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# MiscRes: Magazine Articles

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## Ironhead Tranny, Here's How to Rebuild it from Start to Finish

**TECH & HOW-TO**

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**HOW TO**

# IRONHEAD TRANNY

## Here's How To Rebuild It From Start To Finish

Text and photos by Mark Maida

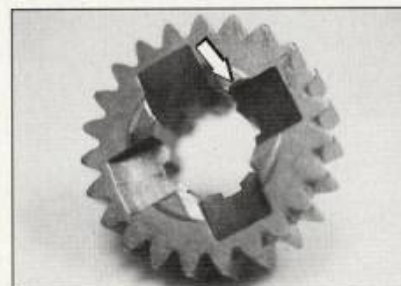
**T**hough many people shy away from tranny work, an Ironhead's transmission is not something beyond most mechanics. Actually, the assembly itself is a very straightforward and by-the-numbers process. And though setting the end plays and shifter fork clearances do take some time, they too are not beyond an average mechanic's expertise.

In this article, we're going to show you the step-by-step process of assembling and rebuilding an Ironhead Sportster's transmission. The Sportster we will be using for this build is a 1973, which, other than the minor changes Harley made before and after this model year, has basically the same tranny as all Ironheads. In fact, a pre-1973 tranny's only real difference is that the speedometer drive unit is no longer driven by a gear on the countershaft's low gear. It runs off the front wheel, instead. (The Autumn 1997 issue of *Hot XL* talks about this modification.) We do, however, strongly recommend that you use a Service Manual and Parts Manual during your rebuild and follow the specifications and tolerances required for your model Sportster.

We are going to be using all quality Andrews gears and shafts in our transmission. All Andrews gears and shafts are made of high nickel 4817 alloy, then heat-treated to 60 RC and ground to a micron finish of 16 or better. Lead-in ramps are machined into the gears wherever applicable for improved shifting and reduced wear on the drive dogs and slots. In fact, Andrews offers not only stock replacement gear combinations for most four- and five-speed Sportsters, but wide ratio and close ratio combinations as well. We chose to install a wide ratio



- 1** Note the rounded edges on the dogs of this gear (see arrow). Though it may not be bad enough to cause a problem yet in the tranny it came out of, it's too far along to put back in and should be replaced.



- 2** Note the wear marks on this gear where the dogs of its mating gear engage it (see arrow). This, and any other gear, are serviceable as long as there are no chips missing anywhere on it.



- 3** Inspect both shifter forks (H-D #34291-52B) for wear like this one has. Though it will have worked fine in the tranny, the smart move is to replace it now while the tranny is being rebuilt. Also inspect the two shifter fork rollers (H-D #34168-52).



- 4** Replace this blind bearing (H-D #35960-54) for the countershaft by tapping it into the transmission cavity using a bearing drift or a 5/8" socket. To help prevent oil seepage, lightly coat the wall of the case where the new bearing will be with clear silicone sealant.



- 5** Reinstall the new bearing from the tranny cavity side. Be careful not to get any sealant inside the bearing. Stop once the lip of the bearing is below the face of the case boss. Wipe away any excess sealant.



- 6** Begin the assembly of the countershaft group by slipping the thrust washer (H-D #35841-58) onto the countershaft. Note that this washer has two ears that slide on the countershaft's grooves. Countershaft second gear goes on next with its slots facing towards the thrust washer.

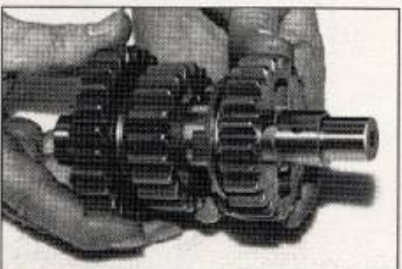




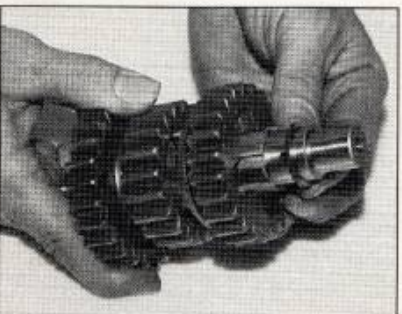
**7** Next comes the spacer (H-D #35809-58) that goes between the countershaft's second and drive gear.



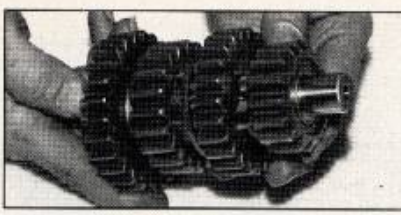
**8** Now install the countershaft's drive gear by putting a socket under the gear for support and lightly tapping the shaft into it with a plastic mallet. The gear must be tight against second gear but second gear must also be able to spin freely.



**9** Working from the other side of the shaft, slip on the countershaft third gear with its dogs facing towards countershaft second gear.



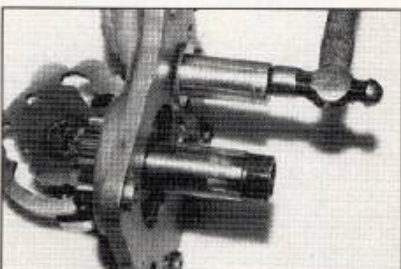
**10** Next is a thrust washer that comes in four sizes, .065", .075", .085" and .100". Starting with the smallest size, you can change this washer along with the countershaft low gear thrust washer to get the proper countershaft end play.



**11** Countershaft low gear goes on next. And though the countershaft low gear thrust washer will go on later, know that it comes in six sizes — .050", .055", .060", .065", .070" and .075" — so you can get the proper end play.



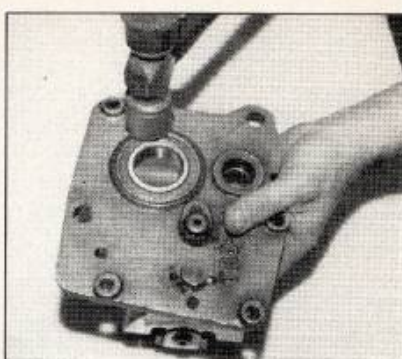
**12** Use a flat-faced punch to pop the oiler plug out of the transmission door. Note that this plug has a hole that faces up when installed so oil can be delivered to the countershaft when the engine is running.



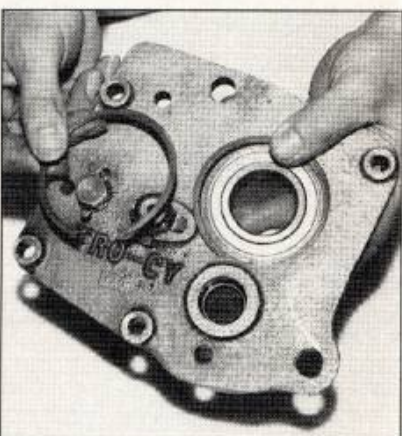
**13** The door is the next part to be reworked. After first measuring how deep the bearing sits in the door, use a bearing drift or 3/4" socket to remove the old countershaft door bearing (H-D #35961-52) and install a new one.



**14** Remove the outside retaining snap ring from the door with a couple of screwdrivers and discard it. Drive out the gear and bearing with a plastic mallet if you're not reusing them. If you are reusing the bearing, press out the gear, then the bearing.



**15** Use the plastic mallet to lightly tap the new bearing (H-D #9025) into the door. Only hit along the outside edge of the bearing, never on the dust cover or inner rim.



**16** Start one end of the new retaining snap ring in the groove in the door (as shown here) and work it into position with your fingers. Then press the new clutch gear into the bearing until the gear rests firmly against the door bearing.



**17** Assemble the mainshaft group next. Start by slipping mainshaft third gear onto the shaft. The mainshaft third gear washer (H-D #35364-56), which has two ears on the inside diameter of the washer, goes on next.



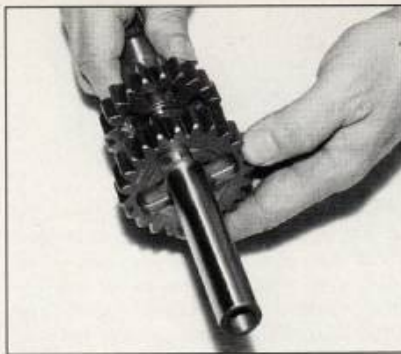
first gear set (#251010) on this bike because this gear set will give us more low end torque with a 21- or 22-tooth transmission sprocket. The shafts and other gears we will be using are Andrews' late mainshaft (#258120); a countershaft (#259010); late clutch gear set (#254720), which includes both gears and comes with a new bushing and bearing installed in the clutch gear; mainshaft second gear (#252020); mainshaft third gear (#253050); countershaft second gear



**18** The third gear's retaining snap ring (H-D #35337-56) goes on next. Be careful not to distort it. (If you do, use a new one.) Start an end onto the shaft and then slowly walk the rest of the ring onto the shaft.

## SHIFTER FORKS

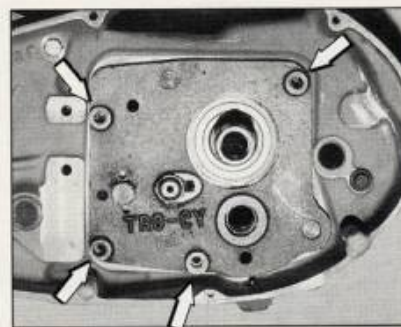
**B**efore proceeding with the rebuild, you must check that the shifter forks will position the gears correctly while in neutral. To do this, turn the tranny gears while you shift up and down through the gears several times. (Hold the mainshaft tight against the clutch gear as you do this. The mainshaft will have a tendency to walk out as the tranny turns.) Then shift the tranny into neutral. Using a feeler gauge as shown in photo #28, check the clearance between the clutch faces of countershaft third and second gears. If the correct clearance of .038" to .058" is not obtained, and the shifter forks are not bent (check them against a piece of glass), a -.020" or +.020" size shifter fork may have to be used to get the correct clearance. Ditto for mainshaft third and second gear. Another check is to shift the tranny into each gear and check that the sliding gears engage into their mating gears by at least 50%, with 25% being the minimum for low gear.



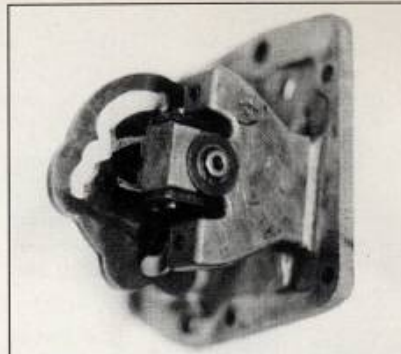
**19** Though we will install the mainshaft second gear on the shaft to show you how it faces when installed, it can't stay on the mainshaft when we install the shifter forks. You'll see why later on.



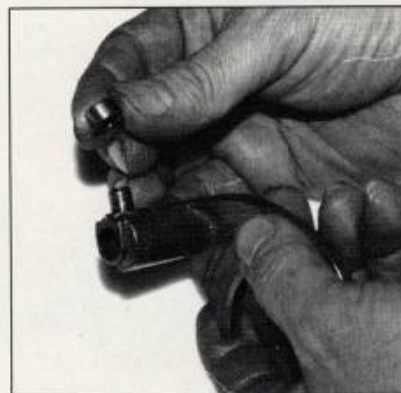
**20** To finish the mainshaft, slip the mainshaft low gear onto the other end of the shaft facing this way.



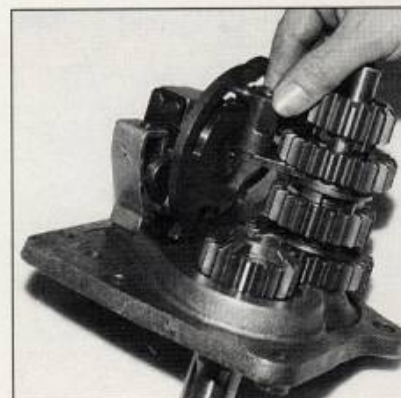
**21** If you are using the same door, skip this step. If you're replacing it with another stock one, or a Trock steel door, install the door and check that the four bolt holes (see arrows) line up cleanly with the threads in the case. If they don't, use a file or router to open the holes up.



**22** Next check that the shifter will go into all five positions (four gears and neutral) easily and solidly. Check that the two large springs inside it are not broken. Also, carefully run your fingertip along the two slots in the cam. If you feel a sharp edge, file it smooth.

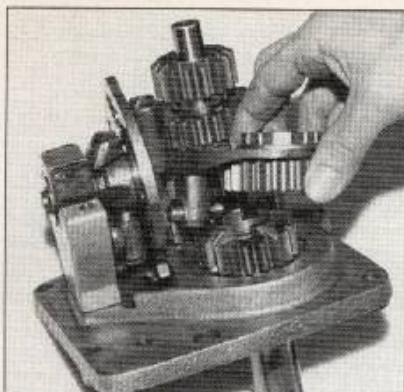


**23** Before assembling the tranny, first install the rollers onto the shifter forks.

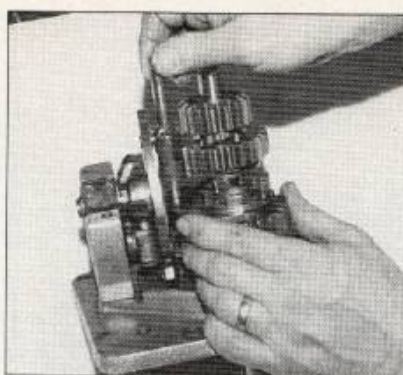


**24** Place the countershaft group onto the tranny door. Then slip the shifter fork into its slot on countershaft third gear as shown here. Then maneuver the fork so it engages its slot in the shifter cam.

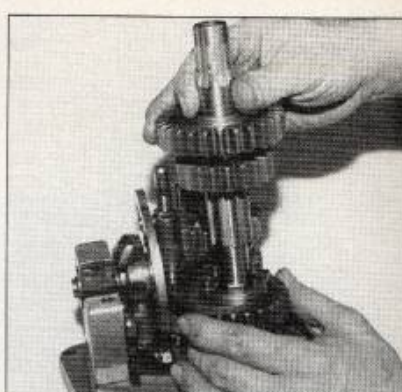




**25** Remove mainshaft second gear from the mainshaft group. Slip the other shifter fork into the groove on mainshaft second gear as shown here. Then maneuver the shifter fork so it engages its slot in the shifter cam.



**26** Insert the shifter fork shaft (H-D #34141-52) down through the two shifter forks and into its hole in the door. You may have to lightly tap the shaft with a plastic mallet. Don't go too far or you might bend out the tab on the outside of the door.



**27** You can now slip the rest of the mainshaft group back into mainshaft second gear. Check the operation of the shifter cam assembly. You'll have to spin the tranny to get all five positions.

(#252040); and countershaft third gear (#253030).

We contacted Kirk Kelley at Sporty Specialties for all the bearings, shifter forks, clips and shims we would need for this build. Kirk has a vast inventory

of Sportster parts on hand and was able to supply all the components we requested for this build.

We are also installing a Trock steel door in this tranny because the engine will be an 82-inch with high performance

cams, carb and headwork when we are done with the build. (We'll be covering the build in *Hot XL* over the next few issues.) Trock steel doors are made of cast ductile iron and are 10 times stronger than the stock aluminum door.

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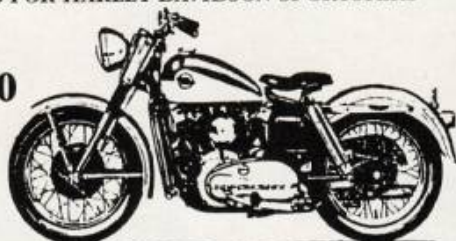
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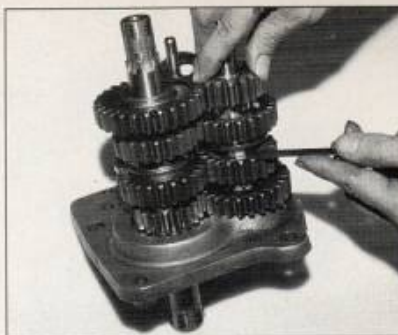
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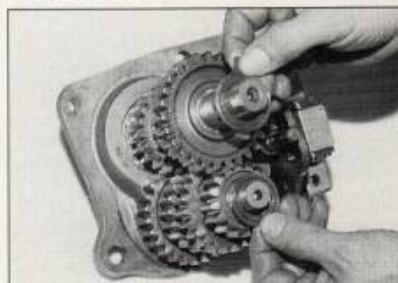


Hi-Per Starter for '89 & up H-D

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**28** Time to check the clearance between the gears. Use a feeler gauge as specified in the sidebar "Shifter Forks."



**29** Now slip the two thinnest thrust washers onto their respective shafts. The one with the ear goes on the mainshaft with the ear down, the other is for the countershaft.



**30** Insert the shifter lever shaft (see arrow) into its bushing in the case. Tip: now is the time to change the shaft's seal or bushing. Carefully install the tranny into the case. Once the mainshaft pokes through the right case, use it to guide the tranny onto its dowels. Then secure the tranny to the door with all four bolts.

These doors are a must in a high performance Sportster. However, the stock door is more than adequate for stock or mild performance modifications.

But before we begin the reassembly, we need to tell you about a procedure that should be done if the transmission case's mainshaft bearing race has been replaced. The bearing race must be line-lapped to the transmission door bearing. This

*continued on page 60*



## IRONHEAD TRANNNY

continued from page 44

### END PLAY CHECKS

**T**hose of you who do not own a dial indicator can save a few bucks by using a feeler gauge, razor blade and a little black bearing grease to get the end play very close, or right on. Then you only have to pay a shop to check your measurements with a dial indicator. If the end play is right, you can go home and finish the assembly. If it's off, have the mechanic tell you by how much so you can make the necessary shim change and finish the job correctly.

Starting with the countershaft, tap an awl into the hole in the end of the shaft as shown in photo #31. Then put a small stripe of black grease on the side of the awl's shaft. With the tranny in neutral, turn it over a few times with the clutch gear, pulling out lightly on the awl as you do. (The awl will also spin.) This will get all the countershaft's end play onto the right side of the shaft. Stop spinning the tranny so the grease stripe on the awl faces towards the rear of the primary case. Carefully lay the razor blade against the door as shown in photo #31. Then slide the razor so its blade lays against the awl's shaft in the grease stripe. Now push in on the awl, moving the countershaft deeper into the tranny until all the end play is gone. Carefully slide the razor away from the awl's shaft, keeping the blade against the door. The grease stripe will now have a thin line in it that the razor made when you pushed the countershaft in. This is the amount of end play in the countershaft. Carefully measure how long the line is with a feeler gauge. Be careful not to lay the feeler gauge right against the grease or you'll mar the line.

Do the same for the mainshaft using your hand and the razor as shown in photo #32. Remember, you must also press against the clutch gear so that the door bearing seats against the retaining ring in the door as you take your measurements. (It may be easier to push in on the mainshaft as you spin it and pull it out for the measurement.)

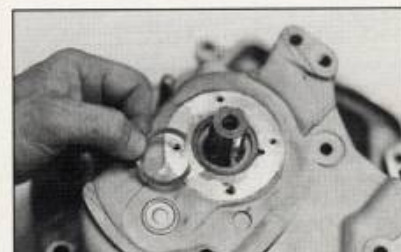
Once you have both measurements, remove the tranny and make the needed shim changes. Try to get right in the middle of the required tolerance (about .006"). Then install the tranny and check the end play again. When you think you have it right, head over to a shop and have it checked with a dial indicator. Once that's done, pop the oiler plug back into the door with the hole aiming up.



**31** The correct way to check the end play of the countershaft (.004" - .009") is with a dial indicator. But if you don't have one, see the sidebar "End Play Checks" to see how you can get it close, or on, using a razor blade and feeler gauge.



**32** Ditto for the mainshaft end play (.003" - .009"). However, you must also press against the clutch gear so that the door bearing seats against the retaining ring in the door as you take your measurements.



**33** Once the correct end play has been reached on both shafts, test shift the tranny again. If it's okay, slip the 23 rollers into place. Use plenty of oil. Now slip the roller bearing washer (H-D #35363-52) over the mainshaft. The retaining ring (H-D #35113-52) goes in next. Start the edge of the ring into its groove and work it in with a softer-than-steel tool.

is to ensure that the race's bearing surface is perfectly aligned with the tranny's mainshaft. If it's not, the mainshaft's bearings will destroy themselves, the mainshaft and the race. Only a qualified shop with the proper tool or your Harley-Davidson dealer should do



**34** The last parts to go on are the oil seal and retainer, which can be purchased as a set (H-D #35150-52), and its gasket (H-D #35169-52). Clean off the gasket surface and install these with four screws (H-D #2669W) and lock washers (H-D #7025W).

this procedure. Whenever you have changed the race and/or the mainshaft, you must check the clearance of the 23 roller bearings in the race. Starting with the standard-size roller, install all the bearings with the mainshaft in place. You have the right fit if finger pressure will slip the last roller bearing into place tightly and the shaft has no side-to-side play whatsoever. If there's play, go to the next larger roller size.

As for the build, once you have completely removed and disassembled the old gearbox, inspect all components for wear or damage. Replace any components that are defective or worn beyond service limits. Once this is done, thoroughly clean the cases, all parts and your hands. (Grit or dirt will destroy your transmission.) Also, though we will not be saying it, coat all gears and shafts with a light coat of fresh oil as you assemble them. Ready? Then follow along with the accompanying photos to see how to rebuild an Ironhead transmission. ■

### SOURCES

**Andrews Products, Inc.**  
5212 North Shapland, Dept. HXL  
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773/992-4014

**Sporty Specialties**  
1875A W. Commonwealth, Dept. HXL  
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