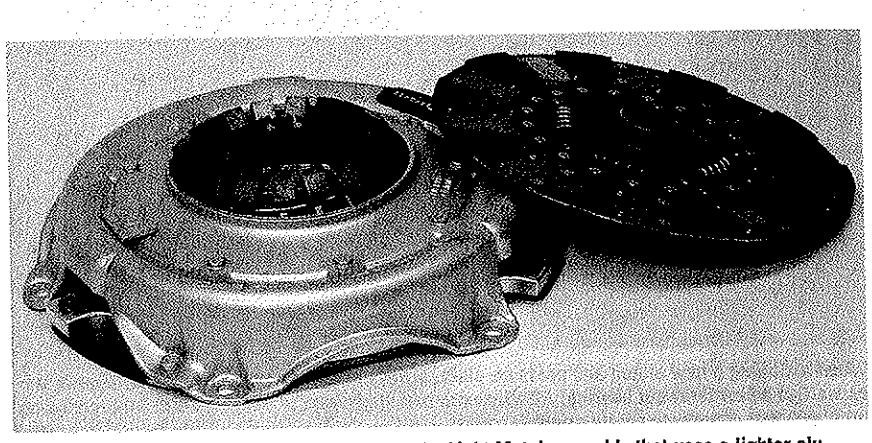


Whether you are using a stock bellhousing or a steel scattershield, you should make the time to dial in the bellhousing using offset dowels. Ideally, the centerline of the large hole should be within 0.005 inch of the crank centerline. As little as 0.015 inch of offset can put the input shaft in a bind and create high-rpm shifting problems, generally when shifting from Third to Fourth gear.



This graph shows how a typical coil spring pressure plate like a Long or Borg & Beck increases pedal effort as the clutch is released. The beauty of a diaphragm is that at a certain point, the Bellville spring over-centers and pedal effort drops dramatically. This makes it easier to hold the clutch pedal in when driving on the street. This is why diaphragms are so popular.

IN THE CLUTCH



Centerforce also offers a pressure plate called the Light Metal assembly that uses a lighter aluminum pressure plate ring with a riveted steel face. This reduces the plate's weight while also using ball bearings for the Bellville spring to ride on, significantly reducing the overall effort required to compress the spring. This allows Centerforce to add static pressure without a pedal effort penalty.

and the diaphragm. Of these three, the diaphragm is the best plate for street use, but all three offer certain advantages.

The Long pressure plate is easily identified by the three thin fingers that engage the release bearing. Under the pressure plate cover is a series of nine coil springs. In order to release the clutch, you must compress these springs. The lever arrangement allows the clutch tuner to add small weights to increase centrifugal loading on the pressure plate as engine speed increases. The Long style is mainly used for drag race applications where the static load (established by the stand height) can be adjusted separately from centrifugal load.

The Borg & Beck style is similar to the Long style and is basically a street version of the Long style pressure plate. It can be identified by the somewhat wider three fingers that release plate pressure by compressing the coil springs found under the pressure plate "hat." Certain applications of the Borg & Beck also offer centrifugal assist for high-rpm, high-horsepower applications. The Borg & Beck uses rollers inside the cover that are forced to the outside under centrifugal force to increase the plate load with rpm.

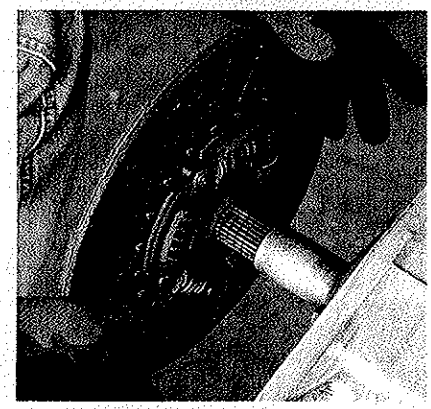
The diaphragm pressure plate uses a single, large Bellville-style spring to load the pressure plate. There are several advantages to this style of spring. First, it loads the pressure plate evenly since the pressure is equally applied to the entire plate assembly. Second, and more importantly, as the Bellville spring is compressed (clutch released), it reaches a point where the pedal effort decreases when the spring over-centers. This makes holding the clutch pedal in at a stoplight much easier than a coil spring type pressure plate.

Recently, companies like Centerforce have attached weights to the fingers of the Bellville spring to add centrifugal load to the spring like the Long and Borg & Beck pressure plates. This does work, although the load increase is not tremendous, it does tend to help the clutch hold the power.

Details

There's also much more to this area than just pressure plates and clutch discs. Proper clutch linkage adjustment and using the right parts is also a major concern. When replacing a clutch and pressure plate, always include a new bellhousing ball stud, release arm, and throwout bearing. Many enthusiasts overlook the ball stud and release arm, and major wear here can bind the linkage and cause all kinds of grief that can be difficult to spot. For example, a worn ball stud can causing binding that can ruin parts and your general disposition.

Fasteners are also critical. Most companies supply new pressure plate bolts with a new clutch and pressure plate, but if not, be sure to include new bolts and always use a torque wrench to ensure proper fastener torque. And we shouldn't have to tell you to never allow the clutch disc or machined surfaces of the pressure plate or the flywheel to get oily or greasy. And always machine



In almost all cases, the clutch disc is installed with the spring hub facing the transmission.

the flywheel surface when using a new clutch. This will ensure a proper break-in and optimal performance from your new parts.

Conclusion

There's at least another story just in installation tips and tricks, but if you pay attention to details, use a quality clutch alignment tool, and don't force the trans if it doesn't want to seat in the bellhousing, you should be in for a pleasant afternoon laying under your car. Also keep in mind that you will need to be easy on the clutch for the first 100 miles or so to break in the organic material. If you pull all that off, your new clutch should reward you with thousands of miles of outstanding performance. **CC**

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