

## M40/M41 Transmission ASSEMBLY

### Putting it back together:

First, we'll reassemble the mainshaft. Put everything together with a light coating of oil between the parts (whatever oil you'll use in the finished tranny is fine).

- [M40 only: Tap the new rear oil seal into the rear bearing housing (hint: springs on oil seals go inside, where the oil is), then put the speedo drive worm and spring into place.]

**Decision point:** realistic thinking required here! The next step is to press the new main bearings; you might be able to do this yourself or you might have it done for you by a shop with more equipment (there is no shame in this). It is possible to install the rear bearing in its housing with a large vise and it's also possible to pull the front bearing onto the input shaft, but it's crucial to apply force only to the outer race of the rear bearing and the inner race of the front bearing, so you'll need suitable arbors in between your vise / puller / press and the bearings. You don't want to damage your pricey new parts by doing otherwise, do you? I know for sure that you would never even dream of hammering on them, aren't I right?

- Read the above paragraph three times and think about it five times more. Now, make the new bearings be in their places by whatever method you arrived at. By the way, the flange on the front bearing goes outboard, towards the motor end of the input shaft (voice of experience speaking). [M40 people: Don't forget the speedo drive in the rear.]

- Install the snap-ring in the rear bearing housing.
- Place the first of the new spring wires in the rear of the 1st - 2nd synchro hub so the little bent part sticks out through one of the three slots. It doesn't matter which way around it goes.

- Slide a synchro ring, first gear and its spacer onto the shaft (you did make notes, right?).

- Install the rear bearing housing onto the shaft. If your puller is long enough to help with this, use it. If not, support the housing and tap the shaft into the bearing, being very careful not to mar the forward end of the shaft. Notice I said "tap," not "pound" -- use oil and get it started square... and don't let the spring wire pop out.

- *M41 only: Install the snap-ring behind the bearing. Install the Woodruff key, the eccentric and its circlip.*

- Install the 1st - 2nd synchro assembly as follows:

- Study the locking ring, the three dogs and your notes until you're sure

which way everything goes. Notice the raised part of each dog is not in the middle and neither is the detent in the locking ring. That's a hint...

- Put the second spring wire into place. Orient it so it's a mirror-image of the first one, with the raised part in the same dog as the first.
- Ignore Haynes and the bit about feeding the dogs in after the locking ring is in place. Instead, put the three dogs into their slots -- the sticking-up parts of the wires go inside the end of the dogs -- and locate the aft end of the dogs into the matching detents in the brass synchro ring. This is crucial!
- While holding the dogs firmly in place by wrapping your hand around the hub, start the locking ring over them. As you slide it further, it will jam against the dogs. Carefully push the dogs forward, away from the brass synchro ring, until everything snaps into place. Double check that the dogs are still in the synchro ring's detents and that everything has a little play in it.
  - Put on the 2nd gear parts, the horrible snap ring and the 3rd gear parts.
  - Load the third spring wire into the rear of the forward synchro assembly hub and install it with its snap-ring.
  - Assemble the rest of the forward synchro assembly just like you did the rear one. On this one, the dogs are the same front to back. I repeat: make sure the dogs fit into the slots in the synchro ring.

Now, we need to load everything back into the case. The first step is to make the dummy countershaft spindle -- this will hold the roller bearings and spacers in the countershaft while we put it through some gyrations. Your life will be much easier if you get something that's just the right diameter. You need to cut it to the exact length of the countershaft or a fraction less (not the length of the "real" spindle!). The places where we're going to apply grease should not have oil on them -- they must be clean and dry or the grease won't stick.

- Apply a thin coating of grease all the way around the bearing surfaces on the insides of both ends of the countershaft.
- Load in a spacer and then stick the roller bearings all the way around. The transmissions we've seen use either 24 or 20 per end. Cap this with the second spacer and smear on some more grease to hold it in place.
- Do the other end the same way. Put the dummy spindle through so nothing falls out.
- Smear grease on the outer side of both thrust washers and stick them in place in the case. The raised tabs fit into the oil channels in the case.
- Feed the countershaft and dummy spindle in through the rear main bearing hole (the big gear goes forward) and lower it to the very bottom of the case. Keep it square to the case as you do this or it won't go past the thrust washers.
- Line the thrust washers back up with the spindle holes in the case as best you can for now.
- Using more grease, load the roller bearings into the end of the input shaft. No spacers in this one.

- Push the input shaft into the case from the front so the bearing seats all the way to its flange.
- Slip the new rear bearing housing gasket over the mainshaft assembly (watch all those gear teeth!) and seat it in place. Make sure it goes the right way around. I recommend against using gasket sealer on a transmission.
- Take the remaining synchro ring, hold it in place so the dogs line up with its slots and carefully pull the locking collar over it just far enough to hold it in place. Don't pull too far or the synchro assembly will come apart.
- Insert the mainshaft assembly into the case from the rear until its tip fits inside the input shaft rollers and the bearing housing seats firmly. Try to keep the gasket aligned with the bearing housing, but don't worry too much about aligning the housing with the holes in the case for now. We need to rotate it so we have access to the rear countershaft spindle hole.
- Return the forward synchro locking ring to neutral position. In fact, don't push it forward any more until the selector rods are back in -- there's nothing to limit its forward travel and it will pop apart (voice of experience speaking once more).
- While using a fingertip through the spindle holes at each end to keep the thrust washers roughly in place, turn the whole case upside down. The idea is for the countershaft to drop into place and mesh with the other gears. It may be helpful to turn the shafts slightly. If you happen to lose a thrust washer or something else comes apart, it's no big deal to take the other shafts back out and start over. Once the countershaft is pretty much where you want it, keep the case upside down.
- Start the real spindle into the case **from the rear**. Remember, you marked which end is which. You will need to get the thrust washer at that end and the countershaft lined up just right for the spindle to go through. Be picky; don't just hammer harder or you will break something you'll regret.
- Drive the spindle through the case. It will push the dummy spindle out before it. As the dummy comes out, you can use it to manipulate the end of the countershaft and the second thrust washer into perfect alignment with the case.
- Turn the case right-side-up again.
- Install the new oil seal into the front bearing cover.
- Lining up the gasket correctly (the U-shaped cutout goes at the bottom), install the front bearing cover. Each Allen head bolt gets a small O-ring around it -- these should have come with your gasket set. Tighten away -- the O-rings fit into recesses and you won't squash them excessively.
- [M40 only: Bolt the rear bearing housing firmly to the case.]
- Install the selector rods with their fittings into the case. Start with the left-hand rod and end by driving in the rolled pin. It won't go together wrong -- just remember the tabs at the bottom of the 1st - 2nd gear yoke. Tighten all screws very firmly.
- *M41 only: Install the adapter casting and its gasket onto the rear*

*bearing housing and bolt it up to the case.*

- [M40 only: Lock the transmission by moving two selector rods at once as before. Tap the drive shaft flange into place until you can get its nut started. Tighten the nut to about 70 lbs/ft. Unlock the transmission.]

- [M40 only: Reinstall the speedo drive unit and secure it with the bolt through the back of the bearing housing.]

- Reinstall the selector rod end cover and tighten the two Phillips head screws firmly. If there's an electrical contact in yours, it goes to the right.

- Put the three balls and springs back into their holes by the front of the selector rods.

- Fit the top cover gasket on the case. It's OK to use sealer on this one, but it's not likely to leak if you don't.

- Make sure the spring is still in the top cover and bolt it into place. If it's the "extended" kind, manipulate the linkage so it can drop into the left-hand selector rod fitting. Tighten the bolts in an alternating pattern.

*M41 people: The OD just slides on. Make sure you align the oil pump ring with the eccentric. Use a new gasket and tighten the eight nuts evenly in small stages.*

### **A few installation notes:**

- 1 If the transmission came out of a salvage yard or otherwise acquired external rust, look at the input shaft. The tip will have to slide into the pilot bearing on the car and the splined part through the clutch disk; it might be nice to clean it up a bit.

- 2 Look at the cylindrical surface of the front bearing cover. The clutch throw-out bearing is going to slide back and forth on that. I would make sure it's pretty shiny.

- 3 [M40 only: There should be a small oil seal in the outer tip of the speedo drive fitting. This falls out easily until the speedo cable is hooked up. I recommend you save installing this until the tranny is bolted into the car. But remember it!]

- 4 If you have the short cover (for the long shifter), it's easy to fill the tranny with oil through the shifter hole. If you have the extended cover, it's easiest to fill the tranny before putting the top cover on. Volvo recommends 90W gear oil for the M40 and 30W motor oil for the M41.

- 5 Brooks Townes notes that the plastic bushing at the base of the short shifter in the extended cover can cause all sorts of problems when worn out, including popping out of gear. It is inexpensive and easy to change out. Take a look at yours, if that's what you've got.

### **THE ASSEMBLY IMAGES**

I got the shaft from Iroll. Mike Dudek, owner, ships a fast little package being as close and small a business as he is. I highly recommend him as well as the other two I used, Sedish Treasures out of NY, and Hiperformanceautoservice, formerly Old Volvos Only.



With the works apart, the first step is to reinsert the layshaft rod.



First we make a shaft slightly smaller than the original in diameter.



In the haynes manual, it appears to fit just inside the length of the layshaft itself, so we cut one down to this size.



Next we drop in the first spacer and pack the grease inside the layshaft end. Then the needle bearings are individually inserted in the gap between the shaft walls and our temporary rod. More grease is packed in.



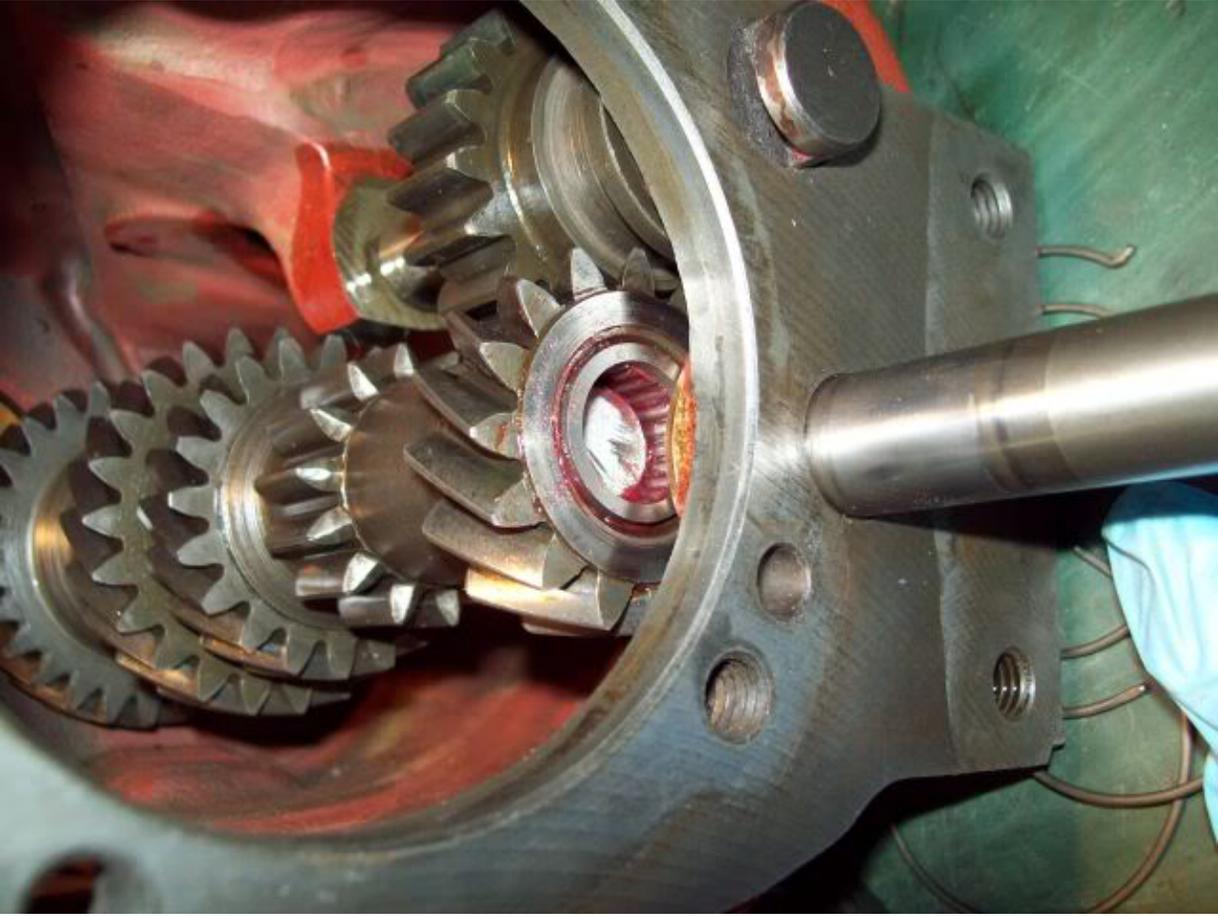


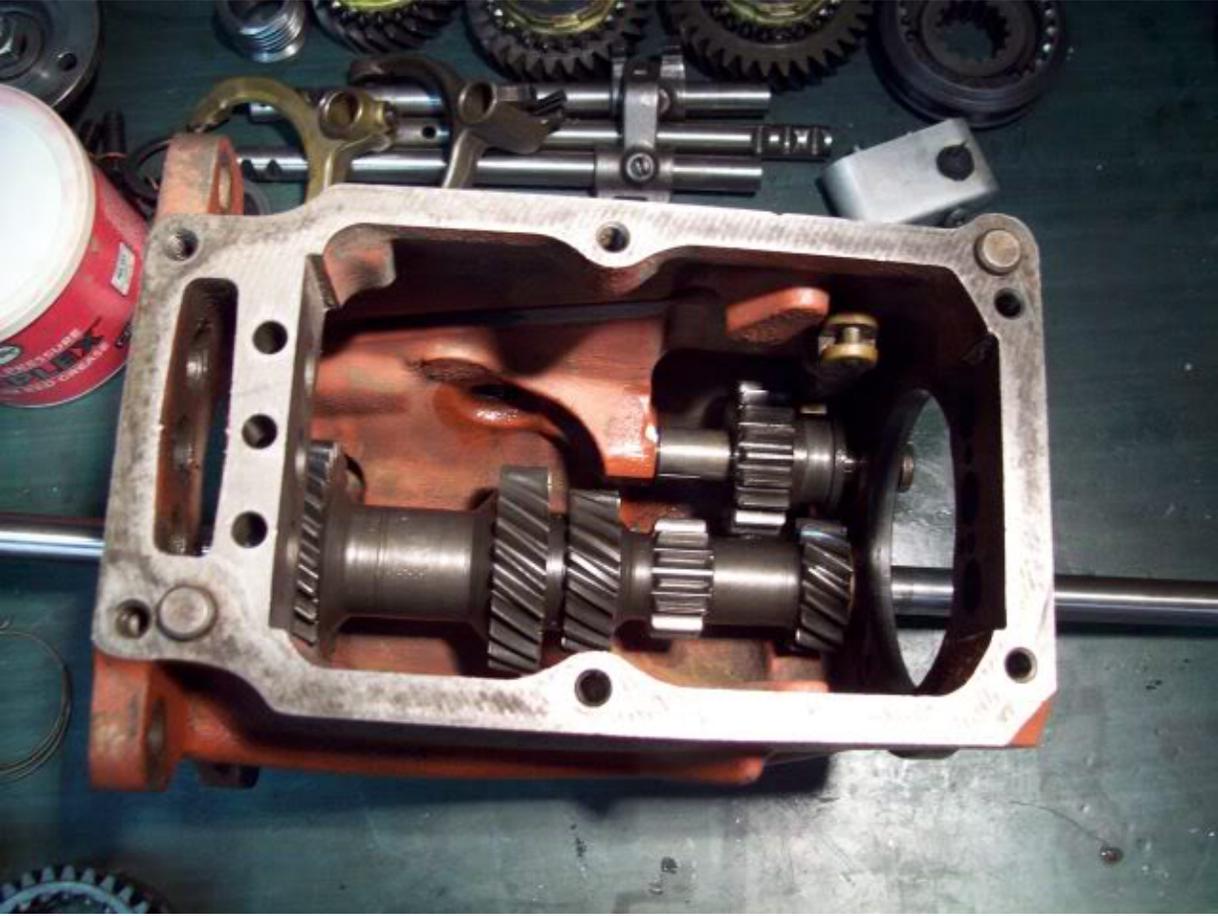


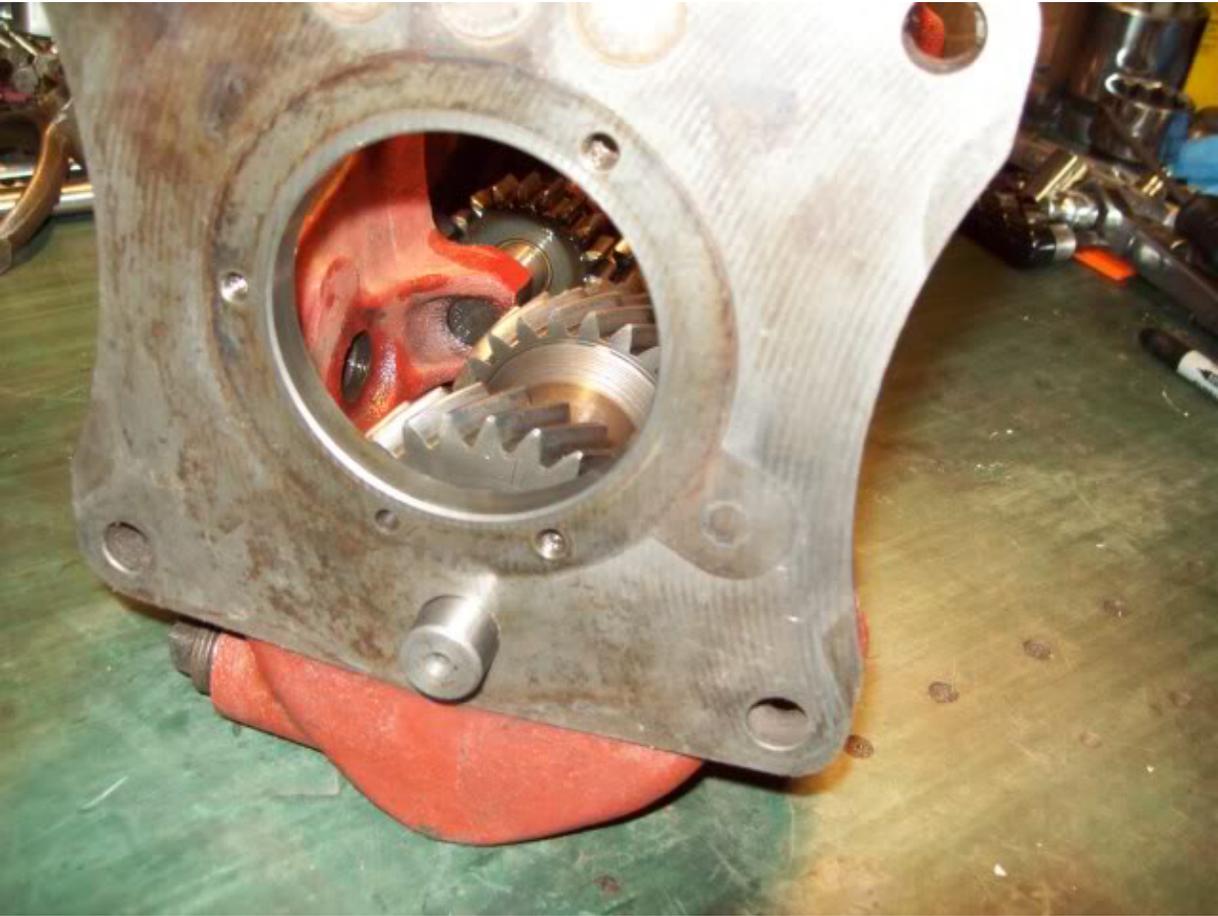
The layshaft washers are shellaced with some oldschool gasket shellac and tacked in position in the 'box. The rod can be used for accuracy.



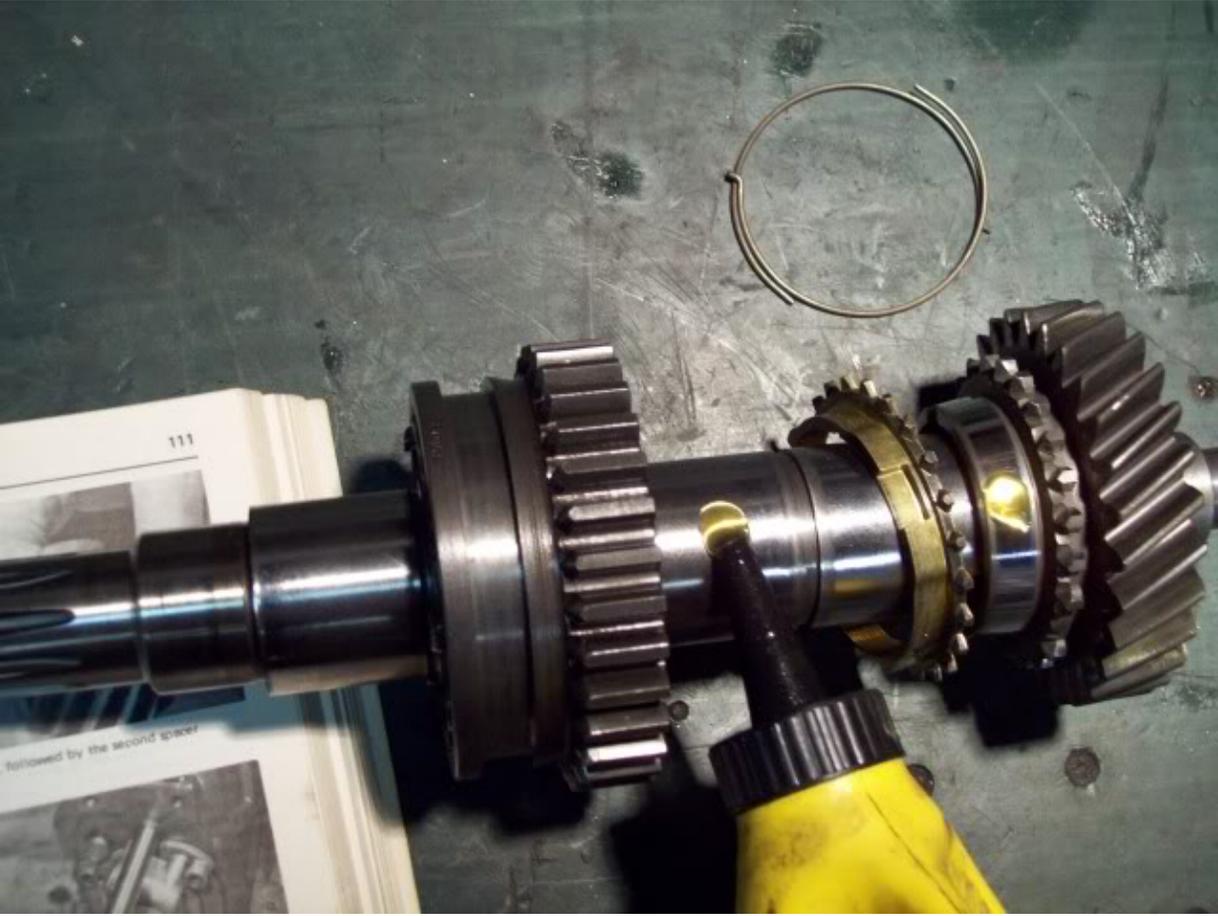
The layshaft can be lowered into the gearbox and the spacer rod pushed out by our replacement rod. We won't drive this in just yet, as we might not get the other shaft in with it in place and need to remove it at some point. Just make sure it is facing the same direction as the old one so that the larger part is driven into the correct end of the 'box. The new one seems hardened and of new design, as it has no number and the ends are coned out.





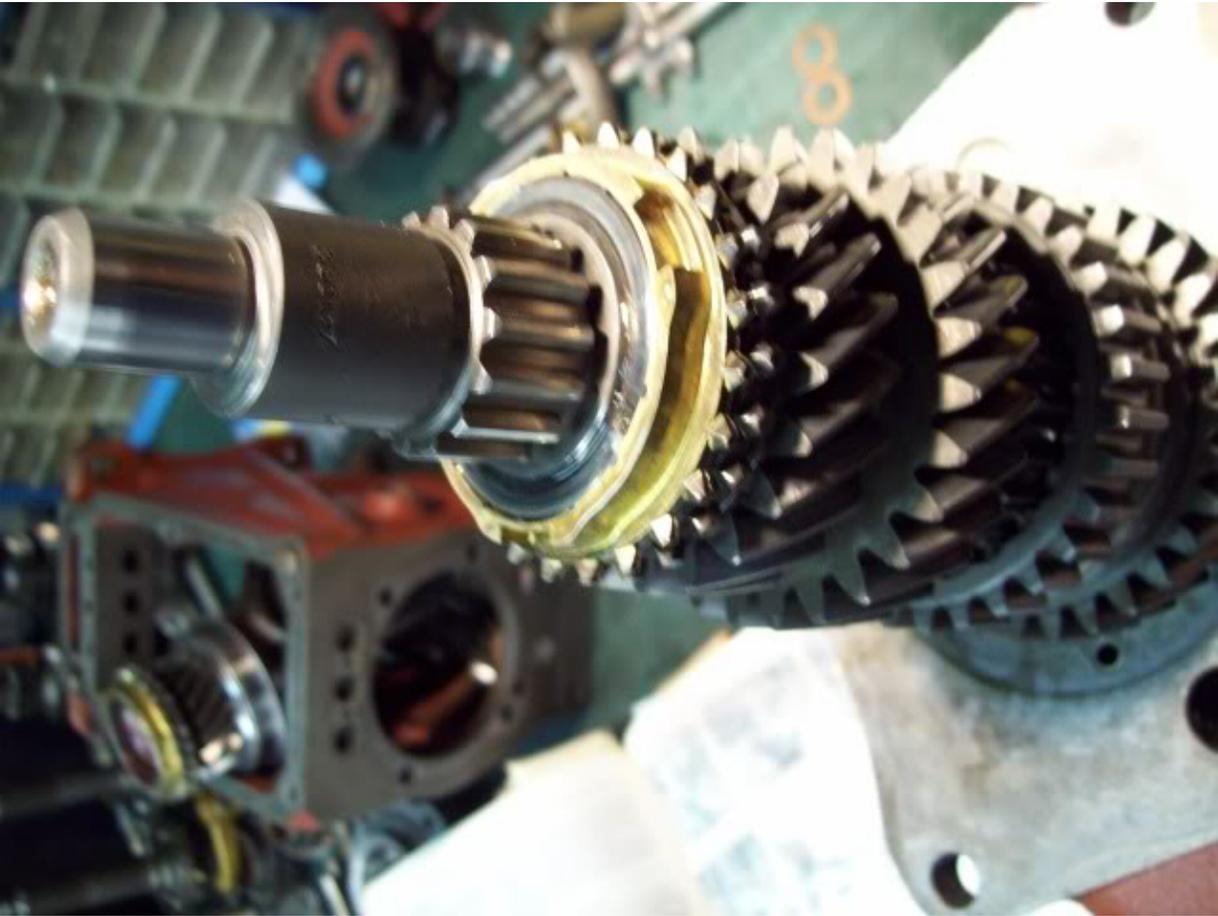


As it turns out, the layshaft rod has to come out for us to merge the halves of the main shaft. So back out with it. Fun exercise though. Let's build the main shafts back up with the new synchros on the gears and a coating of gear oil.

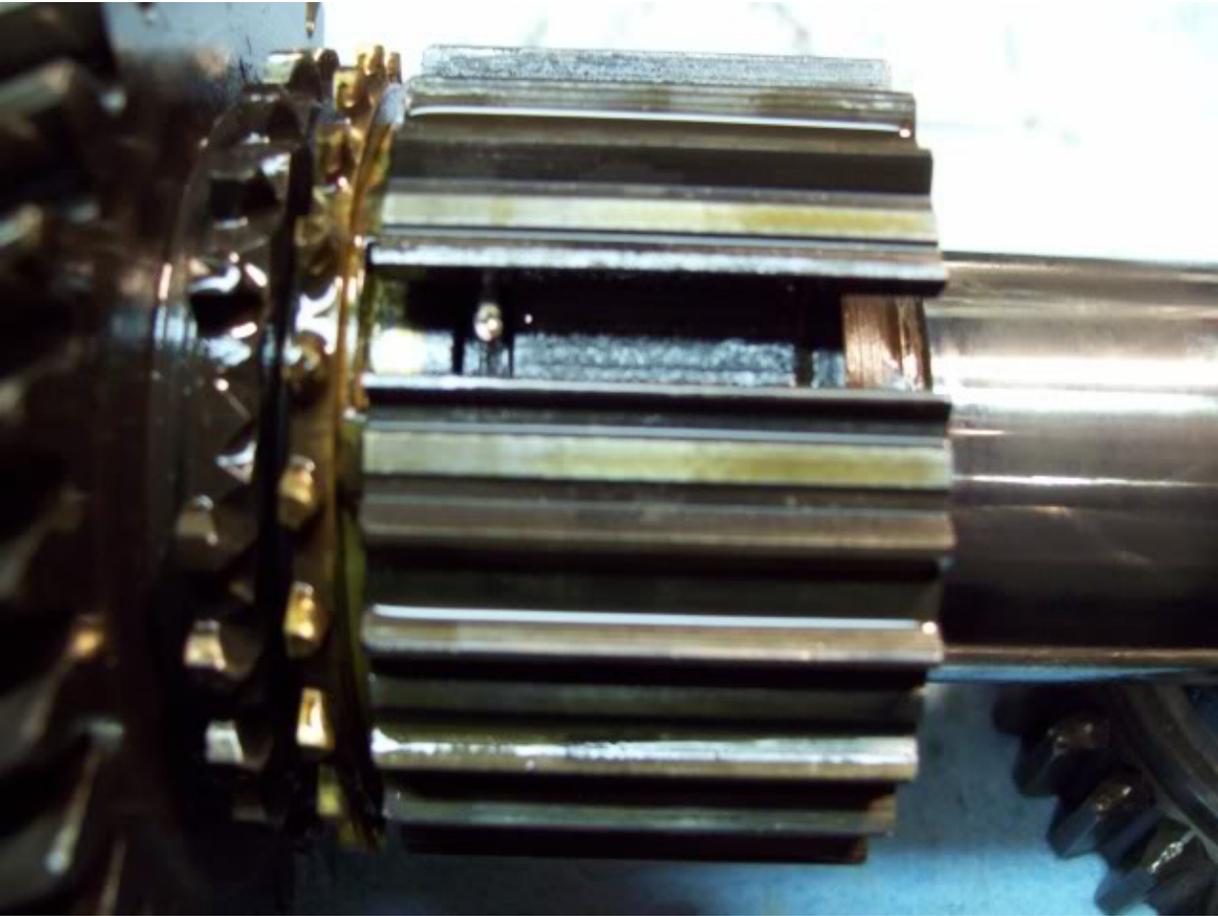






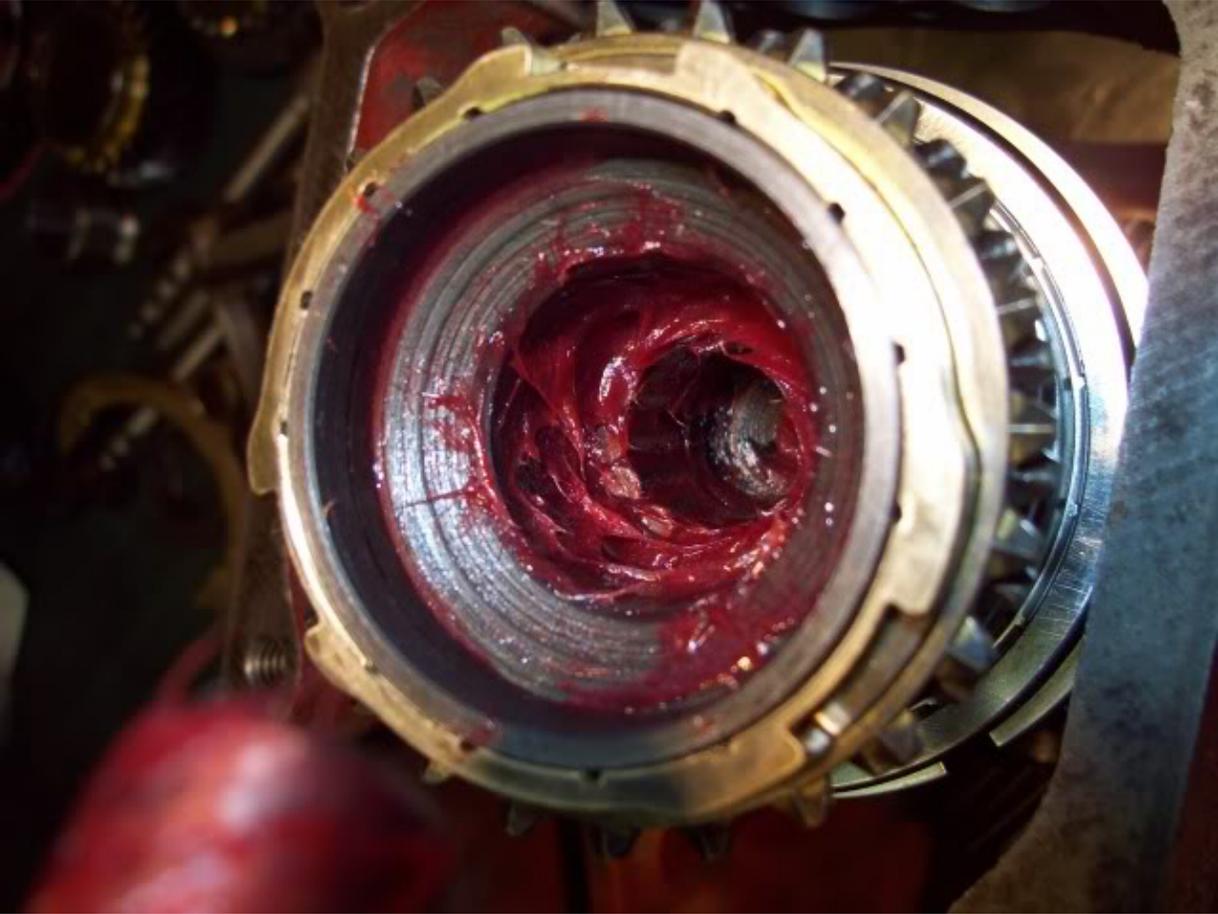


The synchros engaging dogs must go in the same as they came out, big end facing rear. The springs must be situated as a mirror image of themselves, that is, the I-shaped bend is on the same dog on both sides. We'll make the rear one align with this pattern as well, for shits and giggles.

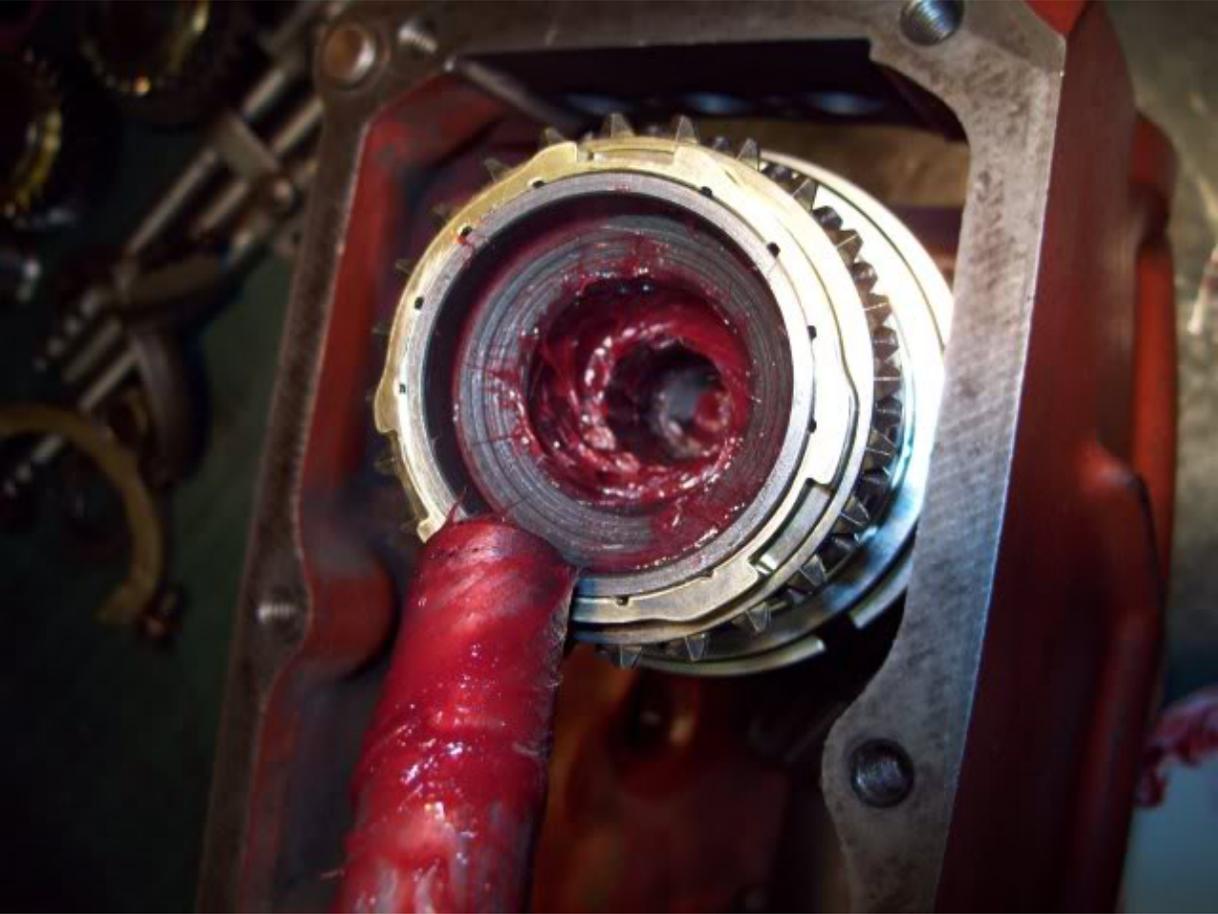




The new synchros can be put on their respective gears and stacked on the way they were originally.

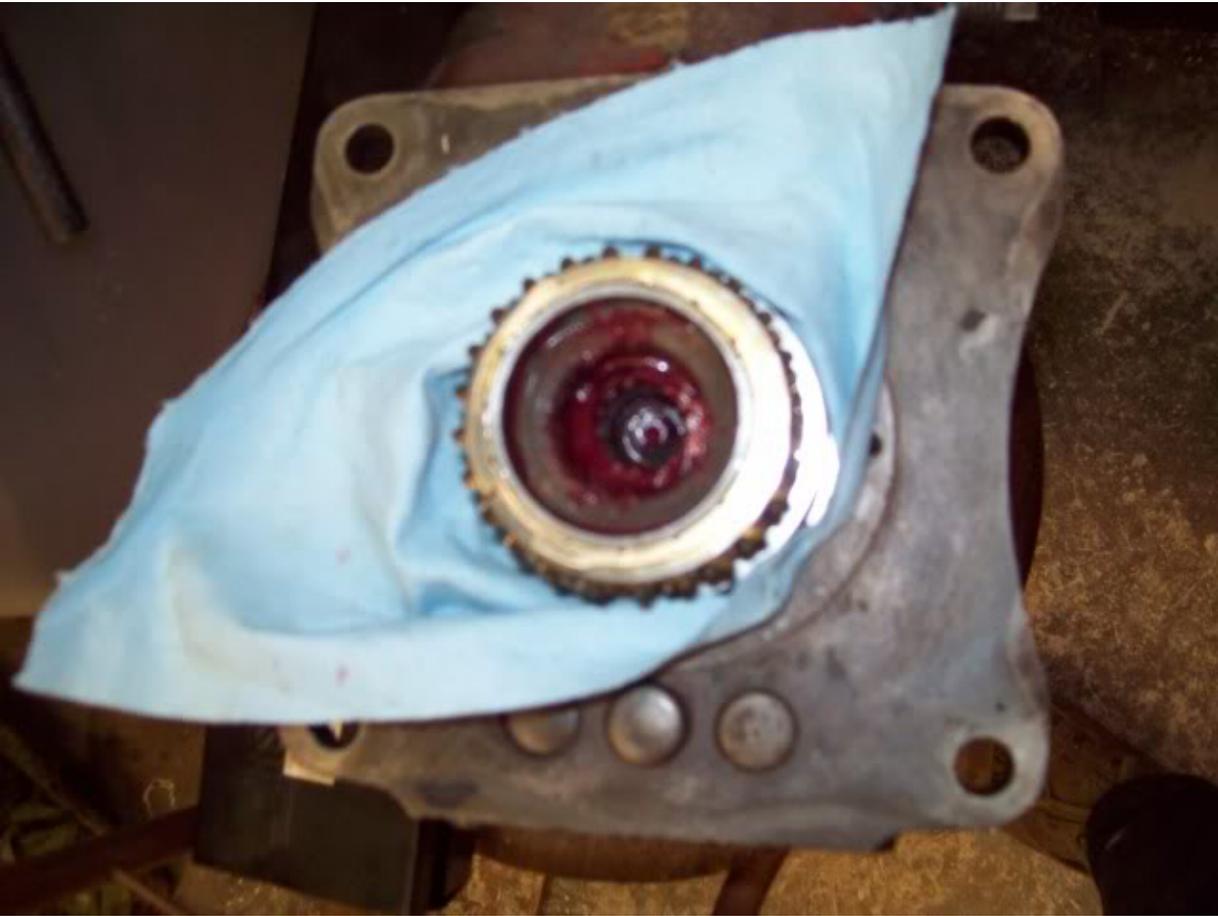


Now we repeat the bearing trick with the input shaft. The same drift we use for the layshaft can be used as a center spacer.

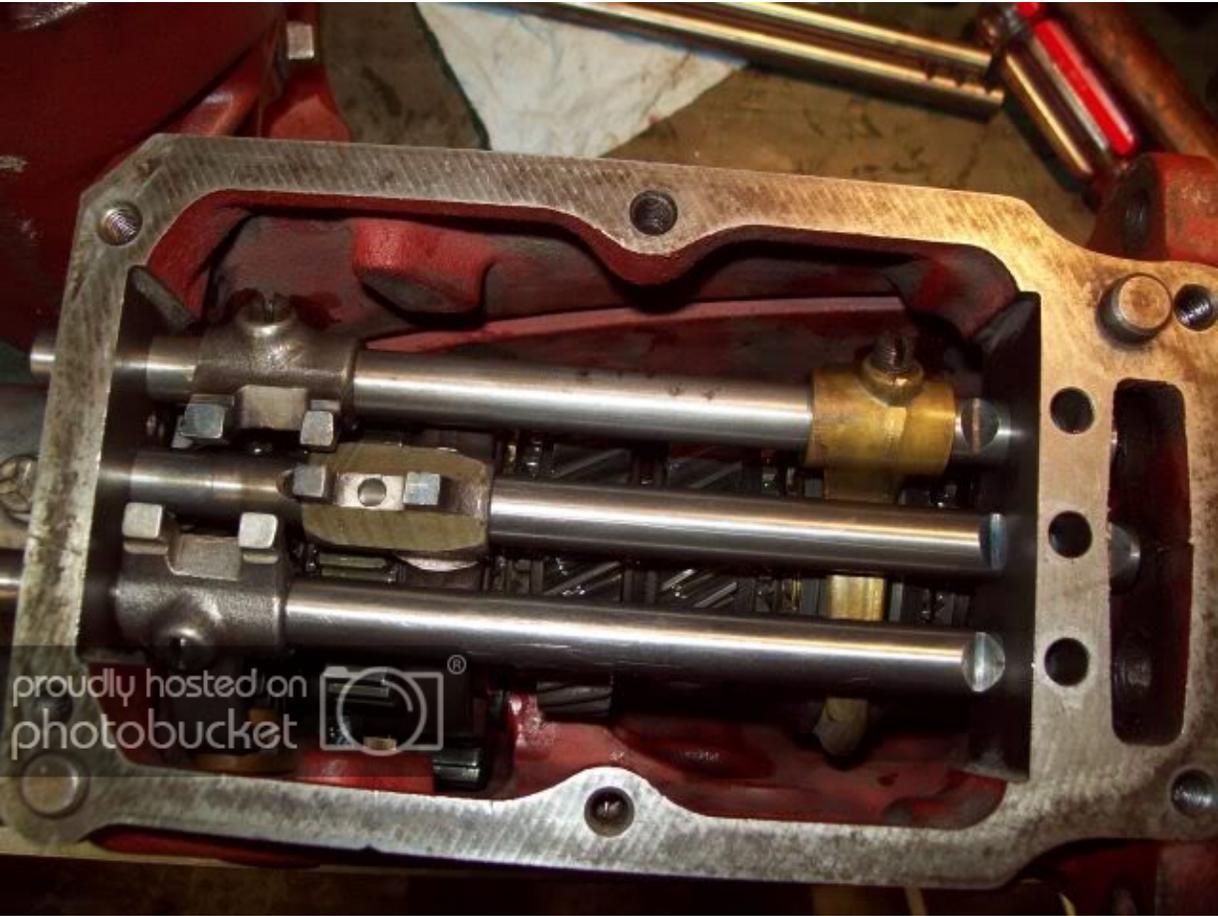




I kept it outside to keep the grease cold while I worked.

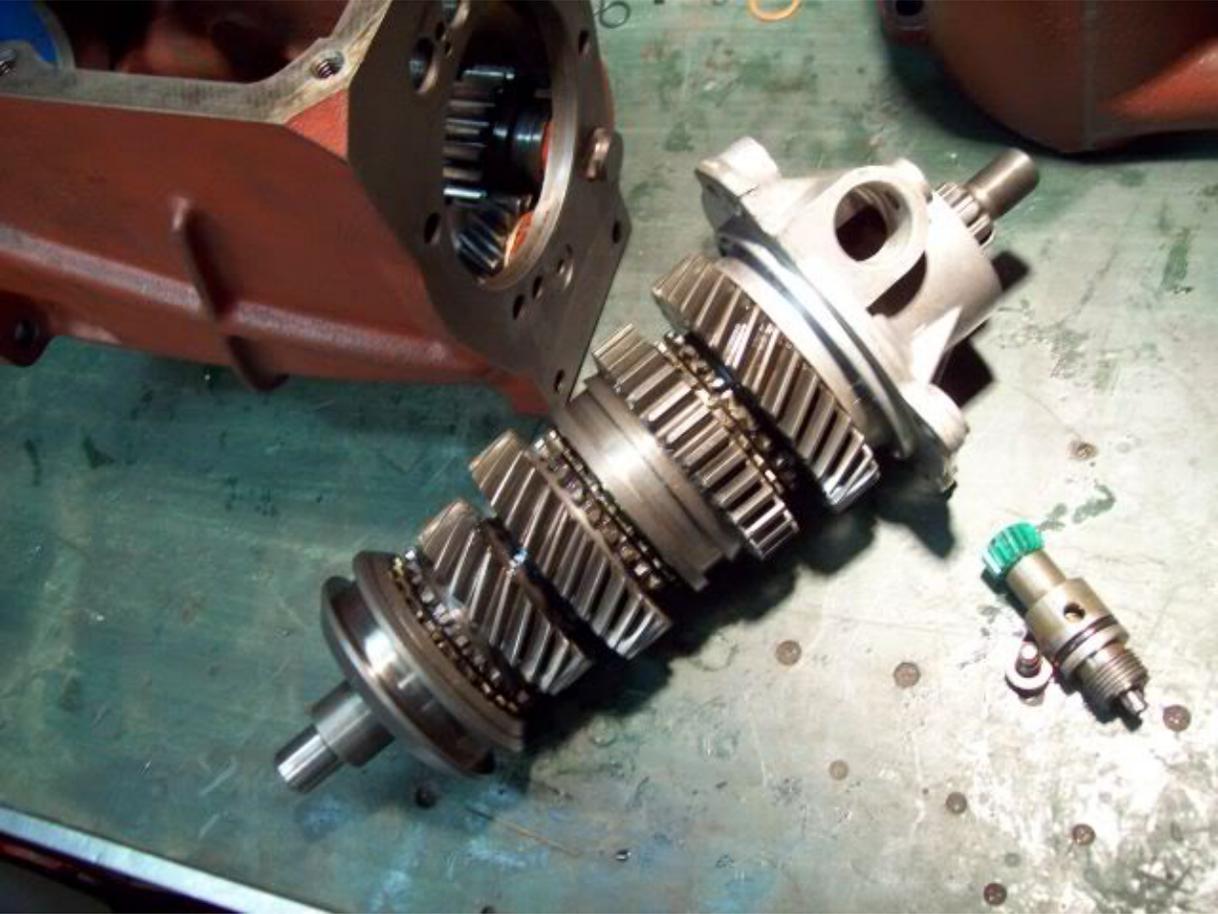


With this shaft rebuilt, and the bearings & grease routine repeated and the input shaft installed, we are ready to insert the output shaft. Careful, now. I realized the big synchro was on backwards later making the shift lever forks misaligned.



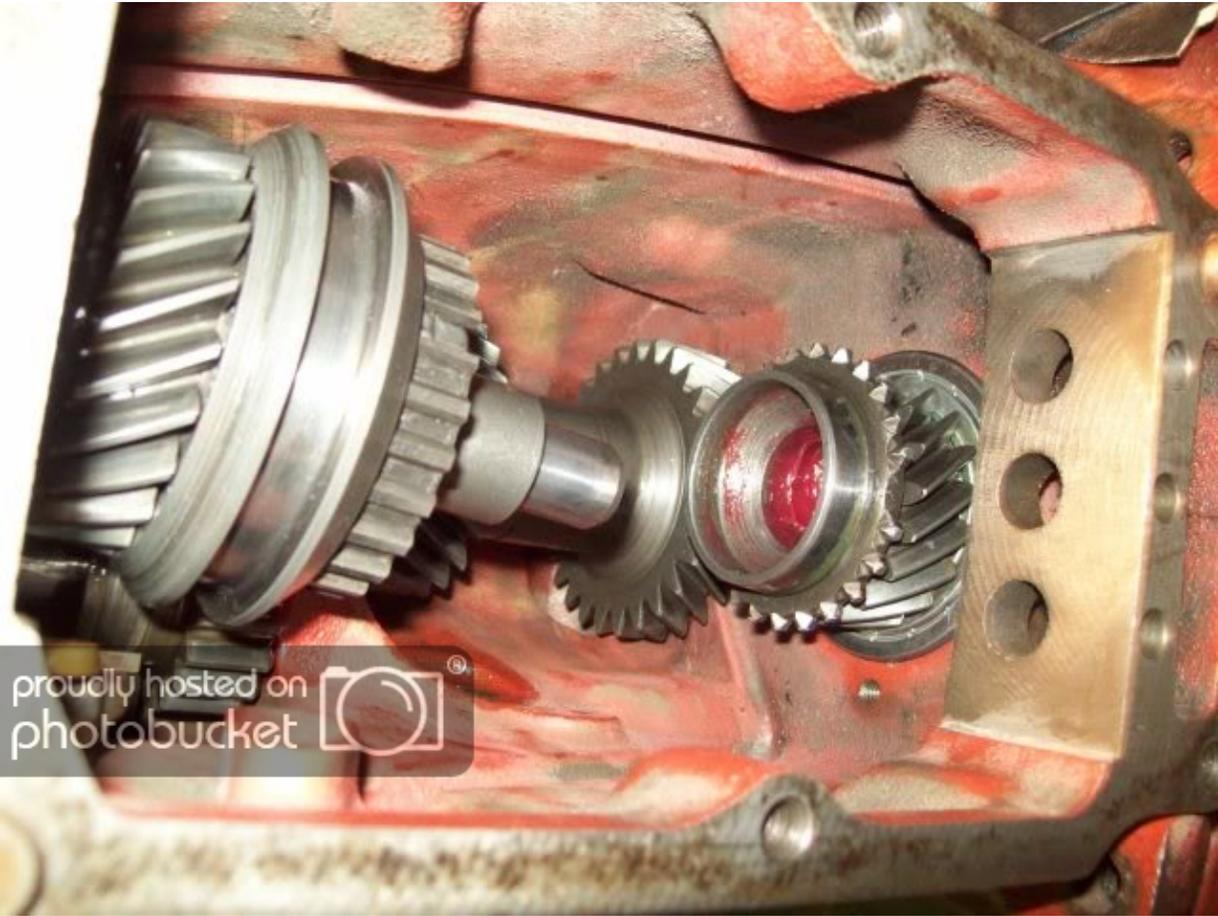
Make sure everything's facing the right direction.





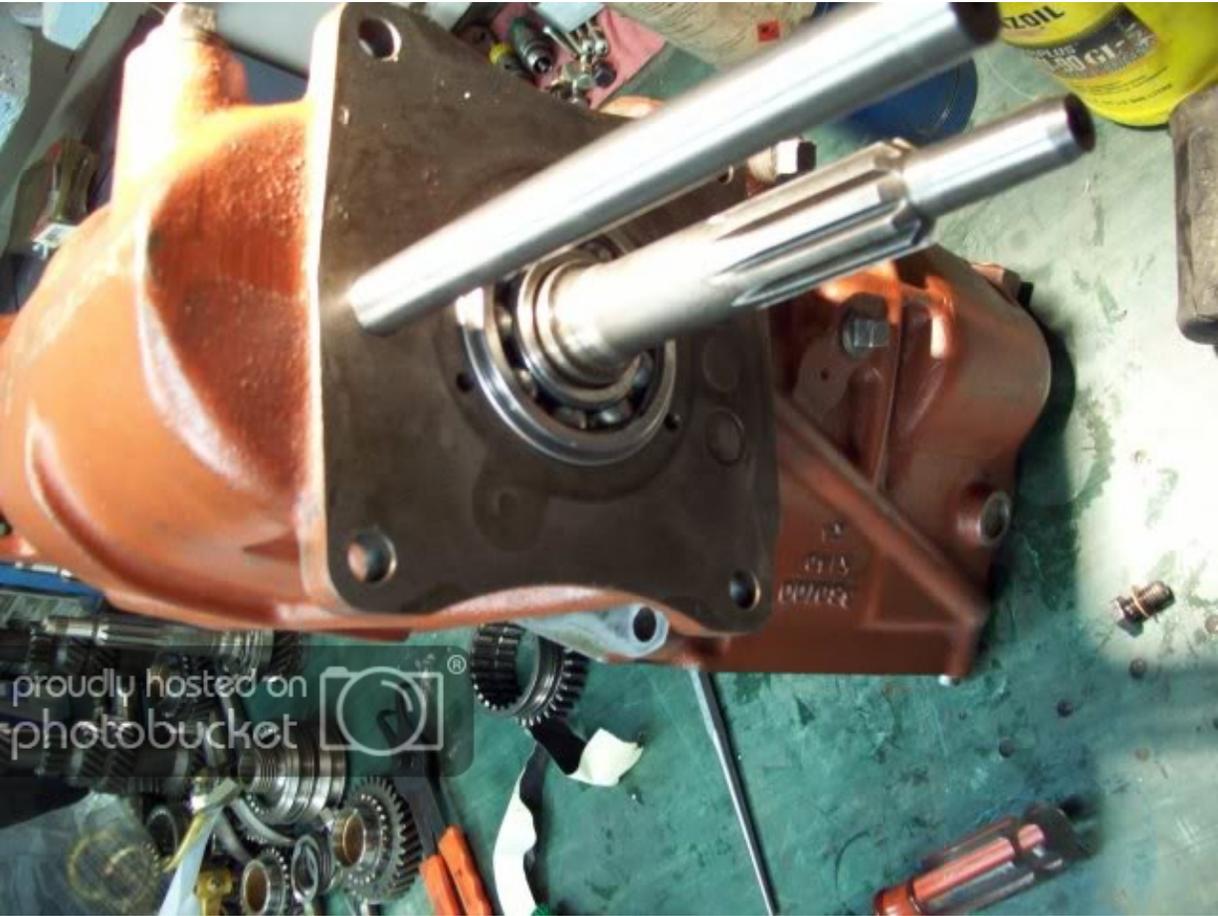








Now we can turn it upside down and turn the mainshaft halves while using some sort of tapered drift to realign the layshaft until we can insert the new shaft from the correct end. The guide says to drive the shaft out the rear, so in the rear it goes, slightly stepped end out.

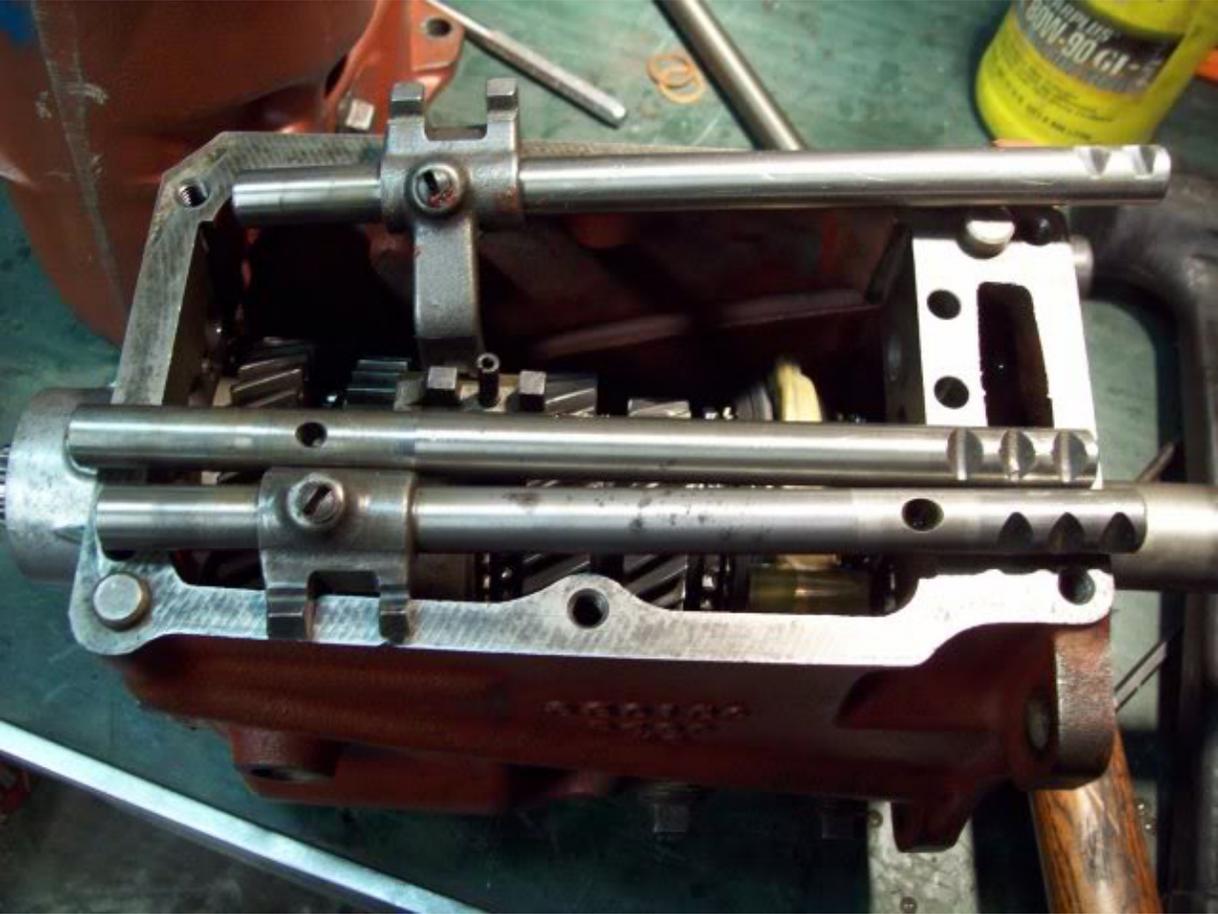


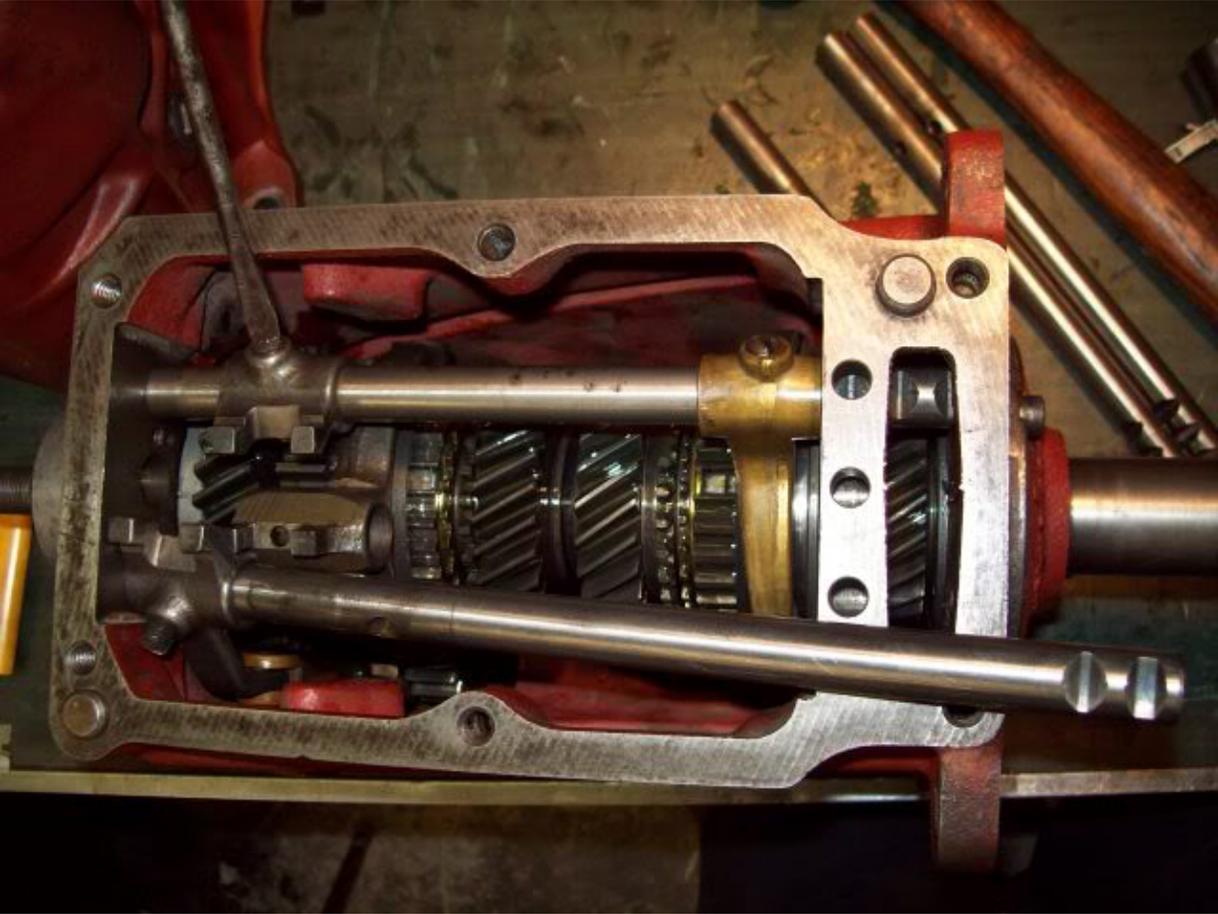


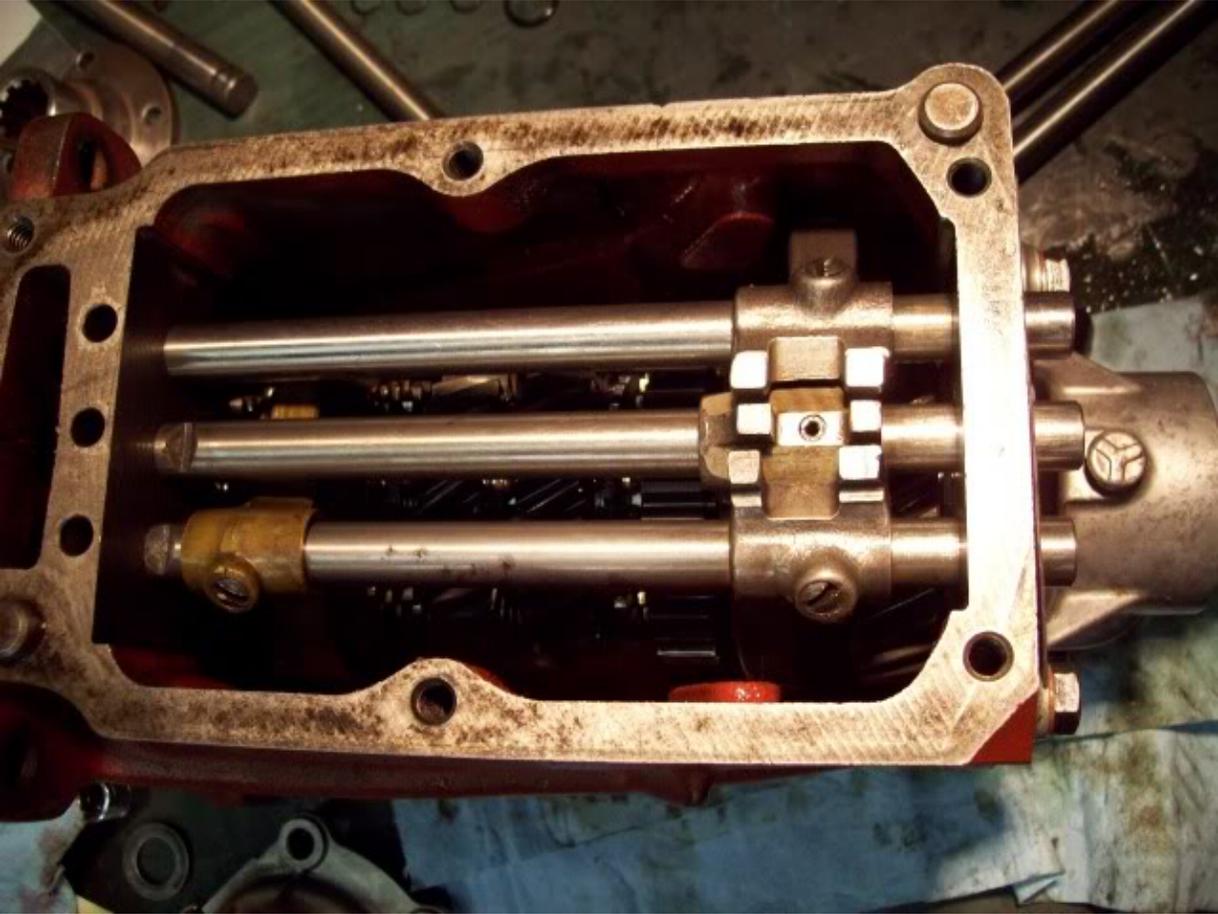


Whew! How many tries did it take you to get that right? I count about 5. Now we seal up the ends and focus on the rods in the top. They are placed back in, I have replaced the two feet on the one synchro shift fork.







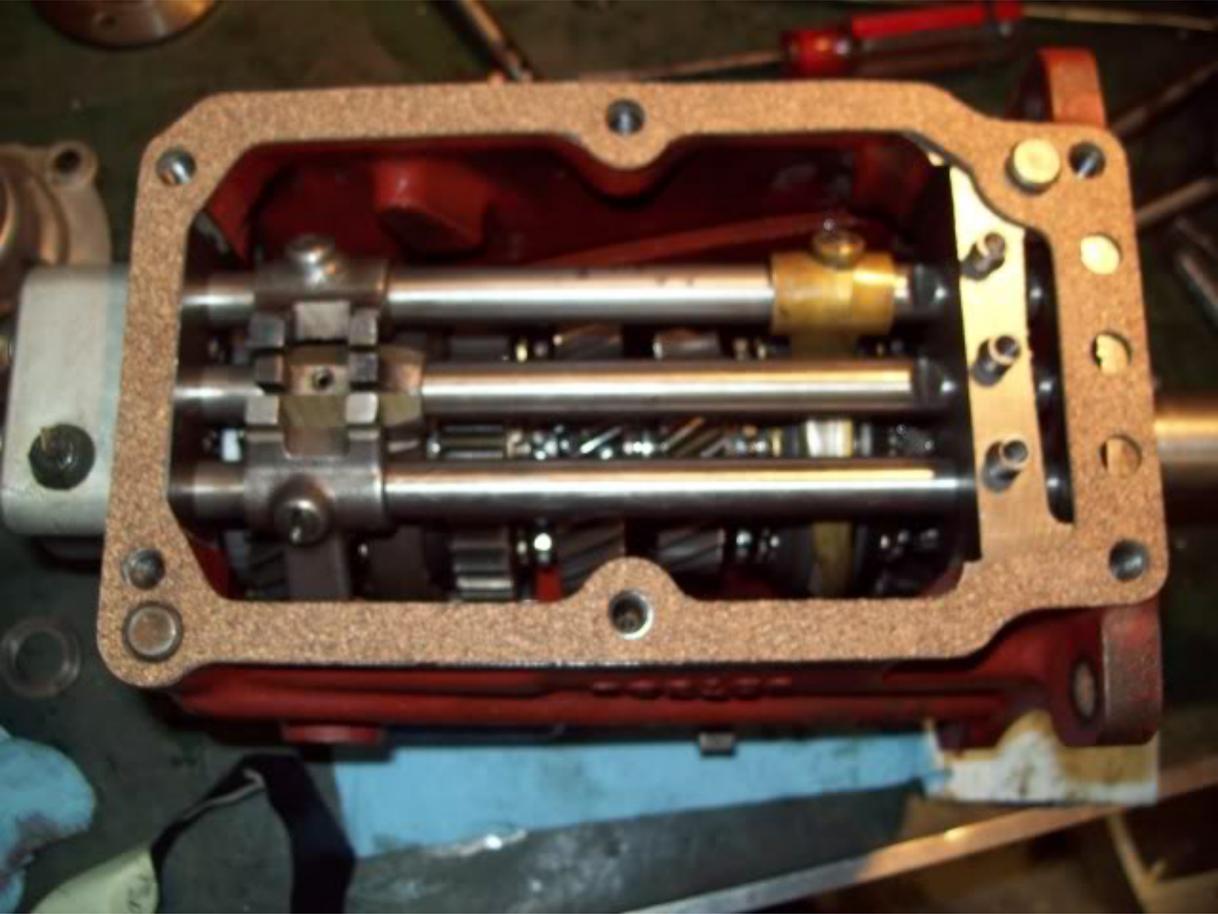


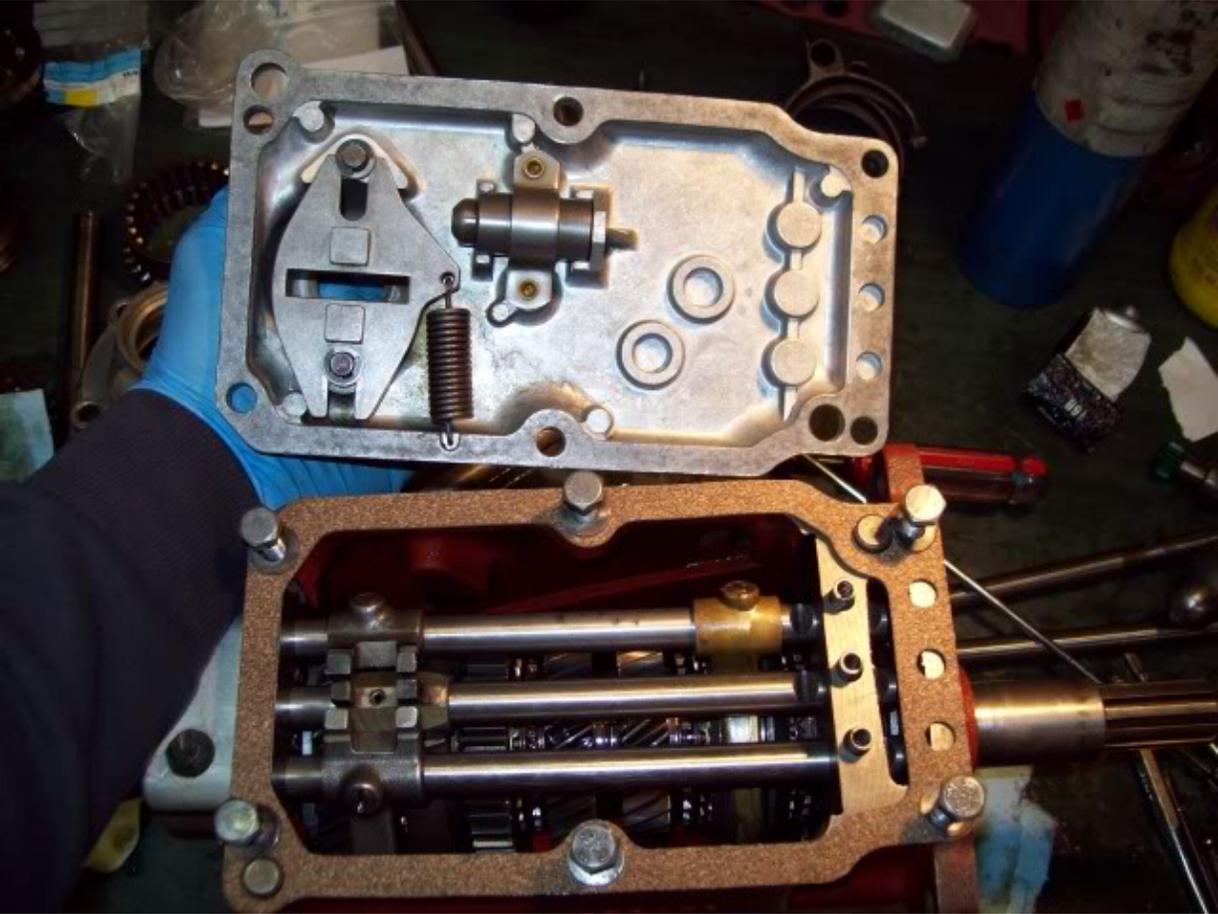


Note that all of these photos show the big synchro guy pointed the wrong way. There is no photo of the main shaft with the bigger synchro on the correct way, please note. You will notice the shift rod attachments will not align right and you

will have to take it all apart again like I did.  
The balls and springs are reinstalled, and the new gasket and top cover can go on.









A brief shift test with the lever fitted reveals that this transmission is now restored and ready to be installed. Gear oil goes in the shifter hole until it flows out the fill level hole and it is ready.



