

Dramatic Differential failure 2018

by Tom Endy

This differential repair is out of a 1929 Model A station wagon owned by a member of the Orange County Model A Ford Club. The customer complaint was that the differential was making a lot of noise and would occasionally go “clunk”. However, it was still a running car. The following photos show the extent of damage found to the ring & pinion, the drive shaft, and the carrier. The ring & pinion is an original 378 gear ratio. The entire rear axle assembly is also of a 1931 manufacture date.

It was also noticed that someone years ago replaced the four bearings, but not the races. The bearings were manufactured by Timken, but had the Ford part number on them as was the case at least 40 years ago; the races were made by Bower and had Ford script on them indicative of being installed at the Ford factory. I have seen this often before, some people don't seem to understand that the race is the other half of the bearing and should be replaced along with the bearing. All the bearings and races showed signs of a lot of wear and were due for replacement, especially the races.

The left carrier bearing was found spun on its mount. In addition the carrier was badly battered by broken gear teeth adrift in the banjo. The bolt tunnels on the carrier halves were so hammered it was difficult to remove the bolts. The carrier will have to be replaced and is not salvageable due to the damage to the tunnels. The ring & pinion and the drive shaft will also have to be replaced. Both axle housings were found full of metal debris and will have to be thoroughly cleaned. The torque tube was also found full of metal debris.

Spun carrier bearings are a result of someone assembling the rear axle assembly without understanding the procedure for establishing proper pre-load by the selection of quantity and thickness of banjo gaskets. If only a single gasket is installed on each side of the banjo the bearings could well be locked. When the car is back on the road Henry's 40 horses will break it loose by spinning the bearings on their mounts. In extremum cases it can shear the carrier hub off. If only one carrier bearing is found spun, it is always on the ring gear side. I suspect it is due to the initial torque being applied to that side by the pinion gear.

The spider gears and both axle shafts were not damaged, are serviceable, and will be reinstalled. A used serviceable original 378 ring & pinion will be installed. A refurbished carrier and an original used serviceable drive shaft will be installed. All new bearings, races, seals, and gaskets will also be installed.

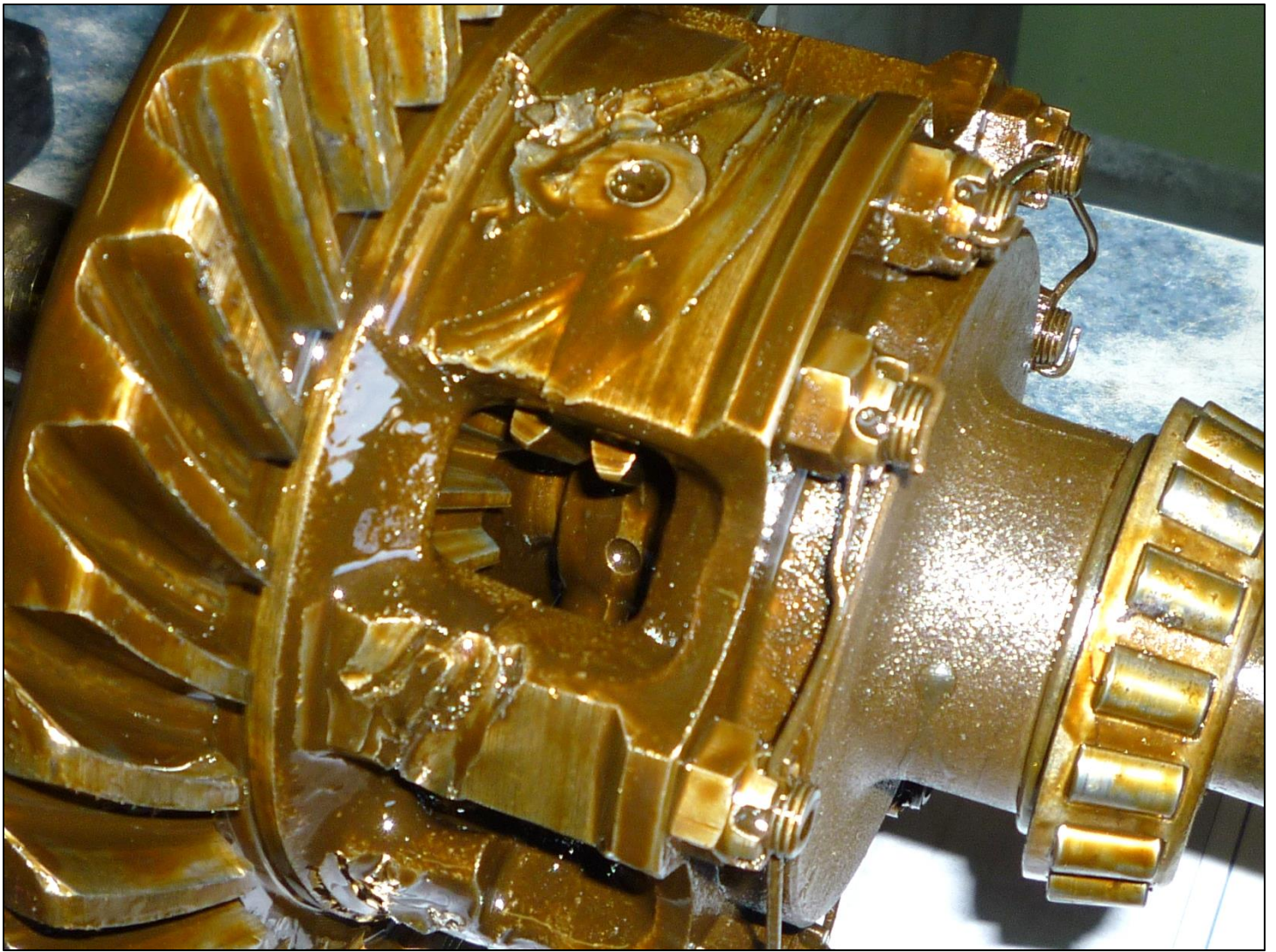


One tooth was knocked off the ring gear, along with damage to many others.



Multiple teeth were knocked of the pinion gear.

The failure of a pinion gear such as exhibited here can be caused by going over a speed bump, railroad tracks, or a rutted road at high speed. The transverse rear spring on the Model A can easily bounce the car such that the rear wheels will come off the pavement momentarily. If the driver keeps his foot on the gas the rear wheels can spin up to 10 times the speed the car is travelling. When the rear wheels reconnect with the pavement the rear wheels and the ring gear attempt to resume the speed of the car; the pinion gear takes the brunt of the process and damage will occur.



The carrier was badly battered by flying debris. Note damage to bolt tunnel surfaces. This made it extremely difficult to remove the bolts. The carrier is not salvageable due to the damage to the bolt tunnels.



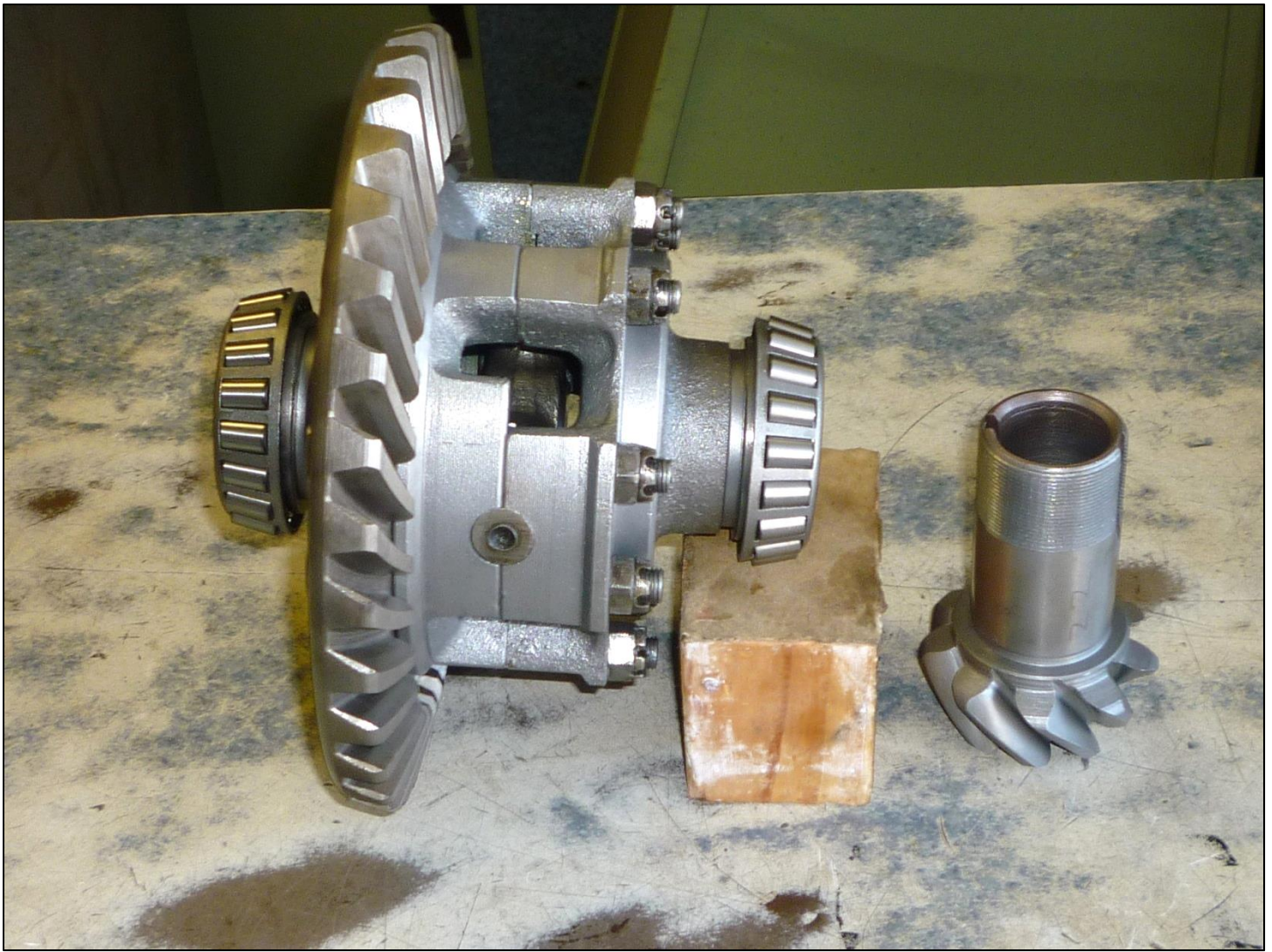
The nut on the end of the drive shaft is battered along with a number of threads on the drive shaft and the cotter pin hole.



Another view of the pinion gear:

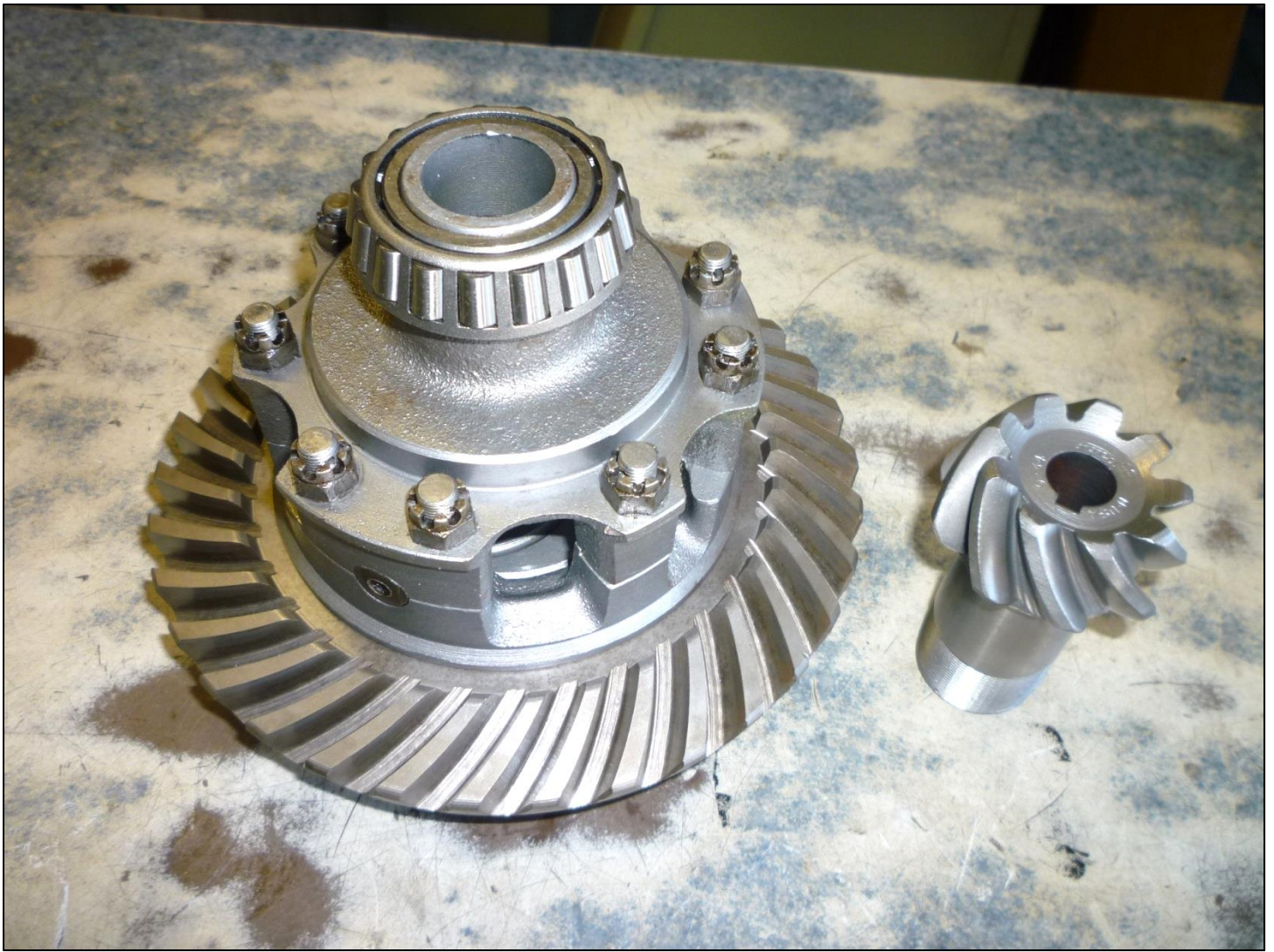


Teeth from both the ring and the pinion found lying in the bottom of the banjo.



The replacements are an original used serviceable 378 ring & pinion and a refurbished carrier:

New bearing have been installed. The pre-load tool is inside the carrier. This carrier has been refurbished by having both bearing hubs knurled. Note the space under the right bearing where it mounts. When the machinist was knurling the hubs I asked him to take a .005 cut on the bearing stops to clean them up. A .005 shim will have to be added to both sides to compensate. I also asked him to take an additional cut just below the bearing stop on both hubs. This cut is a nominal 1\16" deep and a nominal 1\4" wide. The purpose is to afford additional space under the bearing to allow a bearing pulled to be installed in the event the new bearing has to be removed to add additional shims. Henry did not provide much room under the bearings and it is important that when removing a new bearing not to damage it. This is a process I am having done to all carriers I have knurled.

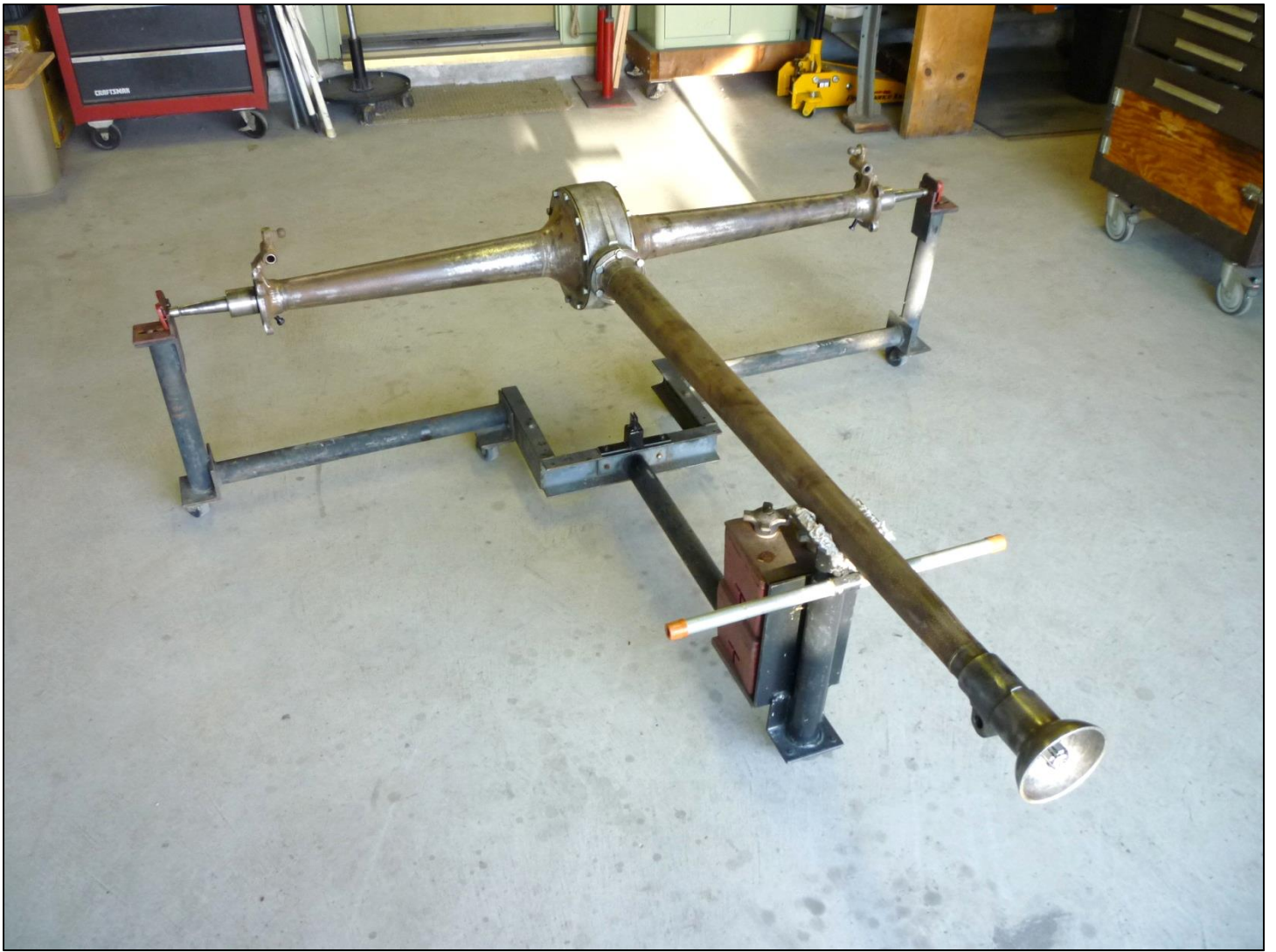


Another view of the replacement ring & pinion and carrier:

This particular carrier assembly required a total of .010 shimming on both sides in order to achieve the proper pre-load. The extra cut I had made under the bearing stops made it easy to remove the bearings to install the additional .005 shims.



Undamaged spider gears and other hardware cleaned up and ready for installation:



Assembly complete:



Painted and ready to be installed in the car. The tag attached to the left axle housing says “no oil in banjo”.

Note: A modification has been made to the roll-around. The device below the torque tube attached to the U-shape structure can be rotated to the vertical and locked in place. The purpose is to support the stub shaft of a rear axle assembly that will receive and overdrive instead of a drive shaft and torque tube.