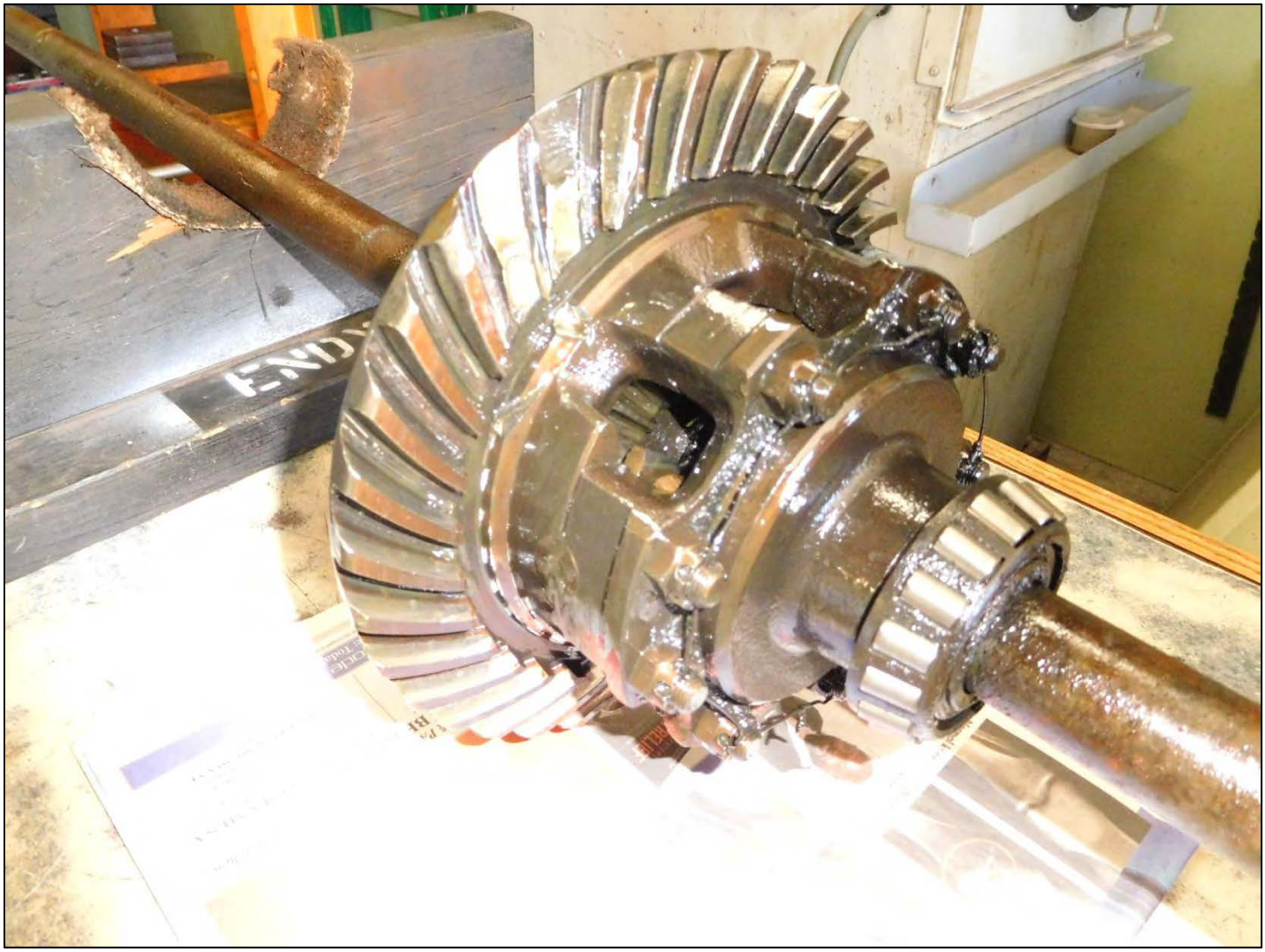
March 2019 Differential Overhaul

By Tom Endy

The first job of 2019 came into the shop on March 16. The customer complaint was the ring & pinion gears appear to be jammed. The photo shows the rear axle assembly being unloaded from a pickup truck. Note the unit has a Mitchell overdrive stub shaft

The owner said he backed the car out of the garage, drove a short distance down the street and made a right turn and heard a “clunk”.

The owner procured an original replacement 378 ring & pinion with matching numbers on them. This will be used as the replacement during the overhaul.



Three teeth were found knocked off the ring gear. Both bearings on the carrier were spun on their hubs. The inside of the carrier where the spider gears rotate was worn excessively. The carrier will have to be replaced along with the ring & pinion.

Close up view of the damaged area of the ring gear.

Teeth broken off the ring gear were found in the bottom of the banjo.

The pinion gear also suffered some damage. The broken teeth from the ring gear can be seen in the bottom of the banjo.

The banjo shown with the Mitchell stub shaft installed. Broken teeth from the ring gear can be seen in the bottom of the banjo.

The nut on the end of the Mitchell stub shaft took a terrible beating and offered a challenge to get it off. What I did was take a 15\16” 6-point socket and drive it on with a hammer. Once in place I applied an impact wrench and spun it off.

The end of the Mitchell stub shaft has part of the end missing clear up past the cotter pin hole. The end of the threads were slightly damaged, I ran a dye over the threads to clean them up.

When re-assembled with a new nut it will not be possible to insert a cotter pin. Hopefully the 100 pounds of torque and some lock-tight will hold it. The other alternative is to replace the stub shaft at a cost of about $100. The owner was contacted and he opted for a new replacement Mitchell stub shaft. The cost of the replacement, however, was $150.

Comparison of a replacement serviceable nut and the damaged one removed.

It was noted during the disassembly that there was no pre-load on the pinion bearings and both large nuts on the pinion sleeve were loose. This may have been a contributing factor to the ring & pinion failure as the pinion gear was somewhat loose. This condition may have been induced at the time the Mitchell overdrive was installed.

The replacement ring & pinion supplied by the owner is an original 378 (9-34) and in excellent serviceable condition. There are matching numbers (3710) on both components. It is shown here after I bead blasted it.

The replacement carrier is shown here. It has had both bearing hubs knurled and has been bead blasted. It is important that both carrier bearings press on tight.

Close up of a knurled hub. Note the bearing stop has been machined to clean it up, .005 was taken off and it will be replaced with a .005 metal shim. A second relief cut was taken below the stop to provide additional room under the bearing if it becomes necessary to remove the bearing to add another shim. The additional room makes it easier to get a removal tool under the bearing to get if off without damaging it.

The new carrier is about to have the ring gear and the new bearings installed. In place of the spider gears a modified spider yoke is installed as a tool to enable the setting of the carrier bearing pre-load. Shims will be placed under each bearing to compensate for the material that was removed from the bearing stop to true it up. The nine bolts and nuts that hold the carrier together have been bead blasted and wire wheeled.

The carrier has been assembled and is about to have a shim installed to one side of the carrier.

The bearing is being pressed down on top of the shim.

The opposite side of the carrier is having a shim installed.

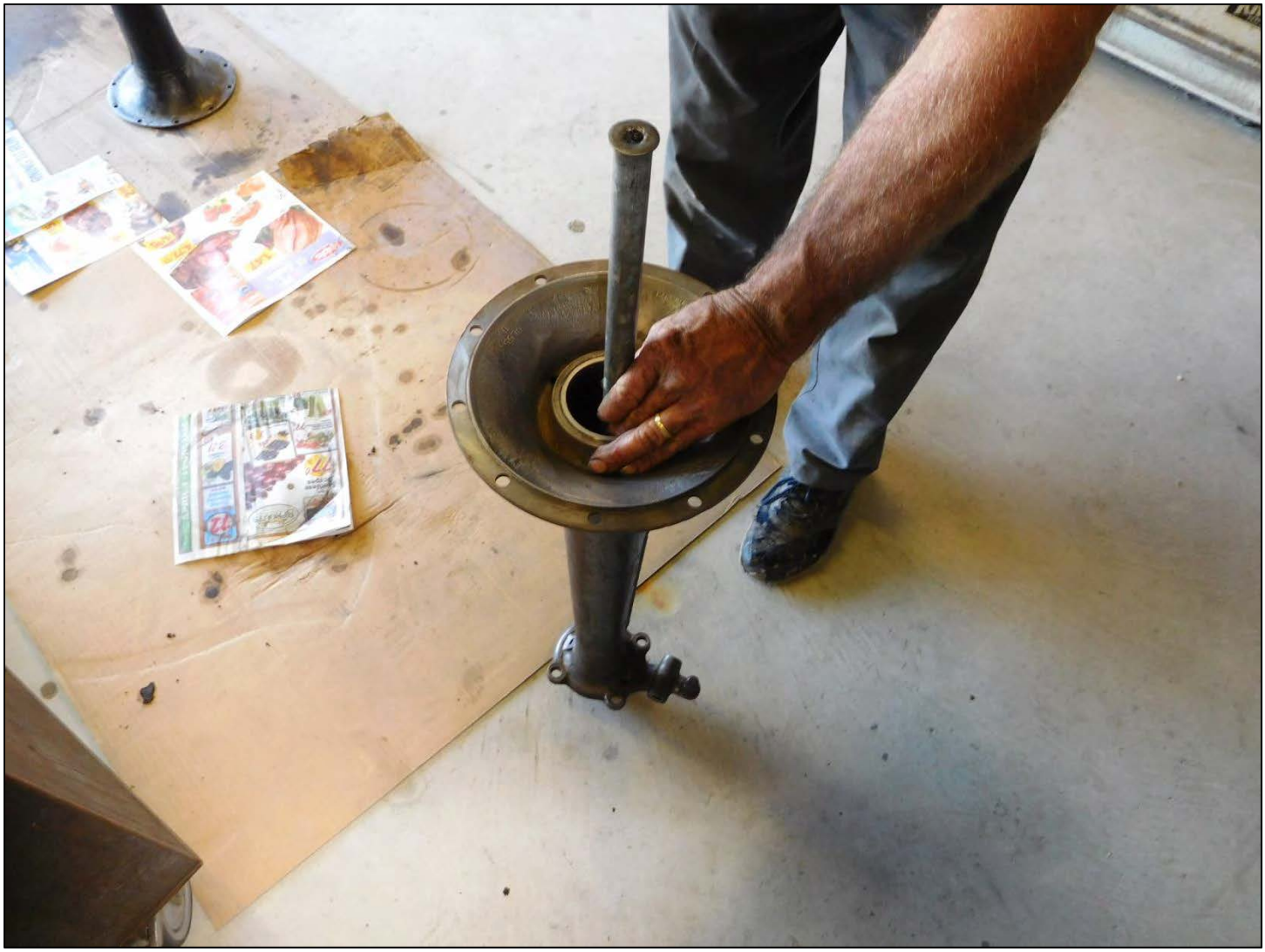
The number 3710 seen written on the back side of the ring gear was done by me after I found this number stamped on the end of the pinion gear and etched on the back side of the ring gear. This is the matching number.

The other bearing is being pressed on.

This photo shows the recess in one of the axle housings where the bearing race installs. After the race was removed it was noticed that there was a slice in the race seat along with a protruding burr. I suspect this occurred at a previous overhaul when the mechanic apparently took a cutting disk and cut the race in half in order to remove it and accidently cut into the seat. The burr was removed with a chisel and a hammer.

A new race is being installed in the axle housing after it was repaired. It is important that the race is pressed down firmly and evenly on the seat. A dental mirror is used to determine that it was done correctly once the race is seated.

This photo shows a K. R. Wilson tool being used to press the race into place in the axle housing.



A new grease seal is being installed in one of the axle housing. The seal is placed on the end of an insertion tool and is driven into place with a hammer. The axle housing is set on a concrete floor as is shown. About six or more hammer blows are required to seat it. With each hammer blow there is a clunk sound. When the seal seats the sound changes to a ringing sound.

Shown here are the two seals removed from the two axle housings. Note these are the original seals that Henry installed in the factory 80 plus years ago. They were made of leather and have the letters CR stamped on them that stand for Chicago Rawhide. After 80 plus years the leather is completely gone and the springs are protruding and there is no sealing left.

Quite often I find the original seals still installed during an overhaul. These are items that are often overlooked during previous overhauls.

The banjo was degreased and bead blasted. A new double race was pressed into place.

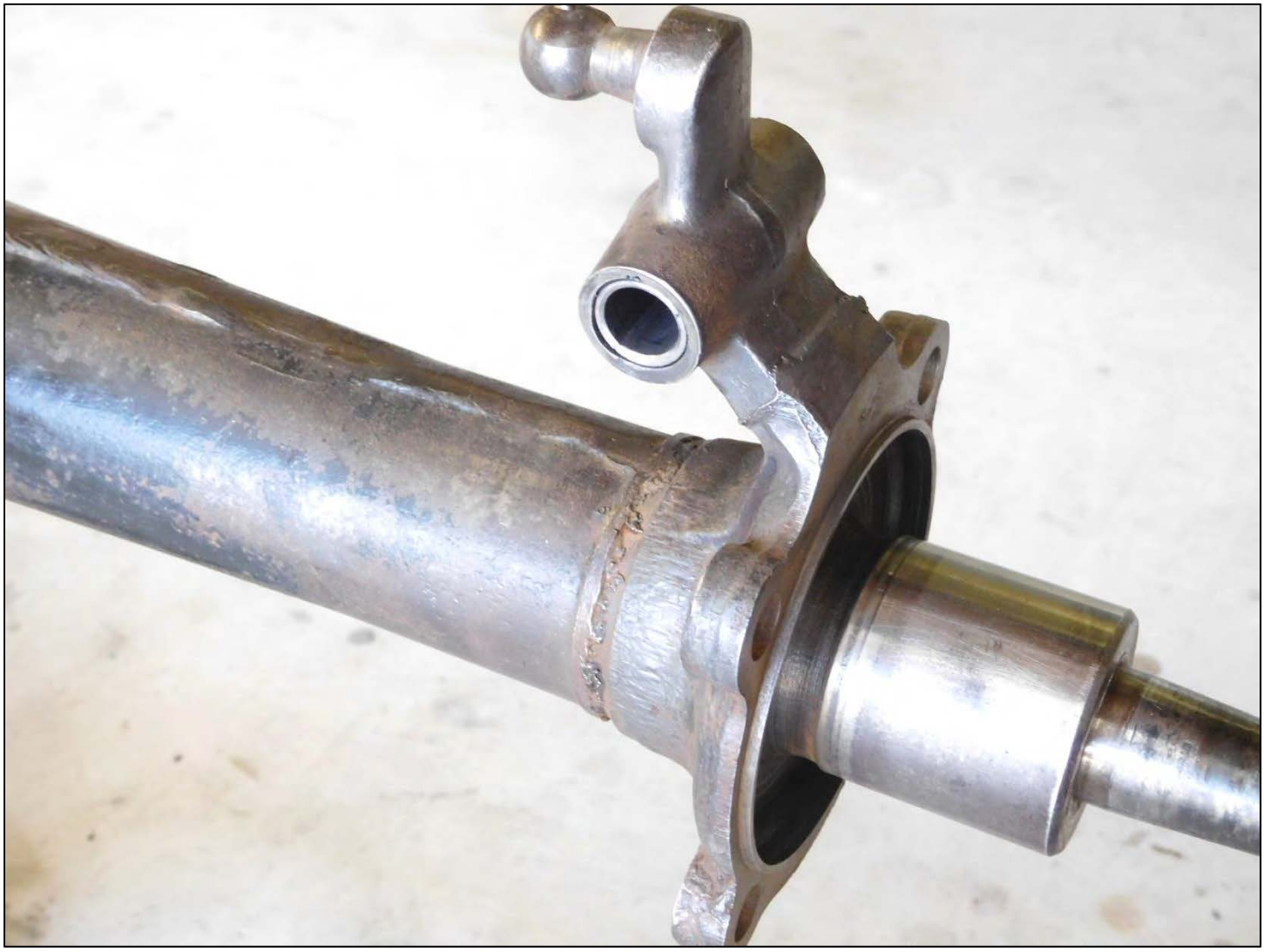
This photo shows the beginning of the carrier bearing pre-load adjustments process. The right axle housing is sitting in the vertical jig with the banjo bolted to it and all the bolts torqued to 35 ft. lbs. he carrier assembly is set down inside. Two .010 banjo gaskets are initially installed. Alignment studs are installed on the left side of the banjo.

The left axle housing is set down on the left side of the banjo and the studs were replaced with bolts and torqued to 35 ft. lbs. The pre-load was then checked. In this case I had to add an additional .006 gasket to bring it to the desired 20 in. lbs.

The pinion assembly was installed along with the new Mitchell stud shaft. The pinion bearing pre-load was established by adjusting the two large nuts on the pinion sleeve. The nut on the end of the Mitchell stub shaft was tightened to 100 ft. lbs. The cotter pin legs were bent down along the side of the nut, not over the end of the shaft.

It is prudent to check the clearance between the end of the drive shaft and the carrier. There is a nominal 1\4" clearance, but it can vary, especially with an overdrive installation or aftermarket ring and pinion gears. This can be accomplished during the overhaul process by temporarily setting the carrier upside down on the right axle housing and setting the banjo with the pinion assembly installed down on top. This allows a view of the pinion gear meshed with the ring gear and a clear view of the clearance between the end of the drive shaft and the carrier.

The narrow clearance is the reason the cotter pin on the end of the drive shaft should be bend down along the side of the nut and not over the end of the shaft.



New shackle bushings were installed in both axle housings.

The rear axle assembly is complete and has been put back in the roll around cradle.

The rear axle assembly has been masked off and sanded and is ready for painting.

Tag attached to the rear axle housing. Don’t forget to put oil in the banjo.

The finished product: