Differential Overhaul May 9, 2019 (LB)

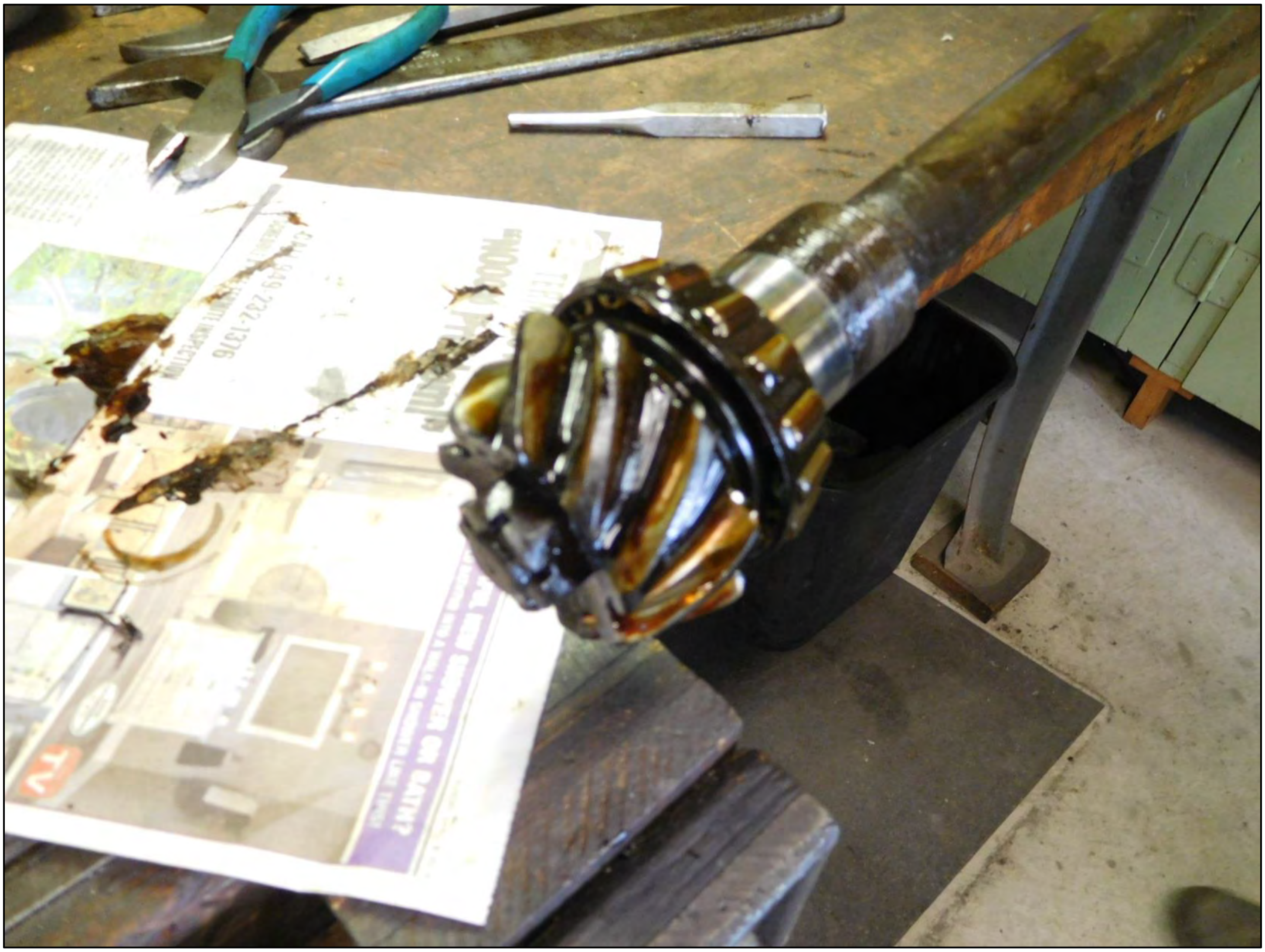
by Tom Endy

This rear axle assembly overhaul project arrived in the back of a pick-up truck and will receive a Mitchell overdrive during the overhaul process. In addition, the transmission and bell housing from the project car were also brought and will be overhauled\restored. The project car is a 1929 Tudor. The owner is a member of the Santa Anita A's of Arcadia, California.

The rear axle assembly was removed from the project car that had been in storage for many years before being transported for overhaul. It is shown here arriving in typical cruddy condition.

The project rear axle assembly has been moved to the roll-around cradle and is ready for disassembly. The torque tube and drive shaft will be removed and set aside as the project will receive a Mitchell overdrive.

The ring gear, carrier assembly, and both axles were found extremely cruddy. Both bearings were found to have spun on the carrier hubs because they were set up too tight the last time the rear axle assembly was overhauled. It was also found that the inside of the carrier was extremely worn and is not a candidate for knurling and reuse.



The pinion gear is also extremely cruddy. It will be removed from the drive shaft and the drive shaft will be set aside in favor of a Mitchell stub shaft as the project will receive a Mitchell overdrive.

The ring & Pinion removed from the project car are originals and have both been degreased and bead blasted. They are in excellence condition and are a 378:1 ratio (34-9).

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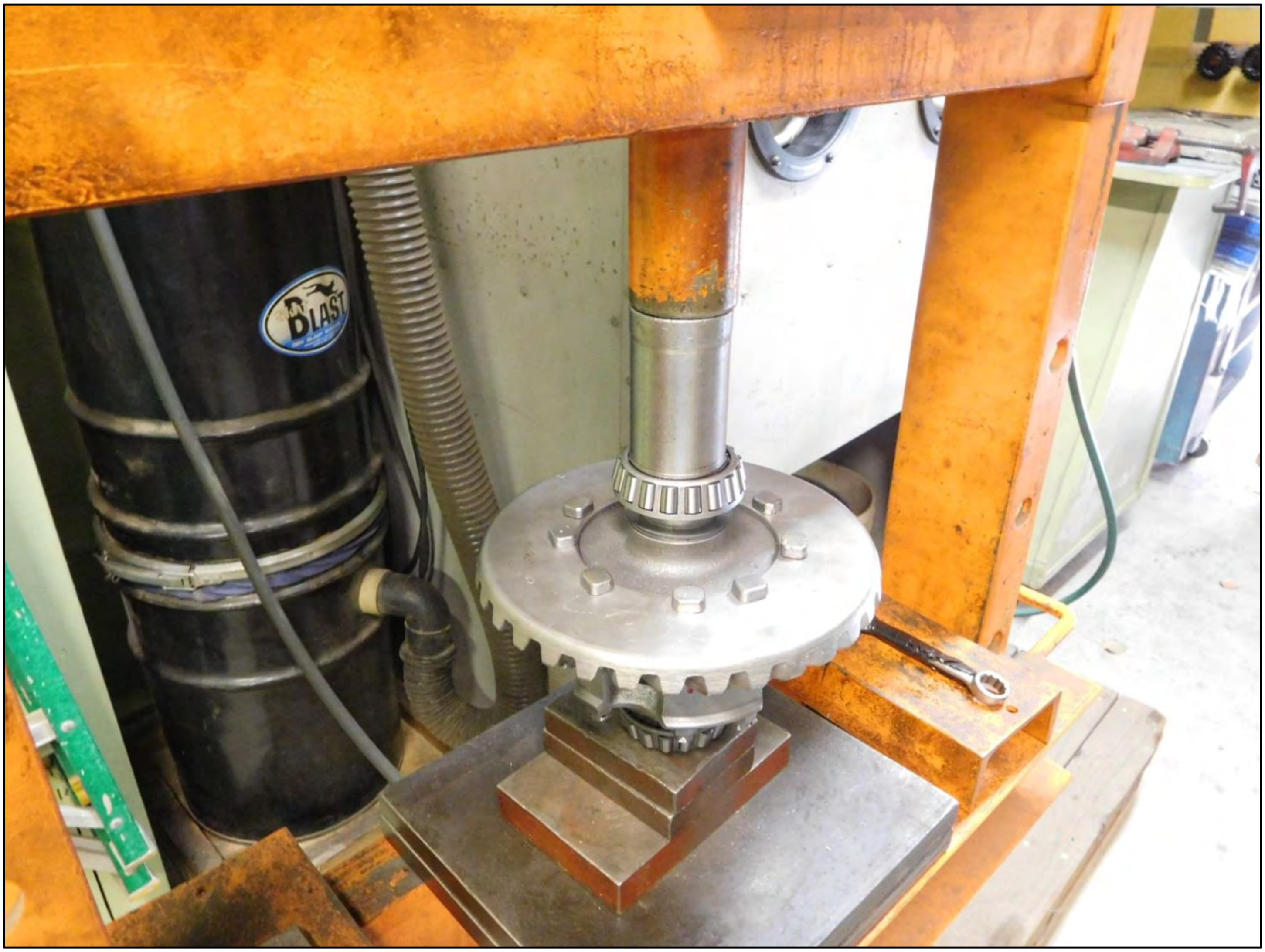
An original pinion gear will have a number stamped into the end of the gear. In this case the number is 436. During factory assembly it was common practice for a worker to use an etching tool to inscribe the same number on the flat side of the ring gear.

Shown here is the flat side of the ring gear that shows the corresponding inscribed number 436 that is stamped on the pinion gear.

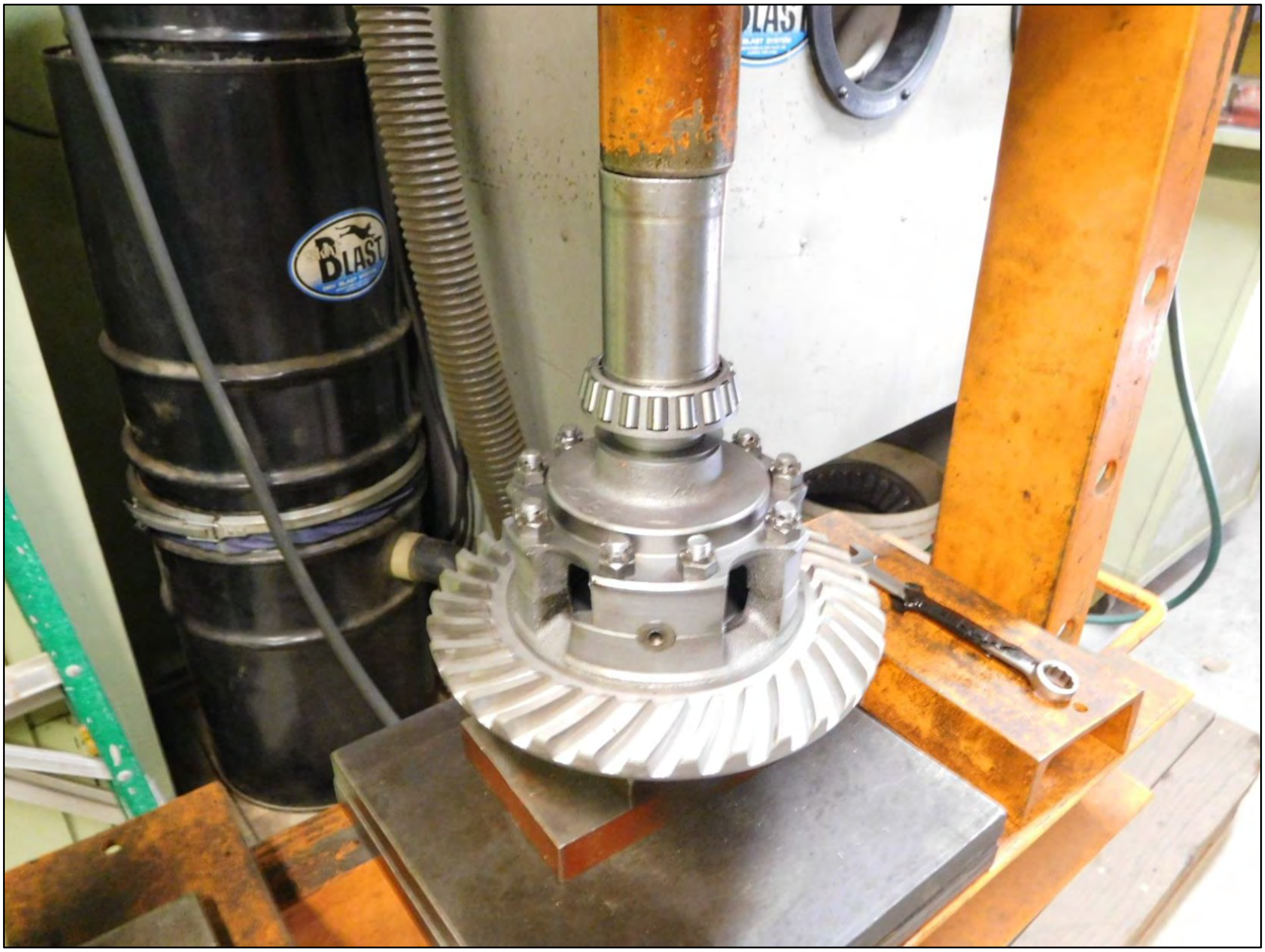
Shown here are all the components necessary to assemble the carrier. A replacement carrier that has had the hubs knurled will be used. Shims will be required to replace material that was machined off the bearing stops when the knurling was done. The nine carrier bolts have been bead blasted and wire wheeled. The carrier bolts removed from the project were replaced because they were found to be the earlier carrier bolts that are not compatible with the later carrier seen here.

The modified three legged spider gear yoke seen here is a tool that will be installed temporarily to facilitate setting the carrier bearing pre-load.

The two carrier bearings will be pressed onto the carrier hubs that have been knurled. The reason for the shims is because pre-determined material was machined off the carrier bearing stops during the knurling procedure in order to true them up.



A carrier bearing is being pressed onto the knurled hub on the ring gear side of the carrier. Shims have been added below the bearing.



A carrier bearing is being pressed onto the knurled hub on the side opposite the ring gear side of the carrier. Shims have been added below the bearing.

Shown here is the carrier fully assembled with new bearings installed and the pre-load tool mounted inside. The nine nuts were torqued to 35 ft. lbs. The carrier will later be taken apart to remove the pre-load tool and to install the spider gears and both axle shafts for final assembly.

A new bearing has been installed on the pinion gear. A second bearing will be installed when the pinion gear is installed into the banjo.

The banjo has been degreased and bead blasted. The old bearing race has been removed and shown here is a new bearing race being pressed into place.

Note how the banjo is placed on the press. You never should place a banjo on a press with the bottom of the banjo resting on the press platform. The force of the press will distort the banjo into the shape of a football.

Shown here is the banjo with a new pinion bearing race pressed into place.

Both axle housings have been removed and both grease seals have been removed. The grease seals were found to be the originals installed by Henry Ford. The original seals were made of leather and were found to be fully deteriorated. Both axle housings are extremely cruddy and will undergo a thorough cleaning before proceeding with the overhaul process.

Both shackle bushing were found to be excessively worn and were removed. Half of each bushing was worn away. New bushings will be installed

Both axle housings were found to have the seams on the bottom. During 1929 only, Ford had a supplier that provided a limited number of axle housings with the seams on the bottom. They are thought to be somewhat of a rarity.

Shown here are the two removed axle housing grease seals. They are the originals installed at the factory in 1929. The seals used in those days were made of leather. The letters CR stamped on the seals stands for Chicago Rawhide. The leather portion of the seals disappeared years ago.

Both axle housings have been de-greased and cleaned up. They were extremely cruddy on the inside and required extensive cleaning. The outside of both housings have been sanded with an orbital sander. New carrier bearing races were installed, along with new grease seals.

Left-right markers have been fixed to the three housings to aid the overhaul process as the housings will be assembled and taken apart a number of times in the effort to establish the pre-loads and backlash.

New shackle bushings were installed in both housings. The shackle bosses in both housing have been damaged as the original bushings had worn through. The new bushings, however, pressed in tight and will be adequately serviceable.

After a series of trial and error installations of banjo gaskets the carrier bearing pre-load is checked with a dial indicator inch pound torque wrench. Shown here is Bryan making the check. As the wrench is turned it will turn the carrier through a threaded shaft screwed into the modified spider yoke attached to the carrier. The reading is read from the dial on the torque wrench. The target value is 20 inch pounds; however, my window of acceptance is anything between 14 and 22.

Once the carrier pre-load is established by the selection of a quantity of banjo gaskets, the housings are disassembled and set aside. The banjo is then clamped in a wood vice and the pinion gear assembly is installed and the pre-load on those bearings is established.

The quantity of banjo gaskets will later be distributed to the left and right sides of the banjo to establish the proper backlash.

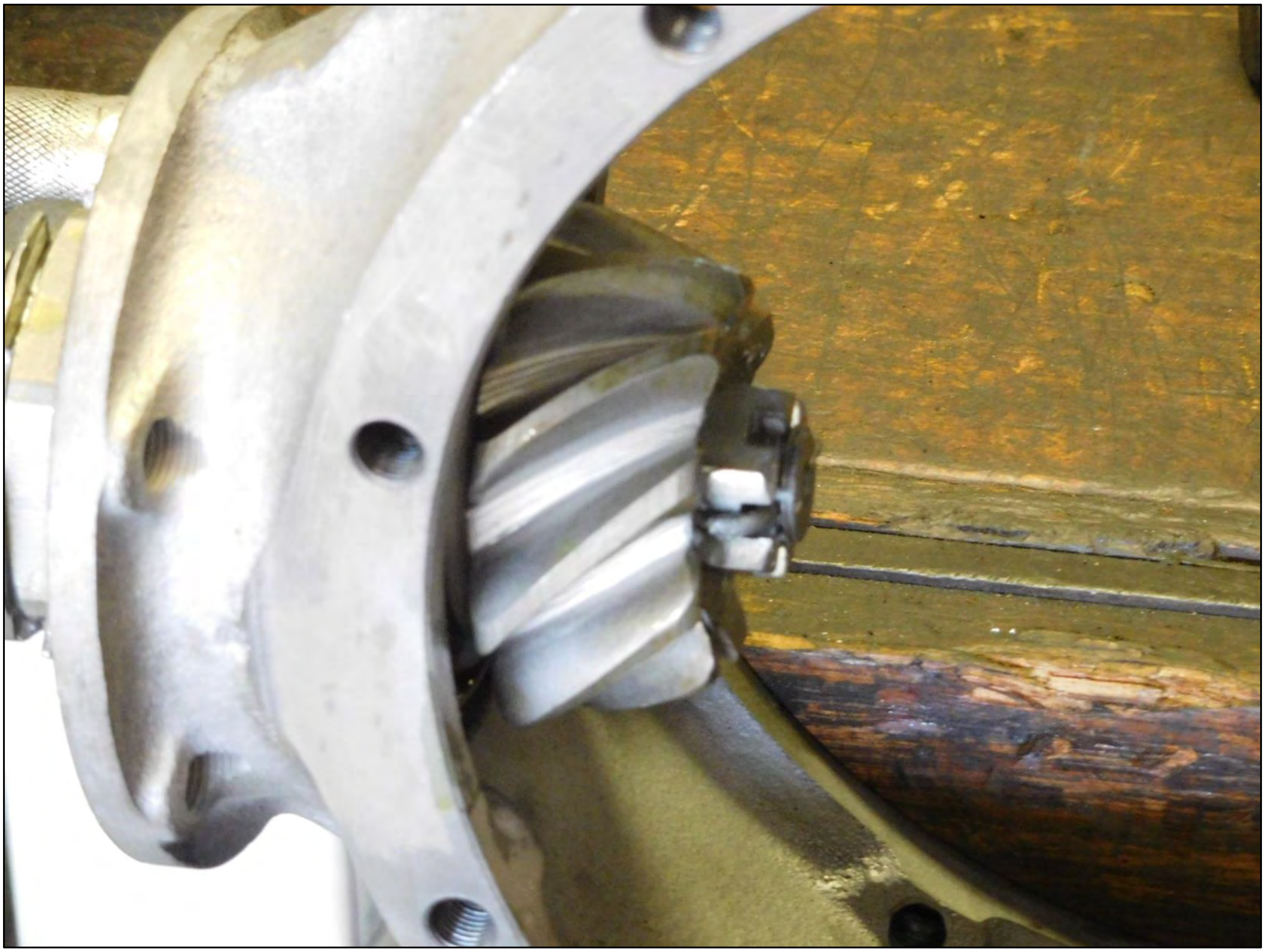
The two large pinion nuts require the use of two large pinion nut wrenches to do the job of establishing the pinion bearing pre-load and securing the two nuts tight against each other. Quite often during a rear axle assembly overhaul it is found that the previous era mechanic tightened the nuts with a hammer and chisel due to the absence of the correct pinion nut wrenches. Not a recommended proceedure.

Shown here are two Ford factory wrenches used on the two large pinion assembly nuts to establish pinion bearing pre-load and to tighten the two nuts tight against each other.

The Mithcell stub shaft, which is part of the Mitchell overdrive, is shown here insatalled in the pinion assembly. Once the stub shaft nut has been torqued to a nominal 100 ft. lbs. the pinion bearing pre-load is established by the adjustment of the two large nuts that are part of the pinon gear assembly. The first nut esablishes the pre-load, the second nut locks the first in place. This is not a straight foraward proceedure as the tightening of the second nut will often over-tighten the pre-load. The end objective is to have the pre-load correct and the two nuts extrememly tight against each other. The Ford service bullitens say to use a hammer against the Ford factory wrench for the final tightening.

The target pre-loead value is 20 inch pounds, the same as the carrier bearing pre-load; my acceptable window is between 14 and 22.

A Mitchell stub shaft comes in three lengths depending on the type of car the overdrive is going into. The standard for most cars is 20.5 inches long. The Victoria, A-400, and 31 two door phaeton stub shaft is 4.5 inches longer than standard. The 31 slant window town sedan stub shaft is several inches shorter than standard.



The nut on the end the Mitchell stub shaft is torqued to a nominal 100 foot pounds before the preload on the pinion bearings is established. A cotter pin is inserted into the end of the stub shaft and the legs are bent down the side of the nut. Never bend them over the end of the shaft as they can conflict with the rotating carrier.

Shown here is Bryan checking the pinion bearing preload with an inch pound dial indicator torque wrench. The stub shaft is rotated by the torque wrench and the reading is taken off the dial on the torque wrench. The target value is 20 inch pounds; my acceptable window is between 14 and 22.

Shown here are the two axle shafts after they had been cleaned up. The threads were inspected and found to be in excellent condition. The locking key slot was inspected for cracks and none were found. Both axles are in excellent serviceable condition.

The carrier has been taken apart and the pre-load tool removed. Shown here is one of the axle shafts installed in the left carrier half. The spider gear assembly has been installed. The right carrier half will be installed, along with the other axle shaft, over the extended carrier bolts. The two carrier halves will be lined up with the red reference marks that were applied when the carrier was initially disassembled.

The carrier has been fully assembled with both axles and is shown here with the nine carrier bolts being torqued to 35 ft. lbs. To facilitate the torqueing the carrier is held in place with a large screwdriver placed into an opening in the side of the carrier.

Once the nine bolts have been torqued they are secured with safety wire. Shown here is my trademark style of safety wiring in a perfect circle.

The carrier assembly has been inserted down into the right axle housing. The pre-determined banjo gaskets were previously installed on the right side. Seen here are the banjo gaskets for the left side. They have been coated with sealer and are ready for the left axle housing to be installed down over the 10 alignment studs screwed into the left side of the banjo.

The sealer used is Indian head gasket sealer.

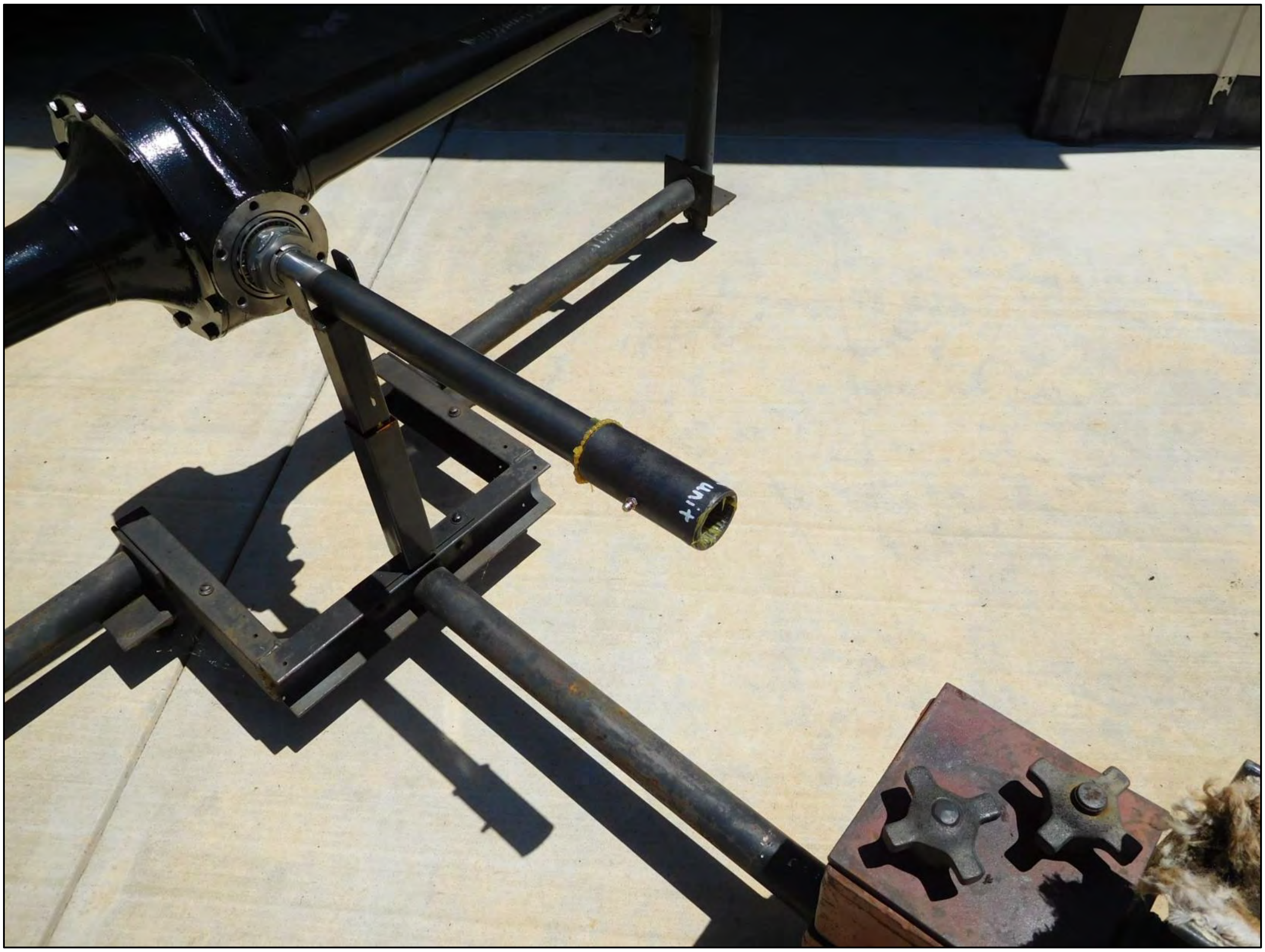
The left axle housing has been placed down over the ten alignment studs screwed into the left side of the banjo.

The ten axle housing bolts have been installed and torqued to 35 ft. lbs.

The assembly of the rear axle assembly is complete and it has been moved back into the roll around cradle. The next step is to mask off the machined surfaces and paint it with black enamel.

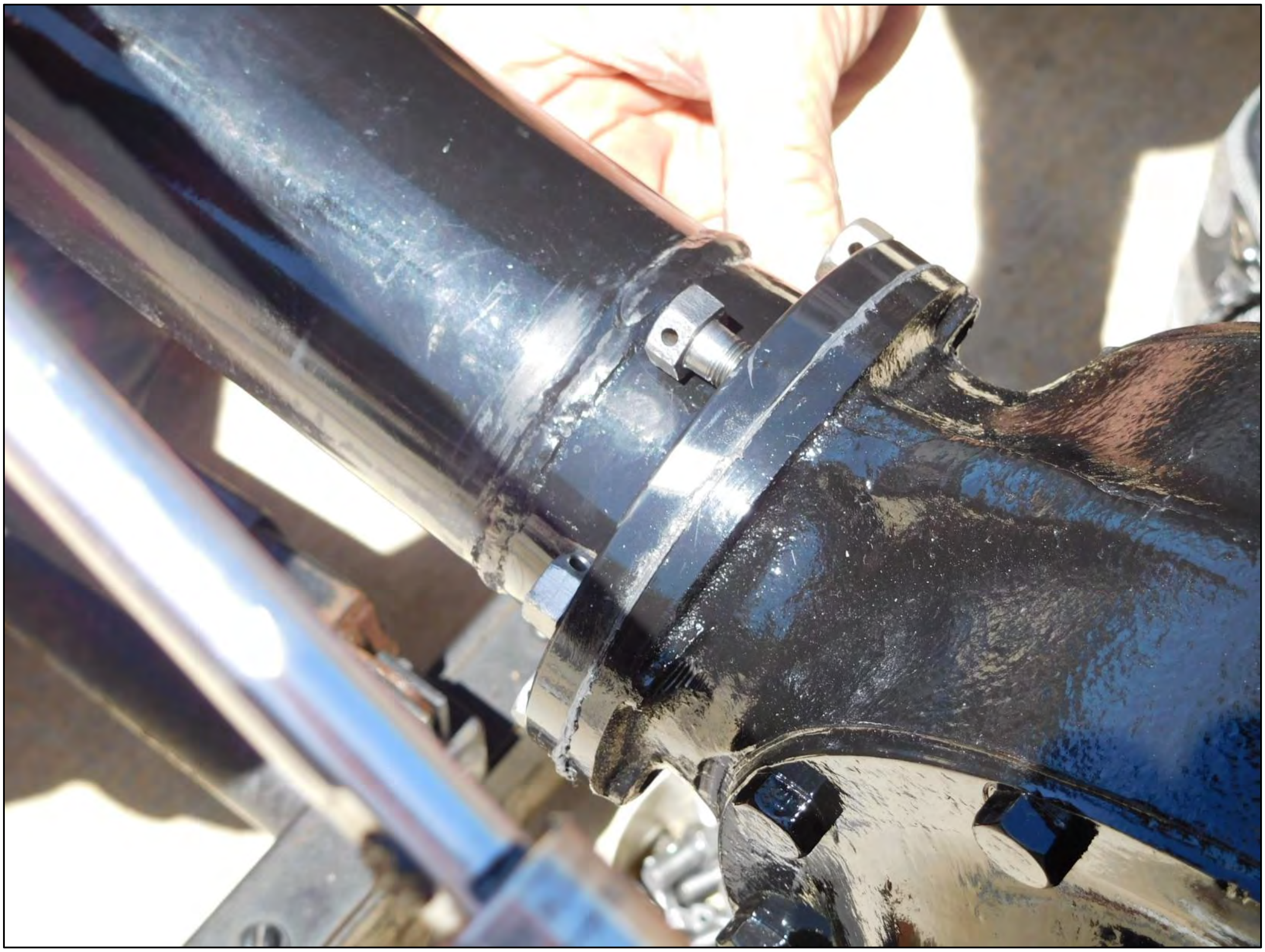
The rear axle assembly has been painted and it will be stored away awaiting the delivery of the Mitchell overdrive. When it arrives, it is an easy task to slide the overdrive on over the stub shaft and install the six securing bolts to the banjo flange.

The overdrive has arrived and grandson Ben is unpacking it.



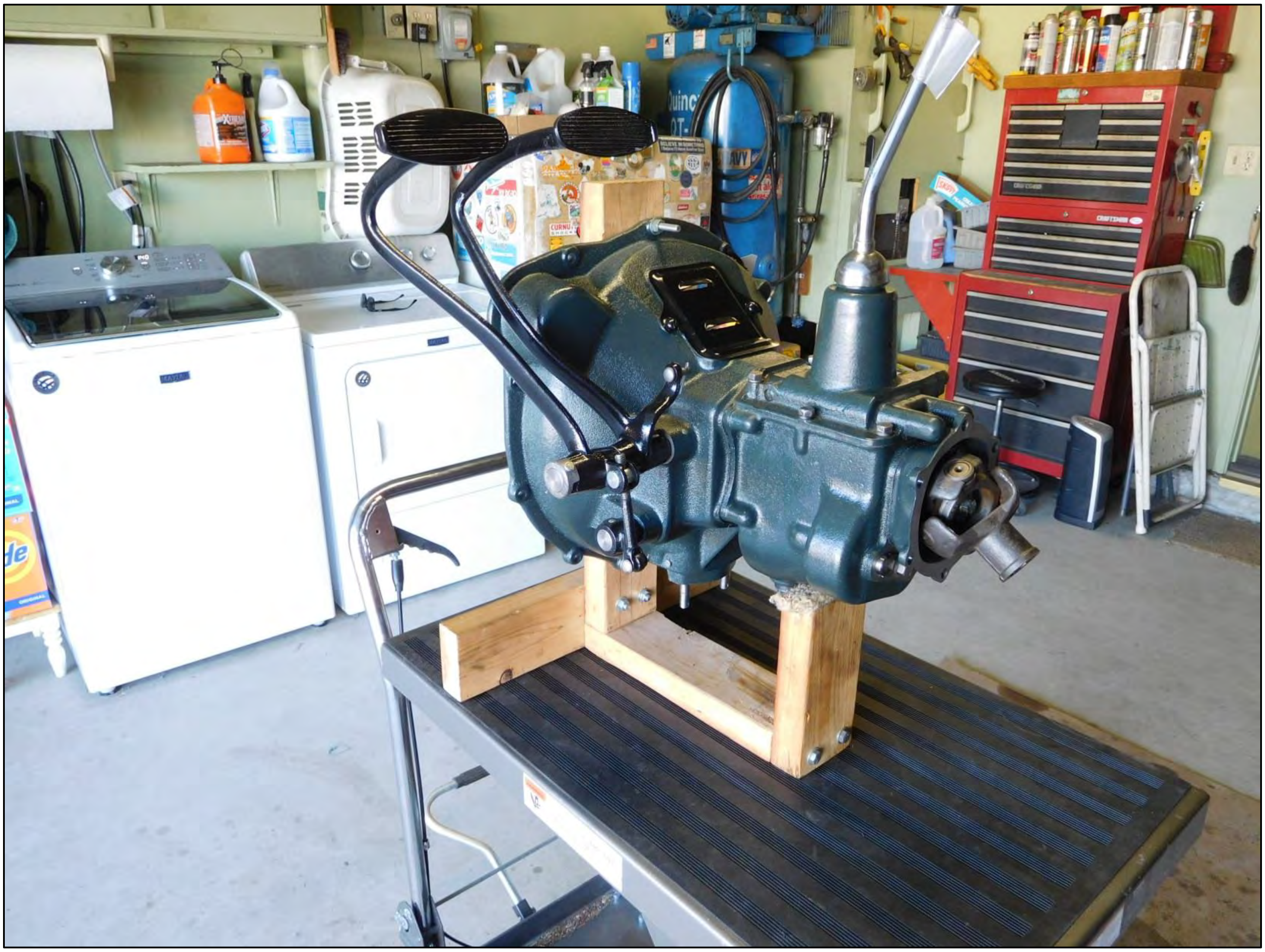
The spline coupler has been greased and installed on the stub shaft. The other end of the coupler will slide onto a mating shaft inside the overdrive.

Ben and Bryan have installed the overdrive onto the rear axle assembly.



The six mounting bolts secure the overdrive to the banjo and are safety wired.

The overdrive and the rear axle assembly are fully assembled and the unit is ready for installation into the car.



The transmission and bell housing were also overhauled.

The bell housing was degreased, bead blasted and painted. The clutch shaft and pedal shaft were replaced. New bushings were installed.

The transmission housing was degreased, bead blasted, and painted. The gears were found to be in good condition and were degreased and bead blasted. The input shaft was found to have a deep groove worn into the nose where it inserts into the flywheel bearing. The shaft was exchanged for one that has had the nose machined and a sleeve pressed on. All five bearings were replaced with new; the two ball bearings incorporate oil seals. The cluster shaft and the reverse idler shaft were replaced with new that are modified with O-rings for oil control. A new throw-out beating was installed.

Both pedals were bead blasted and painted. New bushings were installed. A new trunnion nut was installed in the clutch pedal.

The tower was previously restored at a club seminar.

The U-joint housing assembly has been bead blasted and painted and is ready for installation.