Borg Warner Repair

by Tom Endy

Borg Warner overdrives modified for the Model A generally fail for two reasons. Most contain a less than desirable engineered rear oil seal. This allows oil to leak into the banjo. The owner is not aware he is loosing oil from the overdrive until it starves for oil and fails. The second reason is the owner attempts to back up with the overdrive fully engaged and does damage to it.

Most modified Borg Warner overdrives that are sitting around have been removed from a Model A because they failed. So, if you see one for sale at a swap meet consider that the reason it is not installed in a Model A is that it failed.

Borg Warner overdrives were originally made for a variety of "modern" cars and are pretty much the same inside, and most of the internal parts are interchangeable. What is different are the various housing configurations that were specified by the individual carmakers.

A Borg Warner is not difficult to repair, but they are very frustrating to deal with. Much of the internal hardware is held together with snap rings that you can spend an enormous amount of time trying to remove. They also seem to have an engineering philosophy that included a lot of sub-assemblies that did a lot of strange things in order to accomplish a simple gear change.

One would think that adding a fourth overdrive gear to the existing transmission would have sufficed. However, the need for an overdrive gear came along right after the industry went from a floor shift to a column shift, and when many more women were driving cars. For these reasons carmakers specified that the overdrive shifting had to be almost automatic.

The original Borg Warner overdrives were mated up to the rear of the standard manual transmission and worked in conjunction with it. When modified for a Model A it operates somewhat awkward because it sits alone in the middle of the torque tube and needs a lot of help from the driver.

The better modifications for the Model A are made from units originally used in Studebaker, Nash, and several other cars because they had a "short:" housing. Ford used a "long" housing, and these are not the most desirable for modification.



1. This Borg Warner Model A Modification was made from either a Studebaker or Nash with the short housing.



2. This Borg Warner Model A modification was made from a Ford with the long housing. The long housing modifications have a tendency to crack where the aft section is welded to a flange.

The old blue Motors Manuals of yesteryear have a lot of helpful information regarding the repair of a Borg Warner. The front and rear bearings and the seals are readily available from a bearing supply house. You will have to make your own gaskets. Replacement Borg Warner parts are still around at swap meets and such. Most internal parts are interchangeable with any housing configuration that was used for the Model A modification.



3. A disassembled Borg Warner that has been modified for a Model A. The original configuration is from a "modern" Ford car as it has the "long" housing.



4. The front section is taken from a Model A torque tube and is sectioned and welded onto a mounting flange that mates to the front of the Borg Warner overdrive housing.



5. The aft section is also taken from the rear section of a Model A torque tube. A mating flange is welded to the aft end of the "long" Ford Borg Warner overdrive housing. When using the Studebaker or Nash overdrives a mating flange can be welded to the aft section of the Model A torque tube and mated directly to the aft end of the overdrive housing.



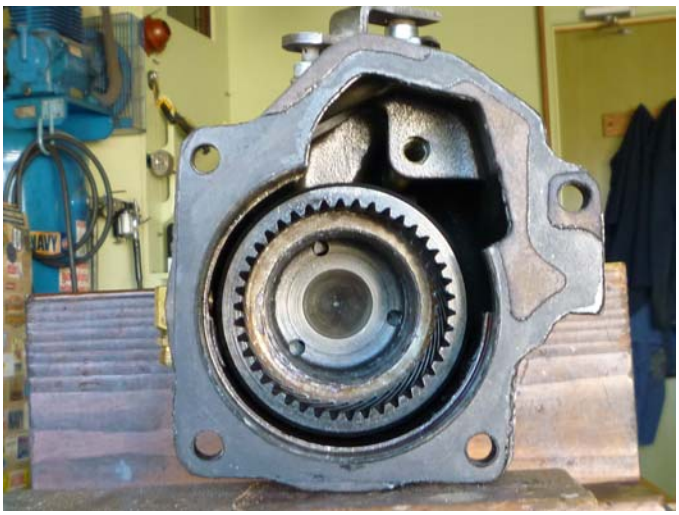
6. The input shaft (at right) is sectioned from a Model A drive shaft and a spline is machined onto the end that mates with a spline coupler that has been pinned and welded to the input shaft (at left) of the Borg Warner overdrive.



7. The output shaft (also known as a stub shaft) has also been sectioned from a Model A drive shaft and has had a spline machined onto the end. A spline coupler has been pinned and welded onto it. The spline coupler mates with the splines on the output shaft of the Borg Warner overdrive. Some type of oil seal is incorporated with the output shaft. There are several variations of engineered methods, all of which leave something to be desired.



9. The over-run clutch pack: There are 12 individual roller elements in every Borg Warner. Whenever you take one apart the rollers fall out of the pack. It is imperative that you find and account for all 12. The rollers are installed in each of the 12 slots in the pack. The roller elements are held in place with an application of Vaseline while the pack is held in a vertical position. Installing the clutch pack is a tricky business.



8. The output section of the Borg Warner overdrive incorporates an over-run clutch. Shown is the large circular ring gear the three planetary gears ride on. Further inside is the circular drum that accepts the over-run clutch pack, which incorporates 12 individual roller elements. The over-run clutch can only be driven in a forward direction. It is the reason you cannot back up in overdrive with a Model A conversion.



10. The sun gear and the three planetary gears: The sun gear at right installs into the planetary with the short section of gear below the shifting groove installed into the opening of the planetary section at left. These two parts are usually the first things to fail when the overdrive is starved for oil.



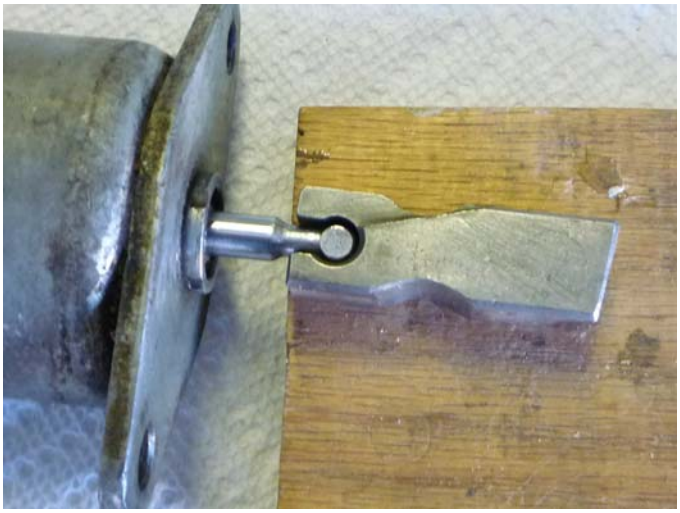
11. The shifting mechanism: The lever at right is inside the housing and fits into the groove collar on the sun gear to enable it to be shifted fore and aft. The lever at the bottom is outside the housing and has a pull cable attached to it. The driver operates the cable to shift in and out of the free wheeling portion of the overdrive engaging sequence. The pin at top right is driven into a hole in the outside of the housing to retain the outside shifting mechanism. The little cap at left is inserted into a hole in the housing. It is removed to enable a mechanic to rotate and engage the inside shifting lever during assembly.



12. The blocking mechanism: These parts make up the solenoid engaging mechanism that is part of the overdrive shifting sequence. The pawl at lower left moves in and out with solenoid action and engages the slots in the blocking mechanism. A round ball on the end of the solenoid shaft fits inside the circular hole in the left end of the pawl.



13. The end of the solenoid shaft has a ball on the end with two sides machined flat. The solenoid is installed by slipping the ball into the circular hole in the pawl and rotating the solenoid housing 90 degrees to lock it in place before installing the two mounting bolts.



14. The solenoid ball is shown inserted into the pall. It is important to install the solenoid correctly in order for the overdrive to work. Incorrect installation will prevent the solenoid from fully actuating and the internal heavy current switch contacts will not open and it will cause the solenoid to overheat and fail.



15. The output section of a Borg Warner overdrive modified for a Model A incorporates some type of an oil seal. This particular modification uses a large automotive seal that is inserted into the recess of the flange.



16. Two other seals are also important to control oil leakage. The one at left is inserted into the shift lever boss. The one at right is inserted into the solenoid shaft boss. Both seals are available from a bearing supply house. It is prudent to change both when overhauling a Borg Warner overdrive.



17. The shifting lever boss is shown with the seal removed.



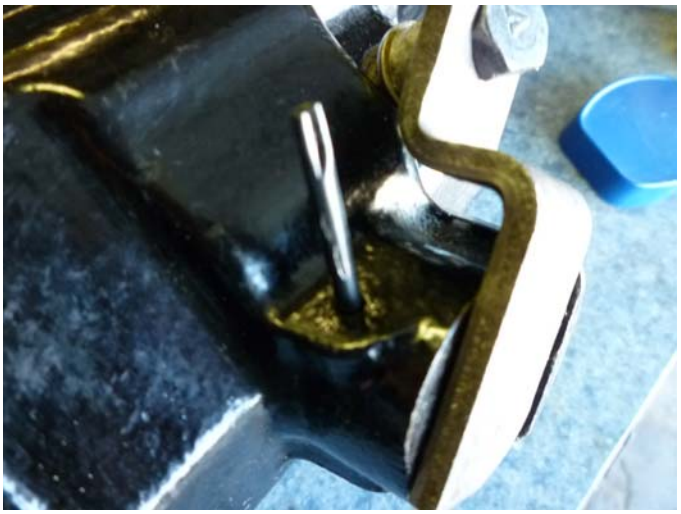
18. The shifting lever boss is shown with a new seal installed.



19. The solenoid boss is shown with the seal removed.



20. The solenoid boss is shown with a new seal installed.



21. The locking pin is shown that retains the outside shifting lever.



22. The hole shown in the housing is where the small plug is inserted after the inside shifting lever is rotated to engage the outside shifting lever during assembly.



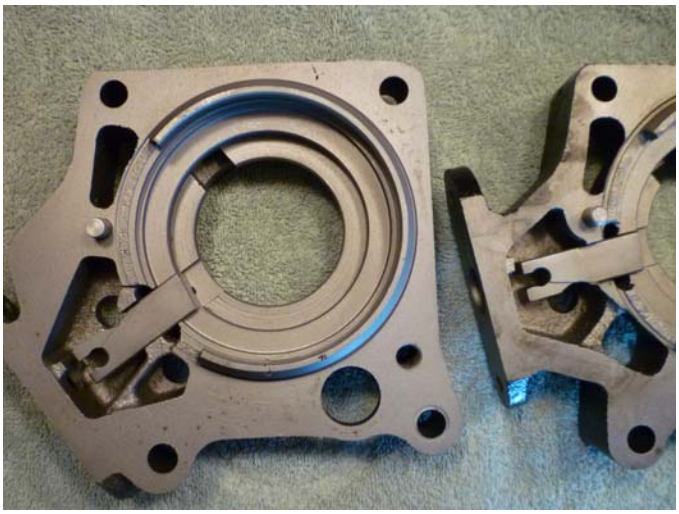
23. The blocking assembly is inserted into this recess. The pawl is inserted and actuates in the slot at lower left.



24. The blocking assembly is installed.



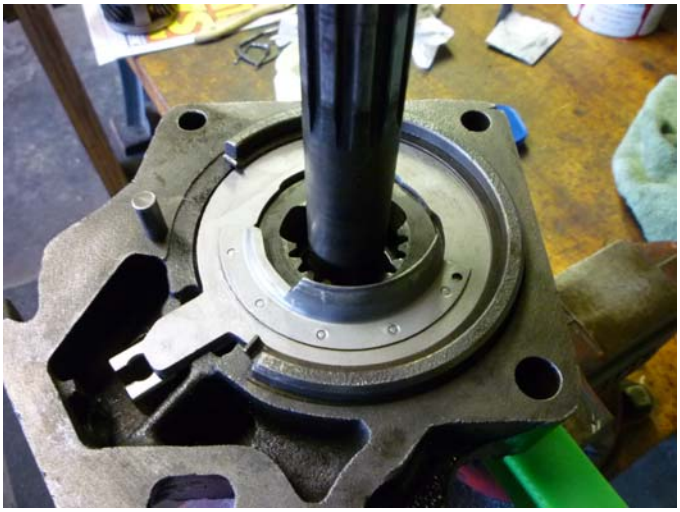
25. The pawl is installed with the machined relief at the lower left facing up. This will align the curve in the pawl with the hole in the casting. Note the direction of the angle at the top end of the pawl.



There is some variation in castings, depending on carmaker housing design specification; the hole in the casting may be on the other side of the pawl. The pawl itself in this case will be manufactured with the cutout on the opposite side with the relief still facing up



There are several pawl variations. The two in the center are identical. The top and bottom pawls are different from the center two. The secret of installation is the machined relief should always be facing up and the angle at the right end of each one is oriented as shown. This is the one part in the Borg Warner that is easy to install incorrectly.



26. The blocking plate is installed and is held in place with a large snap ring. The sun gear, planetary gears, and over-run clutch pack are assembled on top of the blocking assembly. Note the oil deflector standing vertical at the lower right on top of the blocking plate. The Motors Manuals warn that they can easily become distorted and jam the sun gear. The result is the overdrive will be stuck either in overdrive or out of overdrive. If stuck in overdrive you will not be able to back up.



27. An example of a deformed oil deflector: This was the cause of the failure in the overdrive undergoing repair in these series of photos.



28. The sun gear is installed with the long portion of the gear up. The inside shifting lever is installed with the shifting arm inserted into the groove of the sun gear.



29. The planetary gear assembly is inserted onto the sun gear and the clutch pack is installed on top. The bottom of the clutch pack is held onto the planetary gear assembly with a large U-shape snap ring. The top of the clutch pack is held onto the output shaft with a smaller U-shape snap ring.



30. The bottom of the clutch pack is held onto the top of the planetary gear assembly with a U-shape snap ring. The snap ring fits into the slots of the clutch pack and into a groove on the planetary gear assembly.



31. The top of the clutch pack is held onto the output shaft with a U-shaped snap ring. The snap ring fits into the slots of the clutch pack and into a groove on the end of the output shaft. It is important that both of these U-shape snap rings fit snugly in place. Often they are found somewhat spread and could easily become disengaged. Squeeze the ends closer together in the jaws of a bench vice.



32. The 12 roller elements are held in the 12 slots of the clutch pack with a liberal coating of Vaseline. Some people place a rubber band around the elements and leave it in place during the assembly. I don't subscribe to this practice. Broken pieces of rubber band floating around inside could be detrimental.



33. The forward section of the overdrive is slid into place over the clutch pack. The assembly must be held vertical as the two sections are slid together. Care must be taken so as not to dislodge any of the 12 roller elements. The rod on the internal shifter has to be slid into a recess at the same time. The spring is first inserted inside the housing before assembly. The outside shifting lever has to be pulled outward to allow the two sections to go together. The shaft of the inside shifter is then rotated though the hole in the end of the housing to engage the slot in the inner shifter with the cam on the inside of the outer shifter. The retaining pin is then driven into place and the plug inserted into the end of the housing.



34. The front section is then installed and the input shaft inserted. The standard Model A front seal, race and roller bearing are then installed along with the mechanism for the speedometer drive.



35. This Borg Warner modification has a unique oil control and monitoring system. The brass fitting at the bottom of the photo is screwed into the drain boss. The plastic tubing is routed to another brass fitting that is crewed into a hole drilled into the top of the housing. The plastic tube is used to monitor the oil level in the overdrive. The brass fitting with the large hex just to the left of the drain boss fitting is an elbow screwed into the fill port. Normally you would "fill to spill" with this port. With the elbow installed it is easier to fill and you would fill until the oil in the plastic tube is even with the fill port. A very unique engineered system. However, if the plastic tube should slip off of the fitting the overdrive will shortly fail.



36. The governor is shown at the top. It is used only when the installation in a Model A includes a power relay in the electrical circuit. Though not used in most Model A installations it must be in place to prevent a major loss of oil. The solenoid is shown at bottom. Solenoids come in both a 6-volt version and a 12-volt version. The two look identical; there is no visible means of telling them apart. The way to tell the difference is to test them on a 6-volt battery. If they do not actuate test them on a 12-volt battery. Solenoids take a nominal 30 amps to actuate. An instant after they actuate a large set of contacts inside opens and disconnects the 30 amp initial actuation current. A second set of smaller contacts then close to provide a holding current of only a few amps. Most solenoids fail due to being installed incorrectly. The solenoid must be inserted so that the ball on the end of the shaft engages the pawl inside the overdrive. The solenoid is then rotated 90 degrees and bolted down. Failure to follow this procedure will not allow the solenoid shaft to extend, the initial 30 amp contacts will not open and the solenoid will burn itself up. ☺