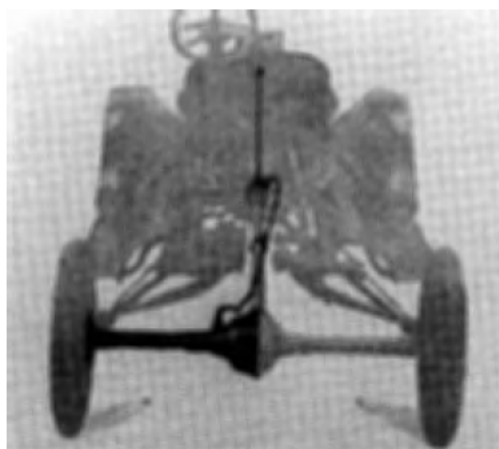


The **RUCKSTELL**

Axle

AND A GUIDE TO MODEL T FORD REAR AXLE SERVICE

By Bruce McCalley



"The Ruckstell two-speed axle unit is a sliding planetary gear built up with the differential assembly. It gives regular Ford axle speed or a 50% reduction functioning back of the ring gear. This device is noiseless, it operates in oil and leaves the road clearance unchanged.

"When running in Ford speeds, Ruckstell gears are locked and do not operate; this means no loss of power through driving auxillary shafts or gears, or wear on Ruckstell parts.

"Its installation as an integral part of the Ford car makes the Ford **The Only Light Car With Four Forward Speeds.**"

. *From the Ruckstell Installation Manual*

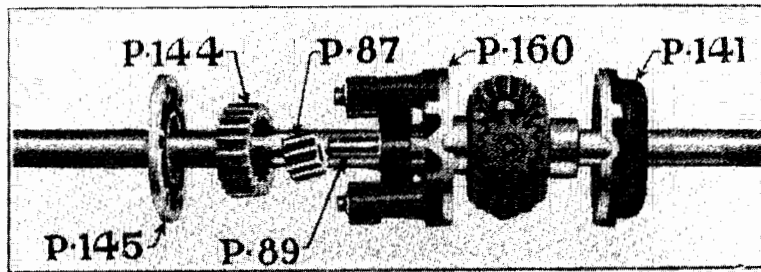
GEAR RATIOS

WITH STANDARD FORD GEARS

High	3.6 to 1
Low-High	5.5 to 1
Low	10 to 1
Low-Low	15.4 to 1
Ford Reverse	14.5 to 1
Low Reverse	22.3 to 1

WITH SPECIAL 3 — 1 OVERDRIVE GEARS

High	3 to 1
Low-High	4.6 to 1
Low	8.2 to 1
Low-Low	12.7 to 1
Ford Reverse	12 to 1
Low Reverse	18.5 to 1



ASSEMBLY INSTRUCTIONS FOR THE RUCKSTELL AXLE

(From an original manual)

IN ASSEMBLING THE RESPECTIVE PARTS, ONE WITH THE OTHER, APPLY FREELY A HEAVY MOTOR OIL TO ALL GEARS, SHAFTS AND BEARING SURFACES. THIS CANNOT BE ACCOMPLISHED AFTER THE AXLE HOUSING HAS BEEN BOLTED TOGETHER. THIS ASSURES IMMEDIATE LUBRICATION DURING INITIAL OPERATION.

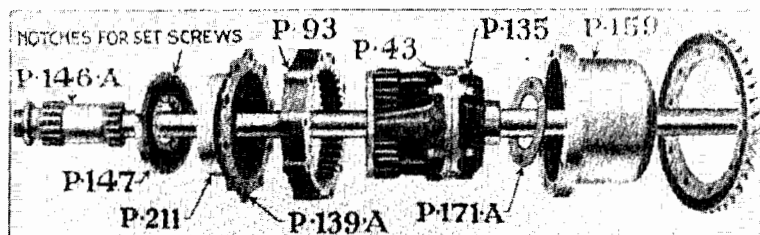
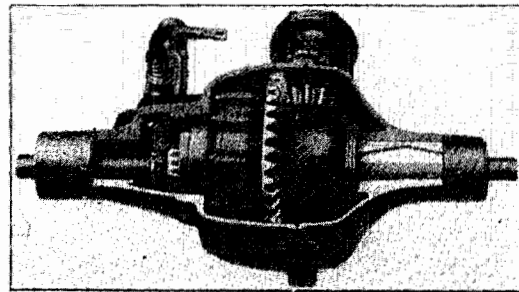
Arrange the center unit parts and assemble them on the Ford master [ring] gear as shown in the accompanying illustrations. Place the fibre differential thrust washer in the right-hand master support.¹ The washer will retain its position if smeared with a little cup grease. Do not use Ford steel washer No. 2529 instead of the fibre washer.²

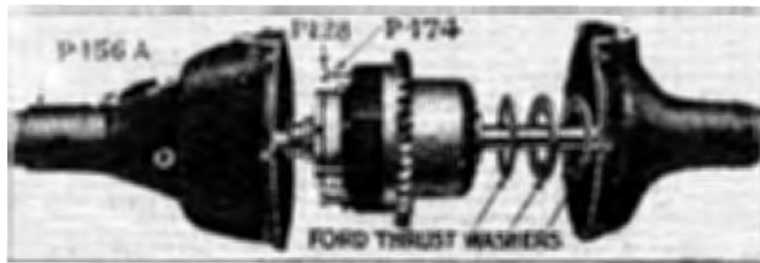
Washers are provided and should be placed under the heads of the master gear cap screws.³ Set all the screws down to a seventy-pound pull, using an eight-inch socket wrench. This is a hard pull for the average man. *Note: The Ruckstell manual says a seventy-pound pull on an eight-inch wrench. This IS NOT seventy foot/pounds on a torque wrench! IF YOU USE A TORQUE WRENCH, TIGHTEN THESE BOLTS TO ABOUT 30 to 35 FOOT/POUNDS.* After they have been pulled up tight, tap them firmly on their heads and then pull them down evenly again. Lock them with No. 18 iron lock wire. THERE IS NO NEED FOR FEAR OF BREAKING THESE CAP SCREWS, as they are made of a special alloy steel, heat treated, and will withstand a great strain.

The use of cap screws other than those furnished with the axle will result in breakage or other trouble.⁴ We cannot be responsible for damage or service claims if the instructions herein are not rigidly followed.

The Ford thrust washers should be placed over the pins on the outside of the master gear support [P159] and Ford axle housing. Mesh the sliding clutch gear [P146A] with the center gear [P144] and press it in toward the center of the axle unit as far as it will go. This cannot be done after the axle housings are in place, and in the absence of the proper setting the shift lock cannot be attached. Slip on the axle housings, lining up the notches in the clutch plate [P147] with the holes for the set screws in the axle housing [P156A]. The set screws should enter both notches.⁵

Attach the shift lock assembly using the cap screws and lock washers. Insert the gear clutch plate screws.





With the axle housings securely bolted together, tighten the set screws and lock them with the 7/16" SAE nuts. Lubricate the shift lock thoroughly with heavy oil before attaching.

Assemble the shift tube halves with the shift tube coupling by means of the headless rivets furnished.⁶ Attach the shift tube assembly using the clevis pins and cotter pins.

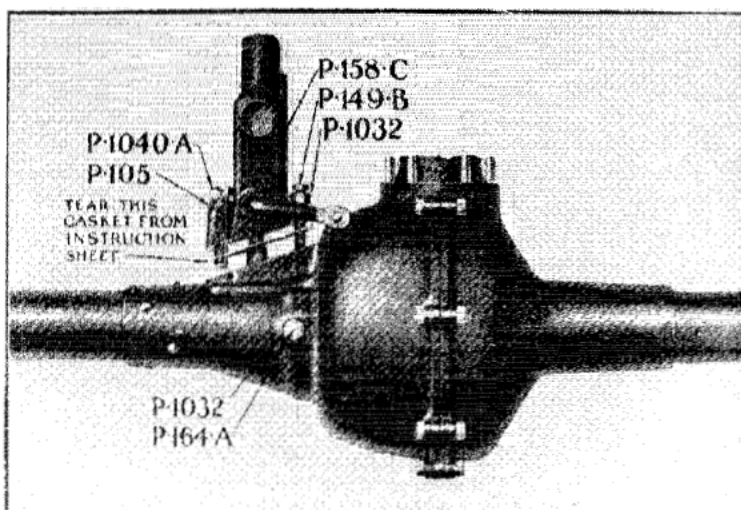
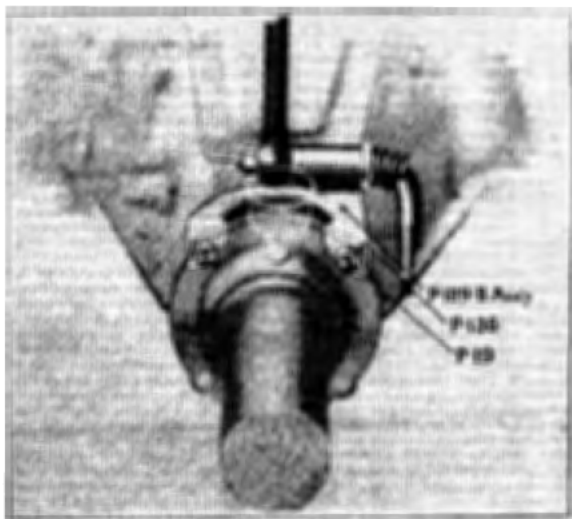
Assemble the shift tube as shown so that it will clear the battery box and gas tank drain. The shift tube

support assembly should be installed about midway so it will shift freely without binding.

The shift lever assembly should be mounted with the shift lever on the LEFT side of the shift lever bracket.

NOTES

1. Note that this washer is fibre. The use of fibre allowed some compression during operation which would make up for differences in manufacturing. The proper fit between the inner and outer housings allowed easy rotation of either part, without any binding.
2. The Ford washer will give satisfactory service if care is taken in fitting. Usually the Ford washer is too thin, allowing end play, but shims can be made and installed between the washer and the inner housing [P135] until any end play is eliminated.
3. These are flat steel washers and are very necessary. Do not use lock washers in their place.
4. Most of the modern bolts being offered are as good as or better than the originals. They can be broken if one uses a big enough wrench. This is why the manufacturer specified an eight-inch wrench. No normal man could break them with the small wrench but anyone can if he applies seventy pounds of pull to a long wrench.
5. Be sure that *both* notches line up. It is next to impossible to rotate this plate once the axle is together and the safety of the car is dependent upon this plate being held firmly. Should only one bolt enter a notch, and then later shear off, you will have no brakes nor driving ability. With both bolts in place, shearing is not likely to ever be a problem.
6. The shift tube was originally supplied in two pieces because it was easier to ship that way. A satisfactory replacement can easily be made from thinwall electrical conduit, available at any electrical supply outlet.



Several years ago [*The Vintage Ford*, Volume 6, Number 1 (1971)] an article on the Ruckstell and rear axle service, similar to the one that appears here, was presented. The supply of back copies of that issue was quickly exhausted, prompting the author to have the article reprinted. The reprints were in turn sold out, yet the demand remains. This article is an updated and improved version of the original.

While we will be dealing primarily with the Ruckstell axle, much of the material will apply to the standard Ford axle as well. Where differences occur we will point them out.

In order to simplify our approach, let us break the rear axle assembly into its four major sections. These are:

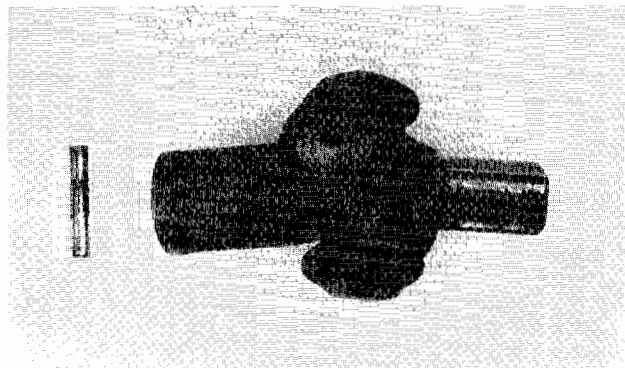
- (1) The drive shaft assembly
- (2) The Right half of the axle housing
- (3) The Left half, which differs from the Right when the Ruckstell is installed
- (4) The differential gear/rear axle assembly.

1.

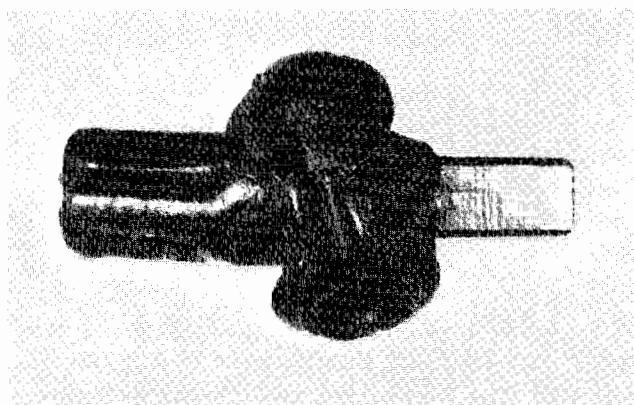
The drive shaft assembly is relatively simple when overhauling the rear axle assembly, though, we cannot overlook its importance.

Beginning at the front we have the universal joint which is riveted in place on the drive shaft. The U-joint may be removed by removing the two screw plugs just to the rear of the ball-shaped housing. Turn the shaft until the rivet head can be seen and drill out the center of the rivet head with a quarter-inch drill. It is necessary to drill only about an eighth-inch deep; just enough to weaken the rivet head. The rivet may then be punched out with a drift punch or a press and the U-joint removed.

Examine the U-joint for excessive wear and for loose rivets. A small amount of play in the bearings seems to have little effect; ideally there should be none. If the rivets are loose, and the wear in the bearings is not excessive, they may be peened until tight. If these rivets have been loose for some time and are well worn in their holes, it is better to replace the U-joint (or the rivets) than attempting to just peen them tight. Once the rivets and/or holes are worn, they will not remain tight



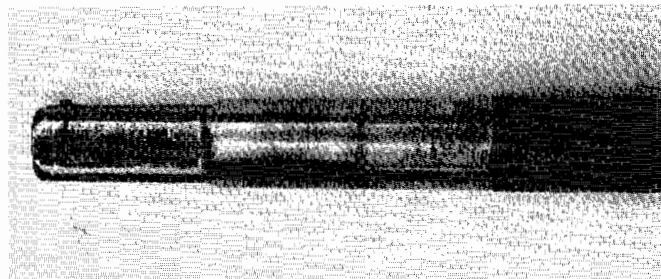
The universal joint should be checked for tightness not only in the bearings but also in the rivets which hold the two halves together. The pin is used to rivet the universal to the drive shaft.



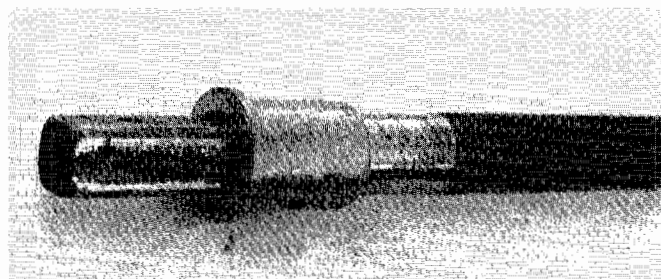
How bad can a U-joint get? This one is worn so that about one-eighth of a turn is required to make up for the play. This might be considered excessive.

for very long, peened or not. Failure to have the assembly tight will result in fatigue of the parts and their eventual breakage.

Just behind the U-joint, pressed into the drive shaft housing, is a small babbitt bearing. Its purpose is to support the front end of the drive shaft and center the U-joint. With the shaft in place and the U-joint removed, check for wear by forcing the shaft from side to side in all directions. If any play is felt the bearing must be replaced. It may be removed by driving it out with a length of water pipe inserted from the pinion (rear) end. New bearings are available and, after thoroughly cleaning the area, may be easily pressed into place. Be



The bearing surface just to the rear of the universal joint should be smooth and free from pits and notches. The minor discoloration shown here is considered useable.



The babbitt bearing located inside the drive shaft housing just behind the U-joint should be a smooth but not tight fit on the drive shaft. Allow for a little shrinkage after the bearing is pressed into place.



sure to check the fit before installing. Ream it to size first and then after it is in place ream it again since there will always be some shrinkage.

Clean the drive shaft pinion and bearing thoroughly and reassemble the pinion bearing and outer bearing housing and check for any wear or play. The bearing should turn freely and not have any side play. Any looseness here will make it impossible to properly fit the ring and pinion gear mesh and will result in gear noise under operation. The importance of a snug pinion bearing cannot be overstressed. There are probably more noisy Ford rear ends caused by this bearing than from any other source.

Wear is usually in the inner sleeve and roller bearing but also can occur in the outer sleeve. The inner sleeve [No. 2596] can be removed by pulling the pinion gear. When reassembling, be sure to get the pinion-retaining nut tight! And don't forget the cotter pin.

Check the thrust bearing for smoothness, pitting and wear. If faulty, find a new one.

A number of firms are now supplying a modified bearing assembly for replacement use which uses modern bearings. In view of the present difficulty in finding good replacement parts, these units might be a wise investment.

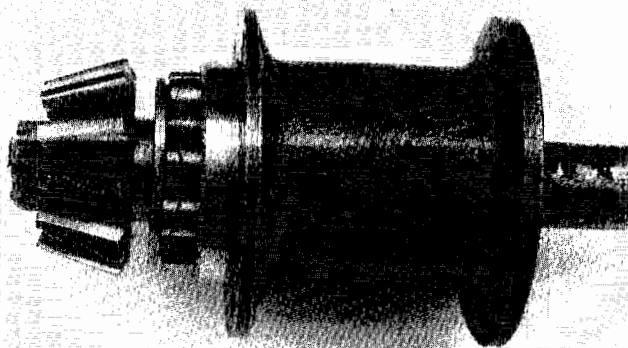
When reassembling the drive shaft assembly, a little end play is permissible. Under load the pinion is forced forward against the thrust bearing and this determines its operating position. Ideally, there should be no end play in the assembly.

A new rivet pin will be needed to secure the U-joint to the drive shaft. If you have no handy supply of these pins, the shank of a 5/16" *rolled-thread* bolt is about the correct diameter. Be sure to use some sort of bucking bar while peening the rivet to prevent damage to the babbitt bearing and to get the rivet tight.

2.

The Right half of the axle housing should be thoroughly cleaned, inside and out, before anything but minor repairs are attempted. (If the standard Ford rear end is being serviced, what applies to the Right half will also apply to the Left half).

The pinion gear, pinion bearing, thrust bearing and inner pinion bearing sleeve should be examined for wear and pitting. With the outer sleeve in place there should be no play, and both the pinion bearing and thrust bearing must operate freely and smoothly. Worn parts in this assembly can cause more axle noise than in any other part of the rear axle assembly. The pinion gear retaining nut must be very tight and cotter pinned.

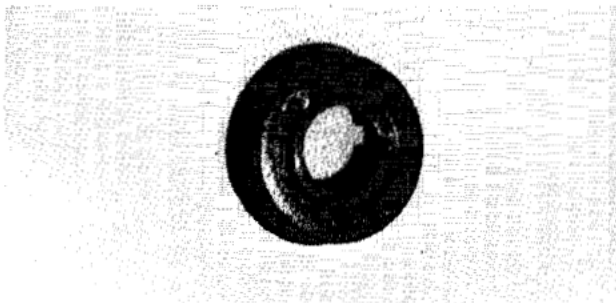


Remove the oil felt retainer at the outer end and remove the outer wheel bearing. Check the bearing sleeve in the housing for wear, especially at the top. If the car has had much use there will be a notch worn at the top and the sleeve should be pulled and replaced. It has been my experience that the modern sleeves are not as hard as the original ones and will therefore not wear as well. There are two sleeves in each half of the standard Ford housings (only one in the Ruckstell half if the car is so equipped) and these sleeves come in rights and lefts, one of each on each side. Usually the inner sleeves show little wear, if any, and I have made it a practice to use the older inner sleeves at the wheels and using the replacement sleeves for the inner bearings.

All sleeves can be easily removed with the simple tool shown in the illustration. This tool is inserted into the sleeve so that the retractable pin engages the hole in



Homemade axle bearing sleeve puller made from a length of exhaust pipe. The end pin is riveted to a strip of metal which in turn is held to the tubing with the bolt and nut. The metal strip will flex, allowing the pin to retract so that the tool can be inserted in the sleeve and the pin engaged in the hole in the sleeve. The strip must be long enough so that the nut and bolt will fall outside the axle housing. By putting a short bar through the holes in the outer end, the tool can be turned and the sleeve easily withdrawn from the axle housing.



Worn oil seal retaining cups are caused by a number of things: worn axle-tapers and/or hubs; worn thrust bearings in the differential; worn (or missing) fibre thrust washer between the axle ends; or merely that the cup was not pushed on far enough, or that it was loose.

the sleeve. Twisting the tool in the direction which tends to collapse the sleeve (the direction towards the slot in the sleeve) will allow easy withdrawal.

When installing the sleeves be sure the oil holes line up with the grease fittings at the wheel ends and that the dimple in the sleeve engages the hole in the housing. Remember that the sleeves come in pairs and are not interchangeable.

Be sure to clean out all old grease and dirt from the area before replacing the sleeves.

A number of newer oil seals are available for the outer bearings; now is the time to install them. The felt-retaining cups usually become worn in the center. This is caused by wear in the wheel hub, wear on the axle taper, or wear on the differential thrust washers — or any combination of the above. There is little use in installing new cups unless the cause of the problem is located. Axle shims can be used to take up wear in the hub or taper. Wear in the thrust washers will be covered later. More than one axle shim may be used if necessary.

3.

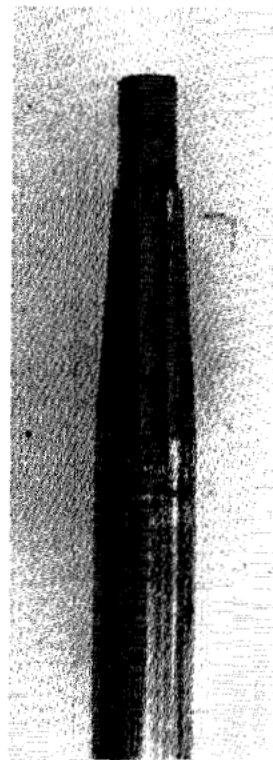
The Left half is similar to the Right. In the Ruckstell axle there is no inner bearing and sleeve; the large ball bearing on the Ruckstell carrier takes its place. Aside from cleaning the ball bearing retaining surface, service is the same as the Left half.

4.

The differential gear/axle assembly. The following will apply to the Ruckstell axle; standard Ford procedure will be similar but the information pertaining to the Ruckstell parts can be ignored.

Disassemble the entire assembly and clean all parts thoroughly. Check both axles for wear at the bearing surfaces and on the tapered end, good threads where the axle nut goes, and make sure that the gear is tight on the shaft. Examine the keyway for any signs of cracking. If fault is found in any of these areas, replace the axle.

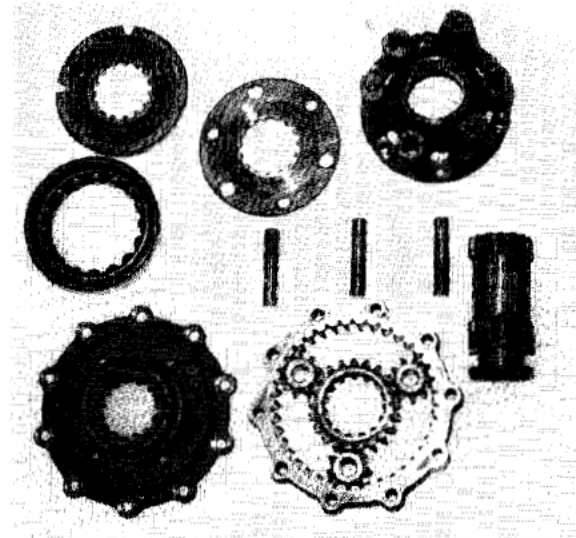
Individual parts of the Ruckstell assembly must be examined. Since no replacements are available except by salvaging old parts, one must allow a great deal of tolerance before rejecting anything.⁷ Fortunately, great



The axle should be examined for good threads on the end, wear on the taper, a good keyway, and a bearing surface that is free of grooves, deep pits and wear. The axle gear must be tight.

tolerances are allowable. Obvious things like broken parts, badly worn gears, etc. need not be covered here. The following items are important.

The large ball bearing must be clean and smooth-running. If any pits or roughness can be detected, a new bearing should be installed. These bearings are still



Individual Ruckstell parts. All should be inspected for excessive wear or other flaws (see text).

7. Aside from the ring gear retaining bolts and the large ball bearing, we know of no source of replacement parts for the Ruckstell axle.

available through large bearing supply houses. (Be sure to get a bearing designed to take side thrust as well as radial forces.)

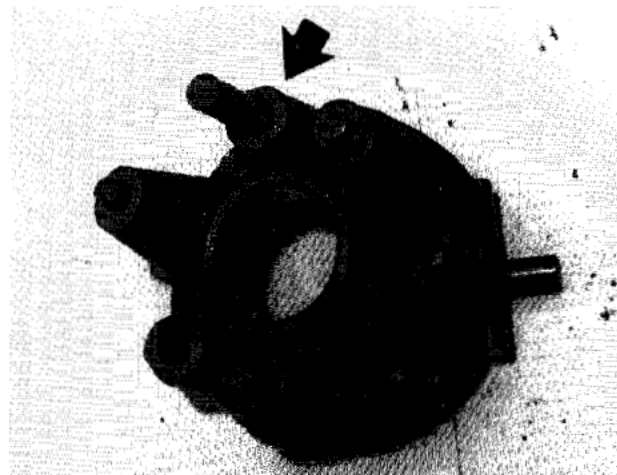
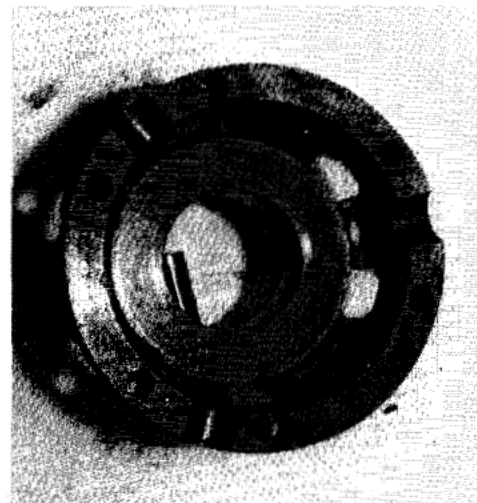
The bronze plate should be a tight fit in the inner ball bearing race. If the fit is loose it must be repaired. The inside surface of this plate acts as the thrust bearing surface for the steel plate P145. Normally little wear occurs here but if worn the center carrier will shift making the left axle appear longer than the right when the whole assembly is installed in the axle housings. If, after a trial assembly, this situation occurs, small washers can be added over the three locating pins on P160 to space P145 outward. If the wear is more than just a few thousandths (say up to .020) the bronze plate should be replaced or repaired.

Carrier half P160 causes more worry than it should. Almost every sample will show wear in the holes where the pinion pins P89 fit. When the unit was new these pins were an easy fit but after a few miles of low-gear driving they wore badly. Many miles of Ruckstell driving has pretty well proven that a tremendous amount of slop is permissible here with no ill effects. No attempt should be made to shim the holes. If wear is such that the gears almost fall out, a machine shop could no doubt fill and re-drill the holes. If this is done, the pins should still be a loose fit (similar to the fit in P145).⁸

P141 should be examined for wear around the hole through which the axle gear rides. This should have little play. More than a few thousandths clearance here will result in misalignment of the planetary gear assembly.

Sun gear P144, planet gears P87, and ring gear P93 need little comment. When the pins mentioned above are loose, the planet gears will wear some. Repairing the pin holes in P160 will generally cause one of the planet gears to take all the load until the hole, gear and pin wear enough to allow another of the planet gears to take some of the load. This process will continue until the third gear engages and by now you are back where you were when you discovered the wear in the first place. Unless you can get new gears, pins, and have the holes filled and drilled you might just as well use the old parts as is.⁹

Outer housing P159 should be checked for wear around the axle gear. This must have a close fit because

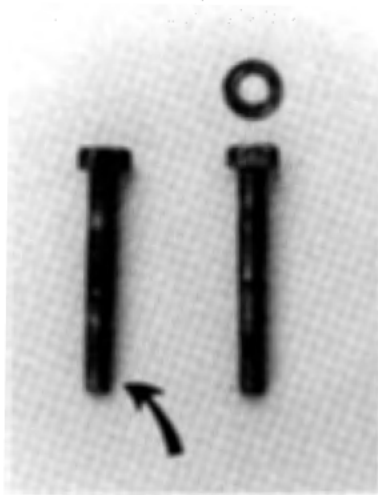


Gear support [P160] generally shows the most wear. The holes which support the pinion pins generally wear as shown in the lower picture. This wear seems inevitable; the amount shown is not considered excessive, although much less would be desirable.

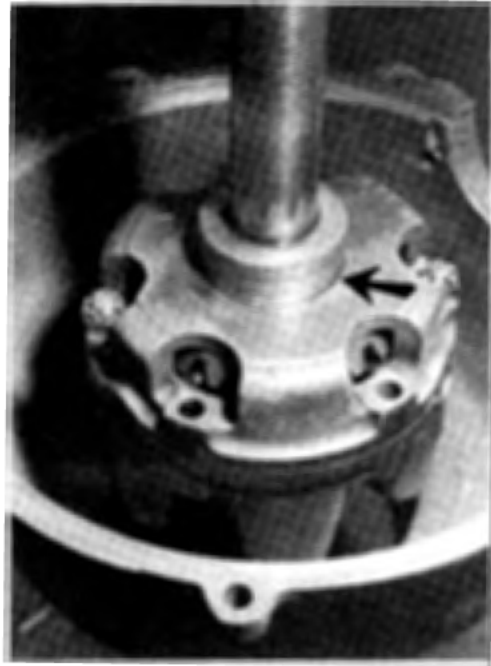
8. The great majority of running failures in the Ruckstell axle have been due to seizure of the planetary gears on the pins. Attempts to use oversize pins, resulting in seemingly ideal clearances (say .002-inch) usually result in poor lubrication between the gears and the pins. We have yet to see a failure caused by *too much* clearance.

9. A little time spent in selecting the "best" location for each gear/pin assembly might be worthwhile. By assembling the components and checking the mesh of each of the three planetary gears, one might be able to find the best combination of gear locations by swapping the

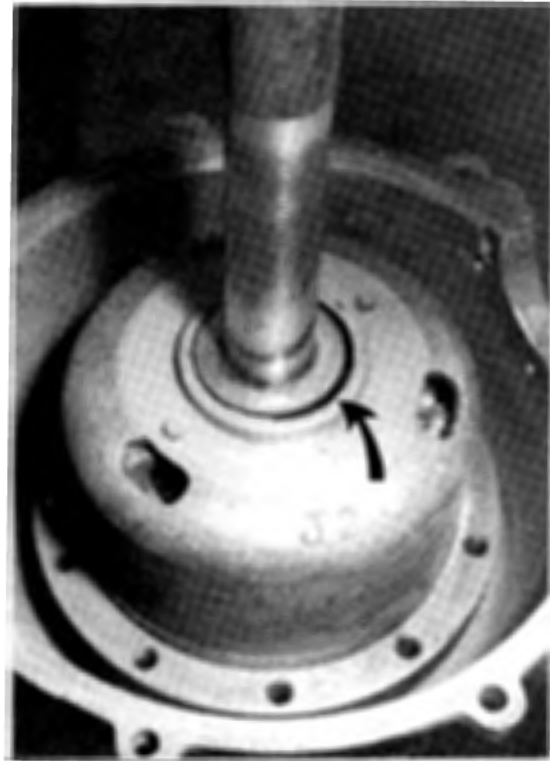
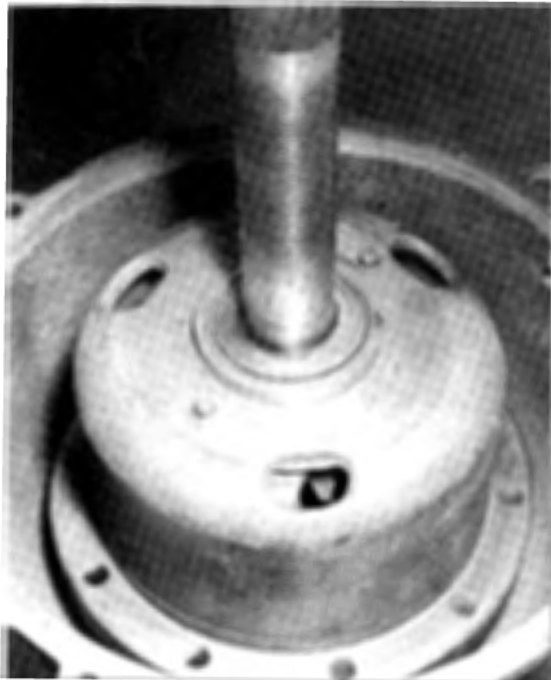
gears and pins around in different holes. If the axle has been in use prior to disassembly, it would be a good idea to mark the gears and pins so that they can be replaced in their same positions.



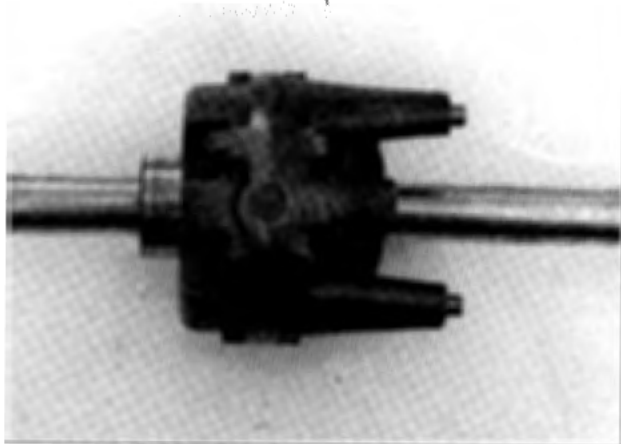
The ten bolts which hold the Ruckstell gear assembly to the ring gear are of critical importance. They are of a special size and material and must not be replaced with standard bolts. Easily cross-threaded and stripped, they should be started into the ring gear by hand and once started, tightened securely to about 35 foot pounds of torque.



Both P141 and P160 should be checked for wear around the axle gear bearing boss. There should be very little clearance.



The outer housing [P159] can wear at the axle gear bearing boss if a condition of insufficient lubrication occurs. Note the extreme wear in the housing on the right. This fit should be close; the ring and pinion gear mesh depends on it. (The axle housing is used as a support for the photograph here; this is not a stage in the assembly.)

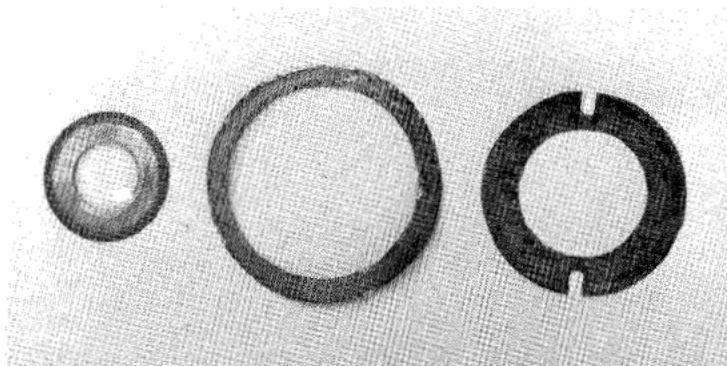


The first assembly is the center section with the differential gears, the spider and the fibre thrust washer (disk) between the axle ends. Draw the bolts up securely and use cotter pins. There should be no end play in the axles. If there is, install a new fibre thrust washer.

any play here will effect the ring gear and pinion mesh. The thrust washer locating pins, both inside and out, must be good enough to hold the thrust plates.

Inner thrust washer P171A was a fibre washer in original equipment. Ruckstell advised against using a steel washer here but if care is used in fitting the assembly together no trouble has occurred in the author's experience. In general, the unit should have about .005" clearance and the axles should be centered as mentioned earlier. A standard Ford steel washer has been used here with, occasionally, a tin washer between it and the outer case to obtain the proper clearance. A fibre washer could, of course, be made.

Of critical importance are the ten bolts which hold the assembly to the ring gear. These bolts are of a special diameter to be a snug fit through P93 and P159. While standard machine bolts will fit they are smaller in diameter and will eventually break off. Fortunately, a



Three shims that might be used in adjusting clearances. The left one is used behind the pinion thrust bearing (between it and the torque tube); the center one is used between the outer ball bearing race and the axle housing; and the right one is used behind the thrust washers on the right side of the differential. None, some, or all might be required, depending on the amount of wear encountered.

few enterprising firms have recently tooled up to make replacements for these bolts and they can be ordered, if needed.¹⁰ In a pinch, as a temporary repair, a combination of original and standard bolts can be used but this is not recommended. Even though the new replacement bolts are a bit expensive, they are, in the end, well worth the cost.

These bolts should be examined for good threads and signs of stretching, and should be replaced if there is any sign of weakness. We cannot stress the importance of these bolts too much! Failure here results in the ring gear running free and the loss of driving and braking ability and unless you have auxillary brakes on the wheels (highly recommended) you can picture the possible consequences.

Assembly begins with the two axles, the spider, the fibre axle thrust disk, the three differential gears and parts P141 and P160. These are held together with six bolts and nuts. Tighten and check for smooth operation and no end play. A little tightness is acceptable; the fibre disk will wear in. Before final assembly oil all parts and when the nuts are tight install cotter pins.

Assemble the outer housing P159, the Ruckstell pinion pins and gears, plate P145 (smooth side out), the ring gear P93 and plate P211, using the thrust washer between P135 and P159. Install the Ford ring gear and two bolts, tighten and check for end play or tightness as outlined earlier.

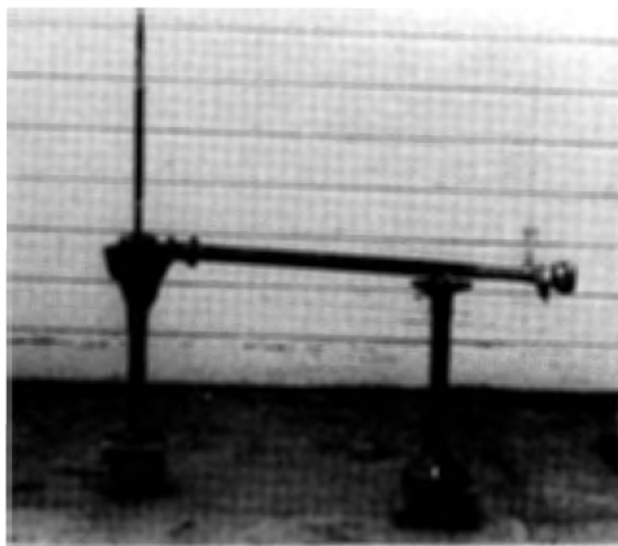
10. These bolts can be ordered from Lucas Engineering, 11848 W. Jefferson Blvd., Culver City, CA 90230 or from C & L Enterprises, 2701 California Ave., S.W., Seattle, WA 98116, or through your local antique parts supply house.



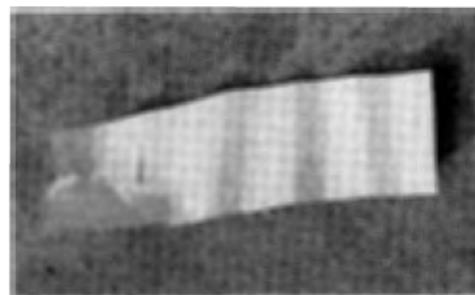
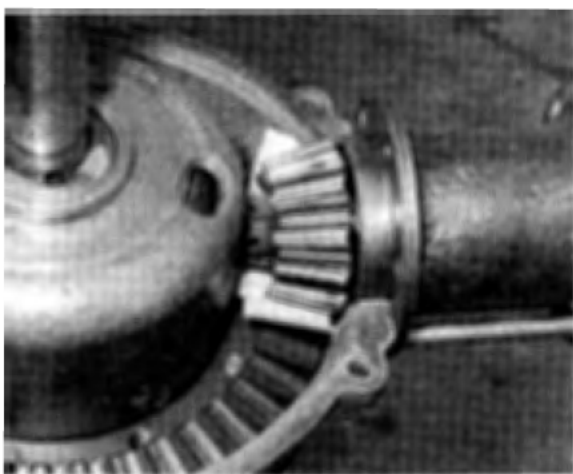
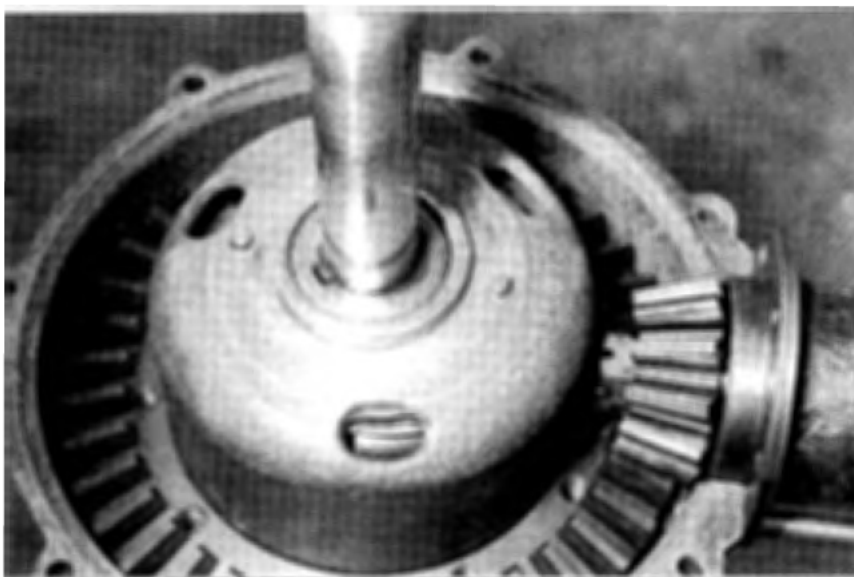
Relative positions of the Ruckstell planetary gears.

At this point it is a good idea to install the ball bearing and assemble the axle housings in order to determine if the axles are centered in the axle housings. If not, adjustment of the positions of shims in the carrier assembly will be necessary. To move the left axle in, the thrust washer P171A will have to be made thinner and washers installed over the pins on P160, to space P145 out. If the right axle must go in (or the left out, if you prefer) the opposite placement of shims is necessary. Many interlocking factors are present here. The drive shaft pinion gear must mesh with the ring gear properly; this is adjusted by the placement of the ball bearing and thrust washers. Any change here will also effect axle positions, which can be adjusted as mentioned above. A trial assembly is the only method of determining what (if anything) needs to be done to what. In general, unless some of the parts are badly worn, very little shimming will be necessary.

Place the Left half of the axle housing in a vise or other fixture which will hold it vertically with the center section up. Assemble the shifting sleeve P146A and the plate P147 and place them in the carrier assem-



Improvised stand for use in setting the ring gear to pinion mesh. The ball bearing supports the differential assembly and the wheel bearing is in place to hold the axle in alignment. The drive shaft must be supported and in proper alignment with (at right angles to) the differential housing, and it must be securely bolted in place.



Ring and pinion gear mesh can be checked as shown. A piece of paper is run through the teeth while a light load is held on the gears. The paper should show even bearing across the width of the gear teeth. Adjustment is outlined in the text.

oil leakage at this point.

When all is together, make sure all nuts and bolts are tight and install cotter keys as required.

The rest is easy. Install the outer wheel bearings and oil seals, the brake shoes and rods, and add oil to the differential if you have not already done so. Use S.A.E. 140 oil in the Ruckstell. **DO NOT USE GREASE** — it will not flow and lubricate the internal gears. Pack the wheel bearings with wheel bearing grease.

The shifting toggle can be installed at any point in the process. It takes a little fiddling to get the shifting sleeve [P146A] in place but it can be done. Use a thin gasket or a sealer between the axle housing and the toggle. Tighten the two bolts which engage the plate P147 and then run the locking nuts down to hold them.

Before installing the assembly in the chassis, make sure all cotter pins are in place. Unscrew the nuts which hold the spring perches almost all the way. This will make it easier to attach the spring shackles. Slide the axle assembly into place and connect the U-joint and ball cover to the rear of the engine. Use gaskets and/or sealer between the flanges to prevent oil leakage. Install one of the shackles and place a small block of wood between it and the axle housing. Now place a similar

block under the opposite spring eye and jack the axle up and into place. With very little prying it should be easy to put the remaining shackle into place. Now tighten the perch nuts and install the cotter pins here and in the shackles.

The installation of the wheels is the last major step. The inside of the hub as well as the outside of the axle should be clean and dry. If the axle is worn, use a shim; two if necessary. Put the axle key in place and install the wheel (or hub), checking to make sure it is seated properly and that the key is not pushed back into the oil seal. Use a *large* wrench on the nuts and get them as tight as possible. Don't worry about stripping the threads; they'll hold unless they are defective and if they are defective it's better to find out now than later out on the road. Be sure to install the cotter pins. After a few miles of driving, tighten the nuts again. *The importance of getting these nuts tight and of the installation of the cotter pins cannot be overstressed!*

The final installation of the brake rods and the shift rod, etc., is routine. Before driving, though, be sure you have added the oil and that everything is tight and keyed.

What about all that gear noise? All Model T Fords have that, don't they?

DRIVING WITH THE RUCKSTELL AXLE

During the Model T era there were about as many types of auxillary transmissions available for the Ford as there were firms to produce them. Most all of them fit in the driveline between the engine and the rear axle, requiring extensive modification of the drive shaft.

The majority of these transmissions were two-speed; direct drive and some reduction for hill-climbing. A few were three speeds, offering an overdrive gear in addition to the direct and under gears.

In addition to the problems of installation, all of these units had a common fault; they could be accidentally slipped into a neutral, leaving the car without brakes unless some auxillary braking system was also installed.

The Ruckstell, on the other hand, mounted in the rear axle and required no major changes in the normal Ford parts. While it is possible to get the Ruckstell into a neutral, it is not easy to do so. The Ruckstell added little to the weight of the car and added little to the noise regardless of which gear it was running. These advantages made it perhaps the most popular of all the "Four Speeds for Ford" units available.

It is the author's opinion that a good set of outside brakes is a *requirement* when any form of auxillary gear system is used, and very desirable even in a standard Model T Ford.

Shifting the Ruckstell is easy providing you remember two things: (1) shift into the lower gear when the engine is pulling the car (not when the car is pushing the engine)

and (2) shift into high when the engine load is at a minimum (with the engine speed synchronized with the car speed, neither pulling nor being pushed). *Never shift into low gear when going down a hill unless you can let the engine pull the car, and never attempt to get back into high gear if the car is pushing the engine on a downgrade!*

When climbing a hill and finding that the lower gear is needed, all that is necessary is that you "pop" the clutch as you pull the Ruckstell shift lever back. With a minimum amount of practice, the action becomes almost automatic. *You do not have to adjust the throttle when shifting into low under load.*

Getting back into high gear is a bit more difficult. Since the throttle and the shift lever are both operated by the right hand, and since few of us have two right arms, and because both levers have to be moved, you can see the problem. The only way to do the job is to get your left hand on the throttle. Adjust the speed of the engine so that the load is minimum, push in the clutch and push the shift lever forward. With practice it can be done easily — *but only with practice!*

The Ruckstell axle can give trouble-free service for many miles if it is treated properly. The most important thing to remember is to keep the oil level up (about a half inch below the filler hole is about right) and to use *oil*, not grease, as the lubricant.