REAR AXLE

All series rear axles are semi-floating type, with load carried on the axle shafts. See Figs. 4-2, 4-3.

All series have torque tube drive and spiral bevel Hypoid ring and pinion gears.

Axle shafts are retained by self-locking horseshoe washers recessed in differential side gears on all series. Axle thrust is taken against spacer block between axle ends.

AXLE END CLEARANCE

The minimum total side clearance of spacer blocks is .000" and the maximum total clearance is .008".

Four different widths of spacer blocks are used in production between the axle shaft ends on all series. The proper block is selected during assembly to give the desired fit.

The spacer block furnished in service affords the two widest limits used in production.

Axle shafts on Series 40-50-60-70 are ¾" longer and on Series 90 $1\frac{5}{16}$" longer on right-hand side than on the left. This is because differential case is slightly offset to give large Hypoid pinions clearance.

Axle chuck on rough roads, which is sometimes encountered, is due to too much end-play in the axle shafts caused by wearing of differential side gear thrust washers.

In some instances this end-play cannot be removed sufficiently by installation of service spacer block. Therefore, in cases where axle shaft end-play is encountered, new bronze side gear thrust washers should be installed back of the differential side gears before selecting the proper thickness of spacer block to provide not over .008" clearance. See Fig. 4-6.

OPTIONAL GEAR RATIOS

Axle ratios will be identified on production cars by paint marks on outer ends of both axle shaft flanges.

The following tabulation shows the series which may be had with optional gear ratios. They can be easily identified either by figures stamped on the underside of axle housing or daubs of paint on outer end of axle shaft as follows:

Series	Ratio	End of Both Axle Shafts Painted
40 (121" W.B.)	4.4	Standard ..... White
	4.1	Optional ..... No Paint
40 (118" W.B.)	4.1	Only ..... No Paint
50	4.4	Only ..... White
60	3.9	Only ..... No Paint
70	4.1	Only ..... No Paint
90	4.55	Only ..... No Paint

See Engine and Car Speed Chart for engine revolutions at various car speeds with different ratios.

AXLE SHAFT REMOVAL

Self-locking horseshoe washers are used to retain axle shaft in side pinions. These washers snap over the shaft ends and service Tool J-1515 is required for removal. See Fig. 4-1.

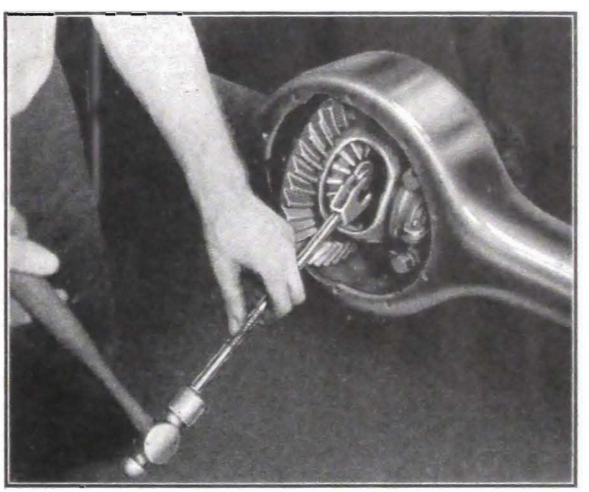


Fig. 4-1. Tool J-1515

AXLE BEARINGS

Rear Wheel Bearings on all series are Hyatt roller bearings. Outer races are light press fit to free fit in axle housing. Outer race, roller assembly, and oil seal can be removed from housing as an assembly by using puller J-528-B or J-1436. See Figs. 4-4, 4-5. Lubricate every 10,000 miles or at time when brakes are relined.

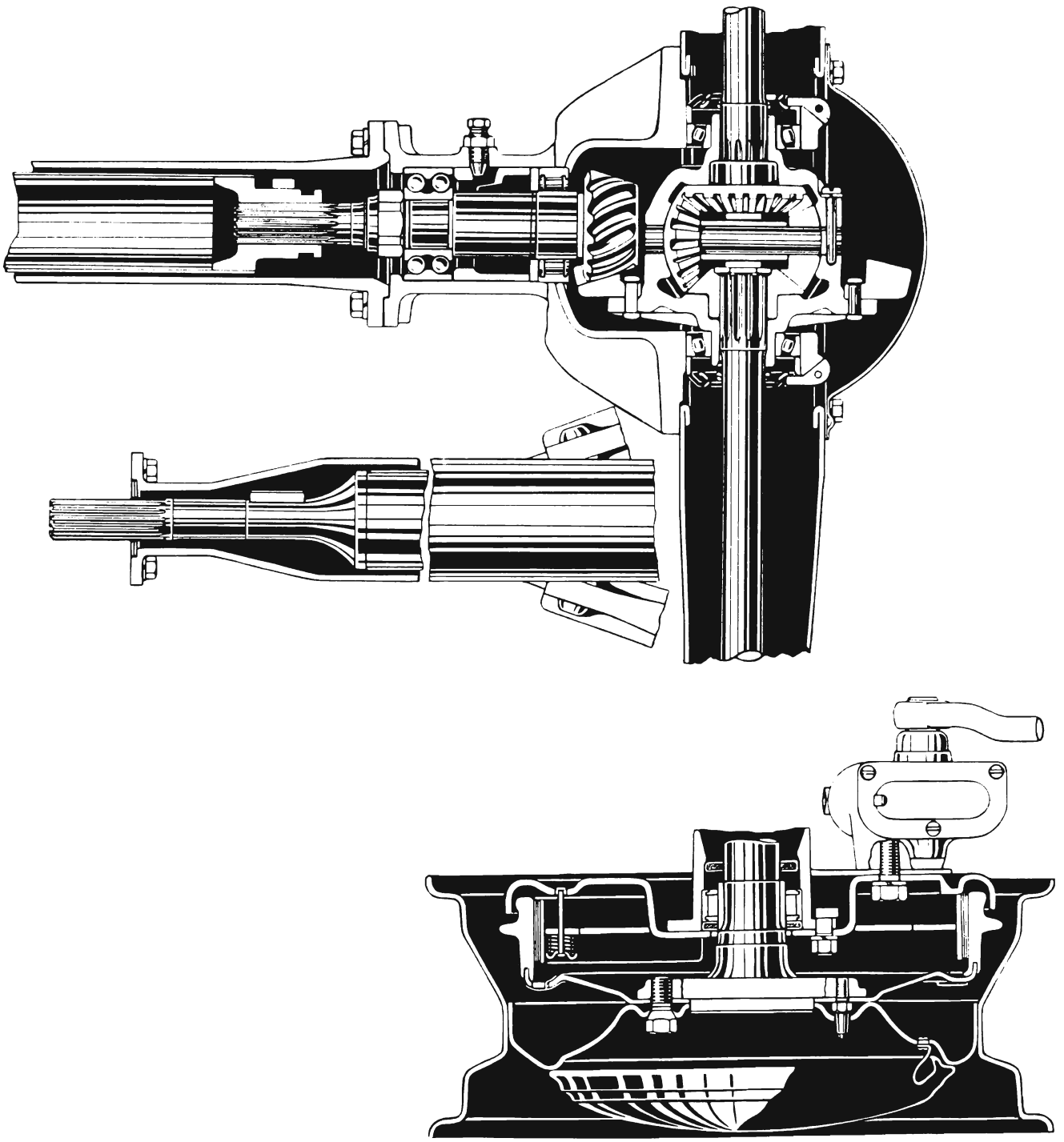


Fig. 4-2. Rear Axle Assembly—Series 40-50-60-70

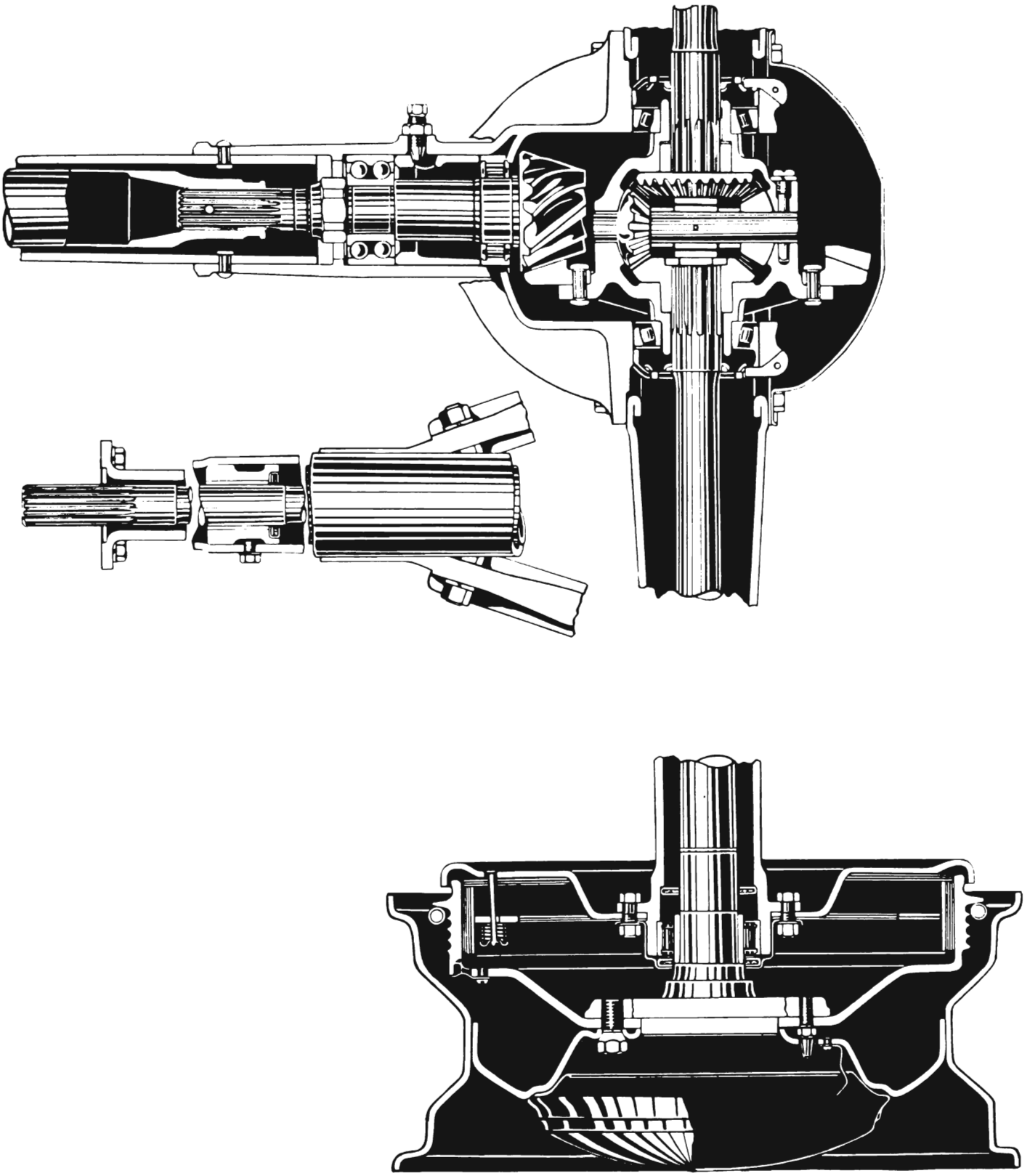


Fig. 4-3. Rear Axle Assembly—Series 90

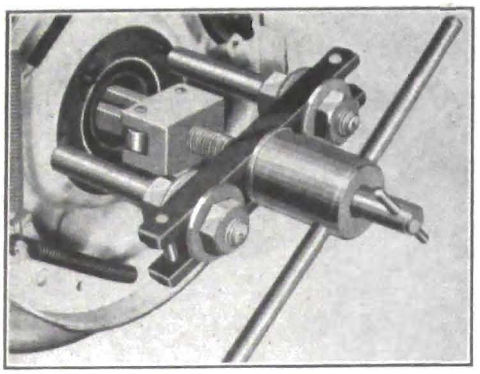


Fig. 4-4. Axle Bearing and Retainer Puller J-528-B

Differential Side Bearings on all series are Hyatt self-aligning roller bearings on both sides of differential case. Inner race is press fit on hub of differential case. Bearings may be removed from differential case by using puller J-1601.

Rear Pinion Bearings on all series are Hyatt roller bearings. Pinion shaft serves as inner race. Bearing is retained in position by light press fit of outer race in carrier housing and by a spacer used between pinion and bearing rollers to prevent creeping.

FRONT PINION BEARING

New Departure double row ball bearing is used as front pinion bearing on all series. Bearing is shielded on one side, the shield is assembled to the front of axle or toward the splined end with the loading groove on front outer race on top. The groove leaves a small opening in shield and when assembled on top prevents oil running through into the torque tube.

This bearing takes the thrust load of pinion. Outer race is free radial fit in carrier housing but is held under heavy pressure endwise by the three cap screws which lock the propeller shaft assembly in the torque tube and carrier housing. Inner race is light press fit on pinion shaft.

Propeller Shaft Front Bushing is used at the front end of propeller shafts on Series 90. Bearing consists of cast-iron body equipped with bronze bushing and seal. Bearing is lubricated from transmission. See Fig. 4-3.

When new third member is installed on Series 90 pour ½ pint of transmission oil in end of third member before attaching to transmission ball joint.

TORQUE TUBE

Tube is flanged at rear end of Series 40-50-60-70 and bolts to differential carrier for manufacturing purposes only and disassembling at this point should never be made unless it is necessary to install a new gasket to prevent oil leaks. Special gaskets are used at this point and substitutions should never be made. The tube and carrier are matched and lined up during production and should always be kept in their original assembly. For service, the assembly only, will be available. Neither will be supplied separately.

Series 90 is of one-piece construction.

Torque tube assemblies supplied in service will not have holes drilled in brackets where the front end of struts are attached.

The holes should be drilled after rear axle, torque tube, and strut rods are assembled. It is necessary that these holes line up with those in strut rod. A drill of smaller size can be used, leaving enough material to allow for cleaning up and aligning holes.

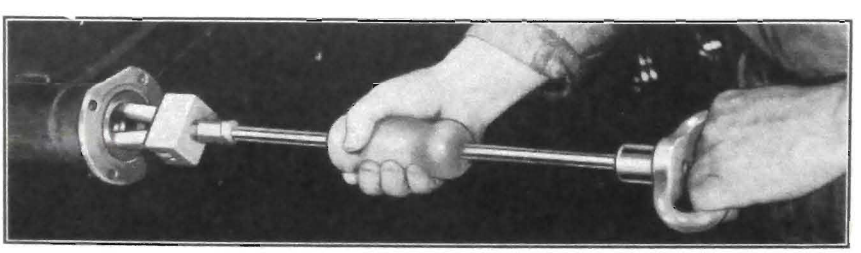


Fig. 4-5. Tool J-1436

REAR AXLE STRUTS

Two struts are used to support torque tube. Struts are riveted to a bracket on forward end of torque tube and bolt to rear axle main tube at spring bracket. The rear bolts on struts require no shims and should be drawn tight around axle tube. The forward side of mounting should be shimmed to fill the space between strut and spring bracket before bolts are tightened. In servicing struts, bolts that fill the holes at front end may be used to replace the rivets.

Differential Assembly

The differential carrier is a malleable casting. Bronze washers are provided back of the side gears and pinions to increase the life of these parts and prevent scoring. See Fig. 4-6.

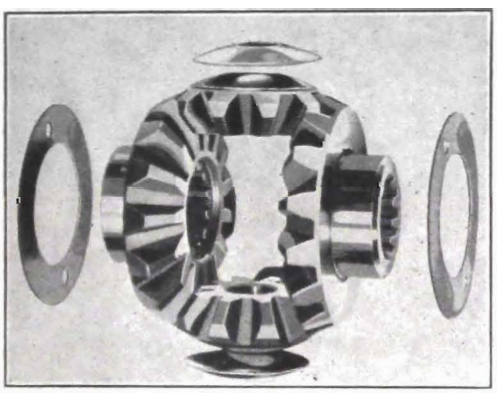


Fig. 4-6. Side Gear and Pinion Thrust Washers

The total lash, measured at the outside diameter of one raised wheel and tire, with the transmission in high gear, and other wheel resting on the floor, should not exceed ¾" with ordinary wear.

REAR AXLE LUBRICATION

Rear axle lubrication should be checked at least each 1000 miles. Lubricant should be maintained to the level of the plug. Do not fill above this point. Drain off any excess lubricant.

The life of the rear axle gears and bearing can be extended if after the first 5000 miles the assembly is thoroughly washed out, the inspection cover removed and all foreign particles wiped out of the housing. This need only be done once. Regular refilling may follow as per Lubrication Chart.

Twice a year the housing should be completely drained, flushed out and refilled with rear axle lubricant. S.A.E. 90 passenger car duty Hypoid lubricant is recommended for refill. In territories where temperatures of —10° F. or lower are regularly experienced, use S.A.E. 80 passenger car duty Hypoid lubricant. See Lubrication Chart for seasonal requirements.

Lubricant Change

After draining lubricant use S.A.E. 10, 10-W engine oil, or a light flushing oil to clean gears by running in high gear at low speed with rear wheels jacked up. *Do not use kerosene or gasoline.* Drain, remove axle gear cover, and clean housing.

CAUTION

Do not raise rear of car to a height which would allow flushing oil to drain past pinion into torque tube.

Axle Shaft Oil Seals

Axle shafts should always be pulled all the way out of housing when removing axle gears. Do not allow shaft to rest on and damage rear wheel oil seals.

Two leather oil seals are used on rear wheels on all series. The inner seals on all series are pressed into the housing. The outer seals on the Series 40-50-60-70 are pressed into the housing and held into position with the flange of the brake backing plate.

On the Series 90 the oil seal is assembled in a retainer which is bolted to the brake backing plate. This retainer should not be bolted up tight until the axle shaft is in place. This will allow the leather to center itself on the shaft and prevent oil leaks.

Service Gears and Lubrication

Ring gear and pinions are supplied only in matched sets. A mating number is stamped on the ring gear and the same number is etched on the pinion. This affords a check for matched sets.

With each ring gear set supplied for service a propeller shaft lock nut and spacer for prevent-

ing Hyatt bearing contacting pinion, and extra shims for pinion adjustment are included. S.A.E. 90 Hypoid lubricant should be used with new gears on all past model axles as well as present models. New gears must be broken in at same speeds recommended for new cars for about 500 miles. Scoring results in noisy gears. If noted in time and driven slowly with the proper lubricant it is possible to smooth up slightly scored gears without replacing them.

PINION SETTING

A definite setting for pinion depth is determined in manufacture by testing each pinion and ring gear set. These setting marks are etched on the toe end of the pinion and read plus or minus, a nominal amount, in thousandths of an inch. See Fig. 4-7.

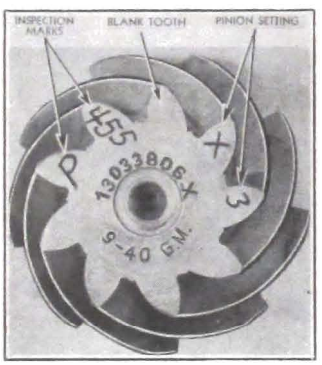


Fig. 4-7. Pinion Markings

A plus marking indicates that the pinion is to be set away from the center line of axle. A minus marking indicates the pinion is to be set toward the center line of axle. In order to make these depth settings in accordance with the marks on the pinion it is necessary to use Pinion Setting Gauge J-681-A. This gauge is provided with a micrometer pointer for setting pinion and made adjustable to accommodate all width differential carriers, also with "stepped" rings to fit all side bearing bores in carriers. This gauge, with a test fixture for checking the correctness of the zero setting on the micrometer pointer, is illustrated. See Fig. 4-8.

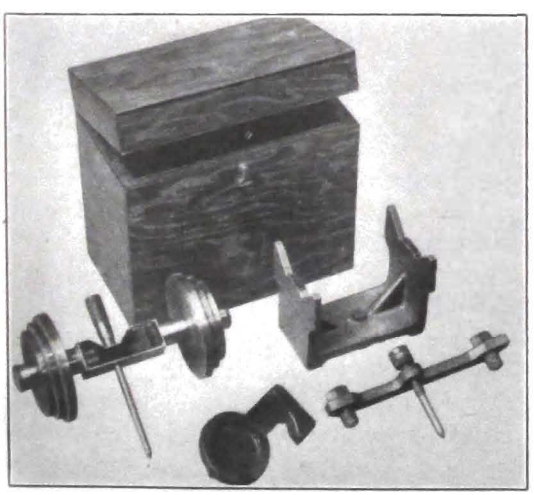


Fig. 4-8. Pinion Setting Gauge

The setting gauge carries a table with the nominal dimension for the various model pinions on which the gauge can be used. The nominal dimension figure shown is the amount micrometer pointer is moved from the "0" mark for each different model pinion depth. See Fig. 4-10.

To locate pinion, adjust micrometer pointer "*out*" the amount shown on table on gauge for the model to be adjusted. This is the nominal setting for the pinion. Next, move the micrometer pointer the number of thousandths etched on the end of pinion. If a plus mark is shown adjust the pointer "*in* or away from center line of axle." If a minus mark is shown adjust the pointer "*out* or toward center line of axle."

In other words, a "plus" (+) marking indicates that pinion is to be moved toward front of car. A "minus" (—) marking indicates that pinion is to be moved toward rear of car.

Place setting gauge in differential carrier pedestals and with pointer on the special adapter used on all series, add or remove shims until the pinion is at the nominal depth, plus or minus the amount etched on end of pinion. See Fig. 4-9.

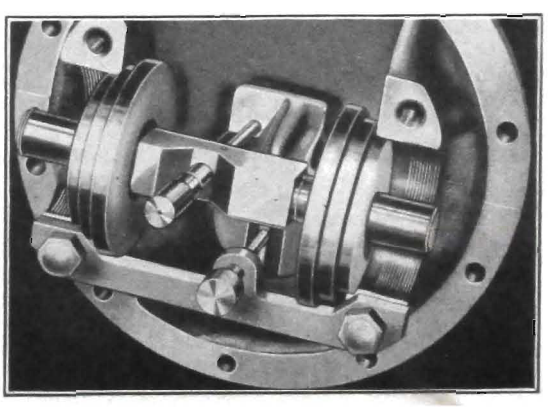


Fig. 4-9. Pinion Setting Gauge in Use

GENERAL INSTRUCTIONS FOR ADJUSTING REAR AXLE BEVEL GEARS

FIG. A

FIG. A SHOWS CORRECT CONTACT. GEARS SET UP THIS WAY GIVE BEST RESULTS FOR NOISE AND WEAR

FIG. B

FIG. B SHOWS HEAVY CONTACT ON HEEL OF TOOTH. GEARS SET UP THIS WAY WILL EVENTUALLY BREAK OFF AT THE HEEL. TO CORRECT, MOVE RING GEAR TOWARD PINION BUT MAKE SURE THERE IS BACKLASH AS GEARS CAN NOT RUN TIGHT.

FIG. C

FIG. C SHOWS HEAVY CONTACT ON TOE OF TOOTH. GEARS SET UP THIS WAY WILL EVENTUALLY BREAK OFF AT THE TOE. TO CORRECT, MOVE RING GEAR AWAY FROM PINION.

FIG. D

FIG. D SHOWS HEAVY CONTACT ON FLANK OF GEAR TOOTH. GEARS SET UP THIS WAY ARE NOISY. TO CORRECT, MOVE PINION OUT UNTIL CONTACT COMES TO THE FULL WORKING DEPTH OF GEAR TOOTH WITHOUT LEAVING LOWEST POINT OF CONTACT SEE FIG. A

FIG. E

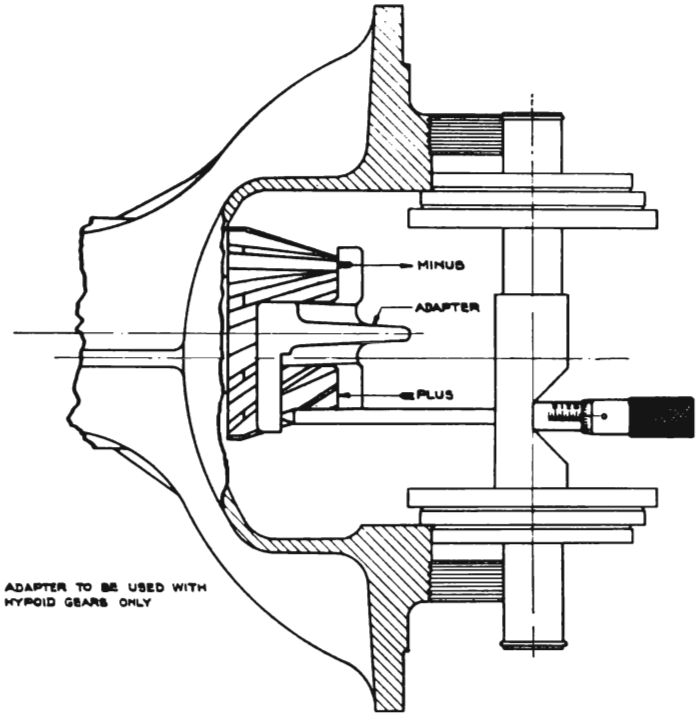
FIG. E SHOWS HEAVY CONTACT ON FACE OF GEAR TOOTH. GEARS SET UP THIS WAY ARE ALSO NOISY TO CORRECT, MOVE PINION IN UNTIL CONTACT REACHES LOWEST POINT ON GEAR TOOTH SEE FIG. A

FIG. F

THE HEEL OF GEAR TOOTH IS THE LARGE END AND THE TOE IS THE SMALL END

FIG. G

GEARS ARE MATCHED AND MARKED FOR THE BEST RUNNING POSITION. THIS MARKING WILL BE FOUND ON THE FACE OF THE SMALL END OF PINION TEETH AND WILL READ + OR — A GIVEN AMOUNT IN THOUSANDS OF AN INCH WHICH IS TO BE ADDED OR SUBTRACTED FROM MICROMETER READING.



ADAPTER TO BE USED WITH HYPOID GEARS ONLY

Fig. 10. Ring Gear and Pinion Adjustment

YEAR	SERIES	MICROMETER READING
PREVIOUS TO 1936	80-90	.000
1932-33-34-35	50	.649
1932-33-34-35	60	.336
1934-35-36	40	.711
1936	60-80	.461
1936	90	.305
1937-38-39	40-60	.379
1937	80-90	.461
1938-39-40-41-42	80-90	.203
1940-41-42	40-50-60-70	.379

The pinion depth on all series is controlled by means of shim washers which are located between the outer race of the double row ball bearing and a shoulder on the housing. Adding shim washers adjusts the pinion toward the center of axle or toward rear of car, and removing shim washers moves the pinion away from the center of axle or toward front of car. These shim washers are available in several different thicknesses to obtain proper adjustment. Various thickness shims may be interchanged. That is, a .010″ shim may be removed and a .012″ shim installed to obtain a minus (—) .002″ adjustment.

The three lock screws which hold the pinion assembly in third member must be tight before pinion setting measurements can be taken.

Rear axle pinions are not ground on face where the pinion setting gauge adapter fits against face of pinion.

A definite tooth is selected to take measurements from and may be identified as being the blank tooth between factory inspection mark (a letter followed by a number) and pinion setting mark (+ or — a number). See Fig. 4-7.

Production pinions are not ground on face and are likely to show considerable error on micrometer gauge unless measuring procedure is followed as outlined:

1. Turn propeller shaft so blank tooth on pinion is in "upward" position.
2. Attach pinion setting gauge adapter and take reading.
3. Remove adapter and turn pinion so that blank tooth is in downward position.
4. Attach adapter and again take reading.
5. Add the two readings and divide by "two" to obtain pinion setting.

When new ring gear and pinion are to be installed in an axle considerable service work may be avoided by observing the marking on the gear being removed, and computing the shim combination needed for new pinion.

Example: Pinion removed is marked..... + 21
Pinion to be installed is marked + 15

This means that new pinion must be set .006″ nearer axle center line or toward rear of car than was the original pinion, and shims must be substituted to give this result.

Adjustment Procedure Where Pinion Setting Gauge is Not Available

Paint the ring gear with white lead or red lead of suitable consistency, and run the gears slowly with the engine in first speed and reverse speed for just a few seconds. The brakes should be applied lightly so that the rear wheels have a one-hand drag while this test is being made.

By examining the contact marks on the ring gear tooth, it can be determined whether contact is too high or too low or too near the heel or toe.

The correct contact is shown at letter A, and instructions are given for obtaining the correct contact in letters B, C, D and E. See Fig. 4-10.

AXLE RING GEAR REPLACEMENT

1. Center punch all rivets from ring gear side. See Fig. 4-11.

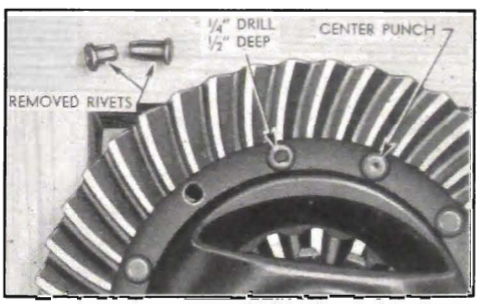


Fig. 4-11. Ring Gear Rivet Removal

2. Drill each rivet approximately ½″ deep with ¼″ drill.
3. Holding assembly in a suitable fixture use a punch in bottom of drilled hole and rivets will easily be parted. Under no circumstances should ring gear rivets be cut with cold chisel, as this practice distorts differential case.
4. After old ring gear is removed, face of differential case where back face of new ring gear contacts should be checked for being true. Use fixture U-4-B or V-blocks if tool is not available. See Fig. 4-12. If not true within .002″, the case should be set up in

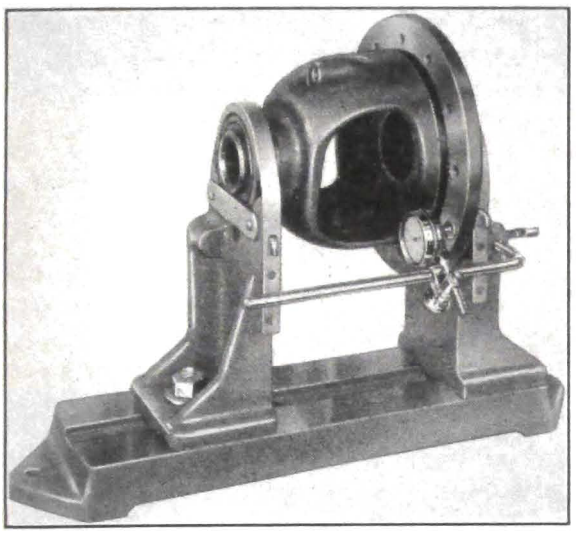


Fig. 4-12. Checking Differential Case Run-Out

lathe and gear seat trued up. Recheck in tool or V-blocks.

5. Check mating numbers on new ring gear and pinion to make sure the two parts have not been mixed with another gear set. See Fig. 4-7.

6. Bolt new ring gear to case with $\frac{5}{16}$" diameter bolts in every other rivet hole. Before starting riveting operation check bolted assembly in tool U-4-B and check run-out of back side of ring gear. See Fig. 4-13. If run-out is more than .004" it indicates burrs or that case is not true.

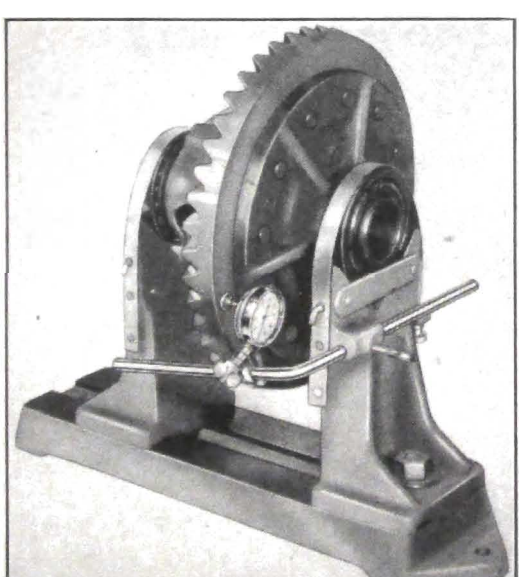


Fig. 4-13. Checking Ring Gear Run-Out

7. Use only new rivets that fill the hole completely and that leave approximately $\frac{5}{16}$" of shank for heading.

   Place gear and case in special riveting fixture and using proper rivet set, head up securely opposite rivets. Do not work around the gear in riveting as gear is liable to be drawn to one side and run eccentric.

8. Remove the bolts and finish riveting as above. Inspect for run-out at back of gear as described above. Run-out at back of gear must not exceed .004".

DIFFERENTIAL SIDE BEARING

Installation and Adjustment

Assemble bearings, adjusting nuts, and bearing caps, which hold assembly in place. Leave both bearing caps loose enough so that adjusting nuts can be turned.

Turn the two adjusting nuts as necessary to set pinion and ring gear at approximately correct lash position.

Tighten but do not strain right-hand adjusting nut. This is done to seat both carrier bearings against adjusting nuts. See Fig. 4-14.

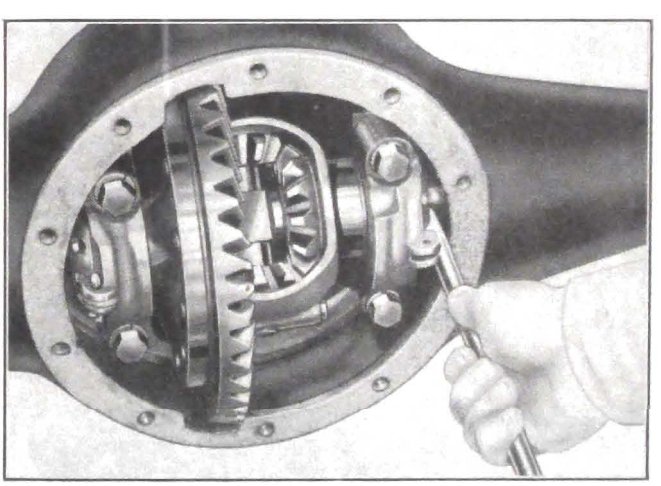


Fig.4-14. Adjusting Carrier Bearings

Use tool J-1365 for adjusting nuts.

Fully tighten cap screws which hold bearing caps in place. Then loosen right-hand bearing cap screws ¾ turn each.

Determine "free position" of bearing by backing off on right-hand adjusting nut and at same

time watching rollers of right-hand bearing to see when they stop turning. **When rollers stop turning, the "free position" of carrier bearing has been reached.** The free position should be rechecked at least once to make sure of adjusting nut position.

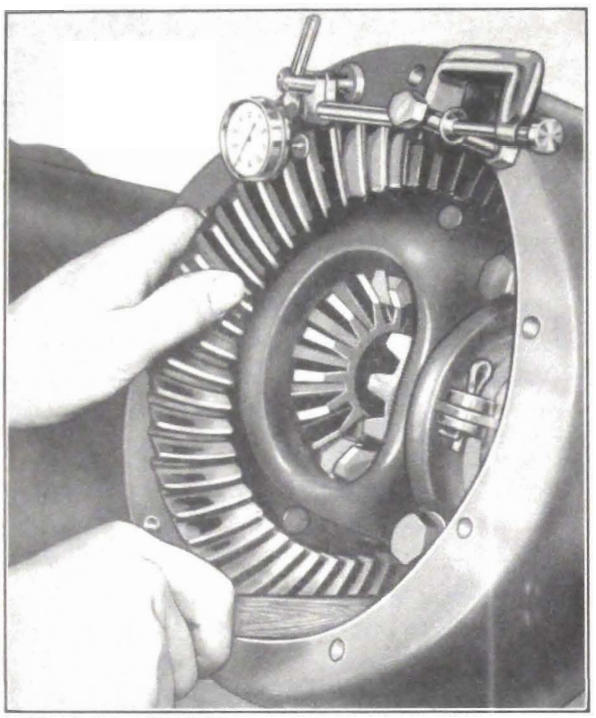


Fig. 4-15. Indicating Ring Gear and Pinion Backlash

The correct adjustment of carrier bearings is 2 to 2½ notches tight. This adjustment is obtained by determining the "free position" of bearings as outlined above and then tightening righ-hand adjusting nut 2 to 2½ notches.

Axle Gear Backlash Adjustment

Before backlash can be measured, the carrier bearings must be adjusted 2 to 2½ notches tight and both cap screws holding both carrier bearing caps must be fully tightened.

Attach indicator so that indicator button contacts outer edge of ring gear teeth. See Fig. 4-15.

Rock ring gear back and forth while holding pinion locked with hammer handle or small bar.

Backlash should be measured at several points to determine point on gear with minimum backlash. **Backlash at minimum point should not be less than .006″ nor more than .010″.**

Move ring gear in direction necessary to obtain the above readings.

This is done by loosening bearing cap cap screws on both sides ¾ turn. Loosen adjusting nut on one side **one notch** and tighten other one **one notch.** Move one notch at a time on each side and this will maintain carrier bearing adjustment.

Loosening one adjusting nut **one notch** and tightening other one **one notch** will change lash approximately .004″ to .005″. **Each time lash is rechecked the cap screws which hold the two bearing caps must all be fully tightened.**

After backlash is properly set, install the adjusting nut locks.

PINION OR PINION BEARING REPLACEMENT

1. File off one head of the straight pin which holds propeller shaft and pinion together and drive out the pin.
2. Pull the pinion shaft from the propeller shaft, using puller J-1292-B. See Fig. 4-16.
3. Pry up staked section of pinion bearing nut and remove nut, gripping pinion shaft on spline. Do not grip pinion teeth in a vise even though soft jaw liners are used.
4. Press off pinion front bearing, using blocks under outer race. All parts assembled on pinion can then be removed.

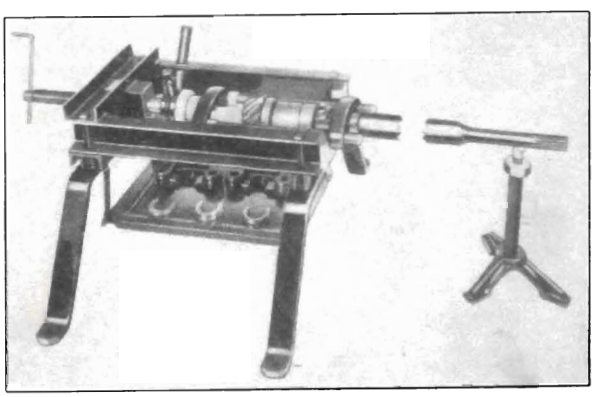


Fig. 4-16. Pinion Press, J-1292-B

5. **Thoroughly wash all bearings with unused cleaning solvent.** Apply a small quantity of lubricating oil and check for smoothness, looseness, or other defects.

6. Press bearing on pinion shaft, after other parts are installed on pinion. See Fig. 4-19. Use a piece of tubing which is the proper size to bear directly on the inner race.
7. Assemble pinion bearing nut and after the same is drawn up tightly, stake into the notch of the pinion shaft.
8. Assemble pinion shaft to propeller shaft, using service tool J-1292-B. **Do not put oil in propeller shaft.** This will cause roughness at high speeds. Use a good lubricant freely on splines when assembling.

   Install new straight pin in propeller and pinion shaft and rivet both ends.
9. **Every time a pinion and propeller shaft are pressed together, the assembly must be straightened, regardless of whether new parts or original parts are assembled.**

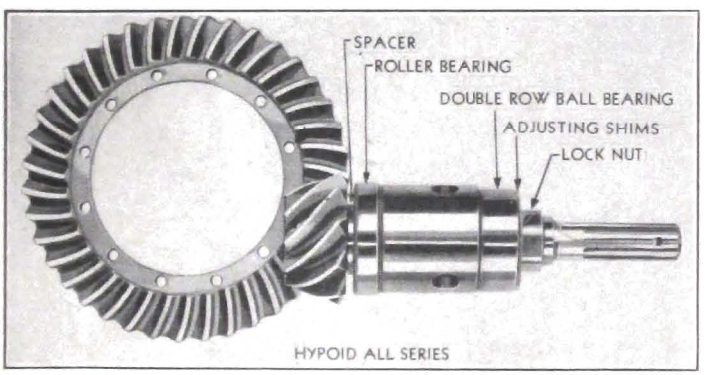


Fig. 4-17. Rear Axle Gears

ASSEMBLY OF PROPELLER SHAFT TO THIRD MEMBER HOUSING

- **Thoroughly wash and clean third member**
- **housing and main tube before assembly.**

To assemble propeller shaft in third member housing, tap the outer race of the roller bearing forward. This outer race should seat against a shoulder in the carrier on Series 40-50-60-70, and against the collar, which locks against the double row bearing, on Series 90.

This is very important, otherwise bearing rollers will bind the spacer between the roller bearing and pinion teeth.

Both pinion bearings should be well lubricated with rear axle lubricant before installing propeller shaft in torque tube.

Due to diameter of some of the pinions used on Series 40-50-60-70 cars, it is difficult to properly seat the rear pinion bearing outer race in torque tube housing.

The O.D. of the pinion is larger than the O.D. of the bearing. It is necessary to insert a special service tool, J-1192, between the pinion and the rear pinion bearing. See Fig. 4-18. This will

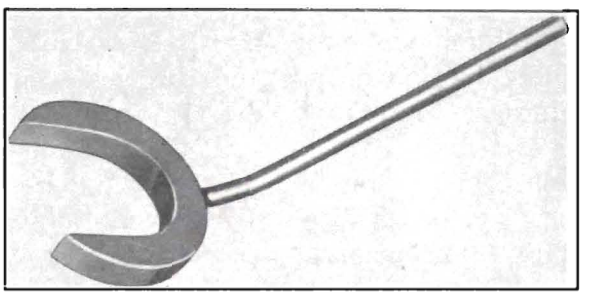


Fig. 4-18. Tool J-1192

allow driving on the end of the pinion (using a bronze driving block) to properly seat the rear bearing in carrier after which tool is removed.

CAUTION

Care should be used in installing propeller shaft in Series 90 to line up front end of shaft when being located in propeller shaft front bushing and bushing seals.

Propeller shafts on all series are dynamically balanced after pinion and bearings are installed. Weights are attached as necessary.

After a pinion shaft is assembled to a propeller shaft, the shaft assembly should be checked for straightness.

Straightening of the propeller shaft within certain limits at specified points will correct a tendency to "whip" with its resulting vibrations. The points subject to straightening and the procedure to follow in this operation are as follows:

CAUTION

Propeller shafts on all series should be handled carefully to prevent damage.

PROPELLER SHAFT STRAIGHTENING
(Using Fixture)

By obtaining the rear section of a third member housing for any series 1940, 1941 or 1942

car, a suitable fixture can be made for use in quickly and satisfactorily straightening propeller shafts for any 1940, 1941 or 1942 assembly. This same fixture will also fit 1939 and earlier model Series 80 and 90 propeller shaft assemblies.

For 1939 and earlier Series 40-60 assemblies, a section of third member housing for those years must be used.

Fig. 4-19 shows a sample fixture. It is recommended that such a fixture be made and used.

The pinion and propeller shaft assembly is mounted in this fixture and the three pinion bearing sleeve locks tightened in place. The shaft is then rotated by hand from pinion end with a regular dial indicator held by $\frac{5}{16}$" rod fastened to bench block of sufficient weight to hold indicator button in place on ground portion of shaft near end splines. The amount of run-out is shown by indicator. To straighten, rotate pinion to high spot on indicator reading and force end of shaft down, to spring into proper alignment. Indicator run-out should not exceed .015".

This fixture will not be available through Hinckley Myers.

PROPELLER SHAFT STRAIGHTENING

(Using V-blocks or held between center in lathe)

(1) Checking for Run-Out at "C"

Turn shaft and pinion assembly on rollers or V-blocks at points A and B. While turning, take indicator readings at front end of shaft at C. See Figs. 4-20, 4-21.

If indicator reading is .005" or less, the shaft is OK at this point. If indicator reading is greater the high point should be marked, and by exerting a force at C in the direction of the arrow the shaft should be straightened until a .005" or less reading is obtained by indicator at C. Care must be taken not to permit seam or hollow spots in propeller shaft to give a "bounce" to indicator and thus show a wrong indicator reading.

When being straightened, the shaft should be so placed that it bears on points A and D, and the straightening force should be exerted not over $1\frac{1}{2}$" from the front end of the shaft.

(2) Checking for Run-Out at "E"

Turn shaft and pinion assembly on rollers or V-blocks at points A and B. While turning, take indicator reading at center of shaft at E.

If indicator reading is .010" or less, the shaft is OK at this point. If the indicator reading is greater, the high point should be marked and the shaft should be straightened by exerting a force at E in the direction of the arrow until a .010" or less reading is obtained at E.

When being straightened, the shaft should be so placed that it bears on points A and D.

Care must be taken not to permit the seam or hollow spots in the propeller shaft to give a "bounce" to the indicator and thus show a wrong indicator reading.

(3) Checking for Run-Out at "G"

Turn shaft and pinion assembly on rollers or

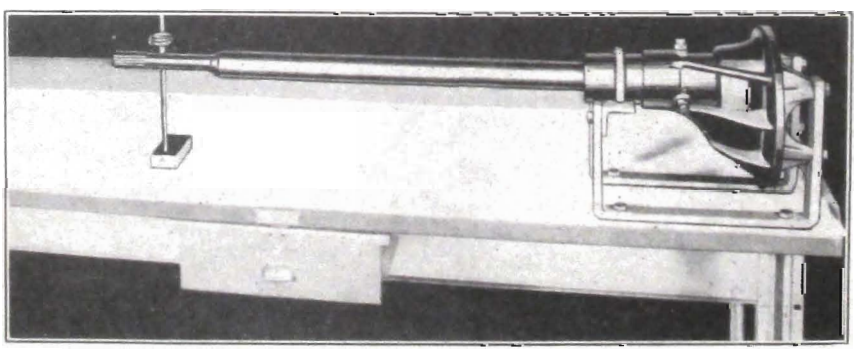


Fig. 4-19. Pinion and Propeller Shaft Straightening Fixture

V-blocks at points A and B. While turning, take indicator reading on front bearing at G.

If indicator reading is .001" or less, the shaft is OK at this end. If indicator reading is greater, the high point should be marked, and by exerting a force at F in the direction of the arrow the shaft should be straightened until a .001" or less reading is obtained by indicator at G. When being straightened, the shaft should be so placed that it bears on points A and D and the straightening force should be exerted at F not over 1½" from the back end of the shaft.

After operations listed in paragraphs 1, 2 and 3 have been completed in succession, it is recommended that a recheck be made at points C, E and G.

If the propeller shaft is within above given limits, the run-out at universal joint end will be within $\frac{1}{16}$" before connecting to the ball joint assembly. More than $\frac{1}{16}$" run-out will cause rapid universal joint bushing wear and possible lubricant leak from transmission to rear axle.

The pinion shaft on all series is supported by a roller bearing and a double row ball bearing, both ahead of pinion.

Propeller Shaft Balance

To test for propeller shaft balance accelerate car to top speed, throw gears in neutral and cut off ignition switch. If the propeller shaft is causing a vibration, it will be noted as car decelerates. A similar vibration can also be caused by universal joint, tires, wheels, hub and drums out of balance.

See "Car Roughness Analysis" in Wheel and Tire Section.

DIAGNOSIS OF REAR AXLE NOISE

Tire noise may easily be mistaken for axle noise even though the noisy tires may be operating on front wheels.

Tire noise changes with different road surface conditions but rear axle noise does not. Rear axle noise usually ceases when coasting with gears in neutral at speeds under 30 miles per hour. Tire noise continues but with lower tone as car speed is reduced. Axle noise always changes when comparing *"pull"* and *"coast."* Tires which have the surfaces of the non-skid divisions worn with one end higher than the other (saw tooth wear), are usually noisy. This is particularly true with low tire pressure. Pressures up to sixty pounds may be used for comparable test purposes. Inflating tires to high pressure will change the contact of tire with road and will often diminish noise. For correction, see "Interchange of Wheels and Tires," Wheel and Tire Section. Worn, brinnelled, or chipped front wheel bearings may cause noise very simi-

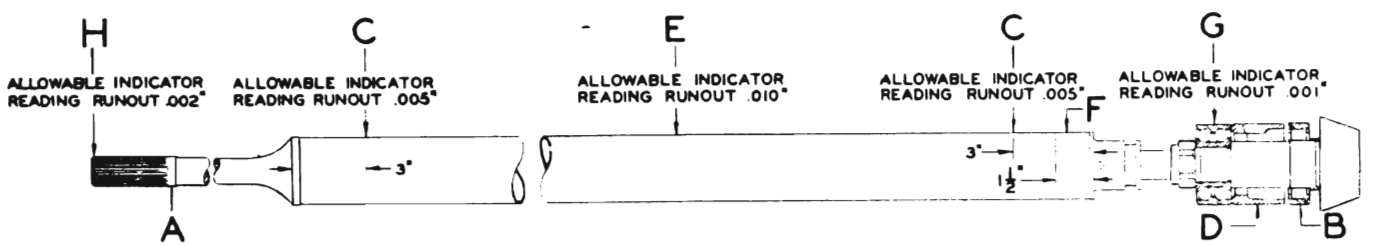


Fig. 4-20. Propeller Shaft Run-Out Specifications—Series 40-50-60-70

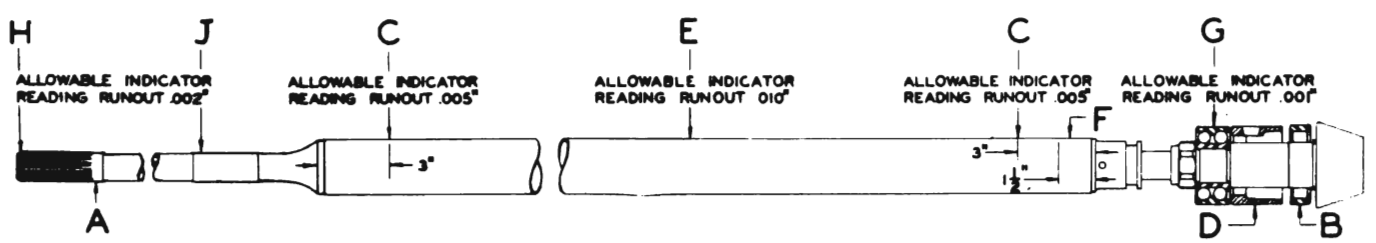


Fig. 4-21. Propeller Shaft Run-Out Specifications—Series 90

lar to rear axle or tire noise. Front wheel bearing noise does not change when comparing *"pull"* and *"coast."* If in doubt as to origin of noise, front wheel bearings should be removed and examined.

Transmission and engine noises occasionally are confused with rear axle noise. To best isolate these noises, first observe approximate car speed and conditions where supposed rear axle noise is most pronounced, then, with the car in a quiet place to avoid interfering noises, and car stationary, hold out the clutch with transmission in high gear and run engine up and down slowly through engine speeds corresponding to car speeds at which axle noise was most pronounced and observe for sound similar to axle noise. Next shift gears to neutral and again run engine at similar speed while slowly letting clutch engage to observe for idling noises of transmission.

Noises which cannot be isolated as above are likely to be found in rear axle.

BRINNELLED BEARINGS

Rail shipments from the factory are loaded in such a manner as to prevent extreme loads on rear wheel bearings when cars are shipped long distances. Regardless of type of transportation used in shipping cars it is possible that vibration during shipment may cause balls or rollers to dig in or brinnell bearing rollers and races to such an extent as to cause the bearing to be noisy.

Rear wheel bearings which are brinnelled will cause a knock or click approximately every two revolutions of the rear wheel. This is because rollers do not rotate around axle as fast as the outer race.

Double row pinion bearings are pre-loaded during manufacture, therefore, brinnelling of this type of bearing usually occurs where each ball contacts the races. The resulting noise from brinnelling this type of bearing will be a continuous whine.

When installing double row bearings on pinion shafts, or when installing any type of ball or roller bearing, never force an inner race in place by pressure or hammering an outer race or vice versa. Force applied to a bearing improperly during assembly or disassembly is very likely to cause brinnelling together with noise and failure.

Gear Meshing

If rear axle gears are removed for reasons other than replacement of gears, the backlash and pinion setting should be measured before removal so that gears can be adjusted to same settings when reinstalled.

If carrier bearing adjusting nuts are prick-punched before removal and bearing outer races are re-installed on same side as from which they were removed, adjustment will automatically be the same. This practice prevents noise caused by a changed setting.

Axle Housing Alignment Tool

A service tool, J-1105, has been developed for checking the alignment of rear axle housings of cars which have been in collision accidents where it is suspected the rear axle housing may be sprung.

This tool is simple to use and very accurate. The shaft is ground and the fits are held to close limits. See Figs. 4-22 and 4-23.

When using this tool for checking alignment of axle housing, the third member must be in place, the differential case removed and the step discs installed and held in place with differential side bearing caps. The bar is then pushed in place through the housing and two step discs. The outside cones are then placed on bar, one cone at each end, and by pushing these cones into wheel bearing or oil retainer it can be determined if the alignment is correct. Misalignment is indicated by gap between the cones and retainer or bearing on one side. It is not necessary to remove pinion drive gear.

On past model axles, which had the rear wheel bearing on the outside of the housing, the check can be made by reversing the cones, using the inside of these to register with the bearing sleeve on the axle.

REAR AXLE GEAR SERVICE

When axle gears are operating quietly and otherwise satisfactorily but must be removed

for any reason, the following operations will assure same adjustment when reassembled.

Prick-punch both adjusting nuts adjacent to adjusting nut locks so that the same adjustment can be made when parts are again assembled.

Paint mark right-hand adjusting nut and right-hand bearing cap to identify these parts as belonging on right-hand side.

This prevents mixing right and left caps.

Mixing caps lead to damaged threads because caps are threaded in production while bolted to carrier housing.

When removing differential assembly keep adjusting nut locks, cap screws, bearing caps and all bearing parts from one side separated from parts from other side of differential.

This makes it possible to reinstall differential assembly and have exactly the same gear backlash and carrier bearing adjustment as was had when gears were previously operating satisfactorily.

Satisfactorily operating gears should not be readjusted in regard to backlash or carrier bearing adjustment. The resultant change in gear tooth contact is likely to cause noise.

If the pinion and propeller shaft assembly is removed and same pinion and pinion bearings reinstalled, the pinion will automatically go back to same setting provided same spacer shims are reinstalled, shims are not damaged, and outer race of roller bearing is pressed forward in housing as far as it will go.

Placing shims in housing and holding in place with heavy lubricant will prevent them from falling out of place during pinion installation.

If double row pinion bearing is replaced, the pinion setting should **always** be rechecked **after pinion is reinstalled and the three lock screws are drawn tight.** Any variation from desired setting must be overcome by adding or removing shims as required.

If one or both carrier bearings are replaced, the backlash and carrier bearing adjustment must always be reset.

Axle Noise—Checks for Cause

To determine cause for an axle noise complaint, proceed as follows:

1. **Remove differential cover** and clean axle gears and other internal parts.
2. **Examine gear teeth for being scored and**

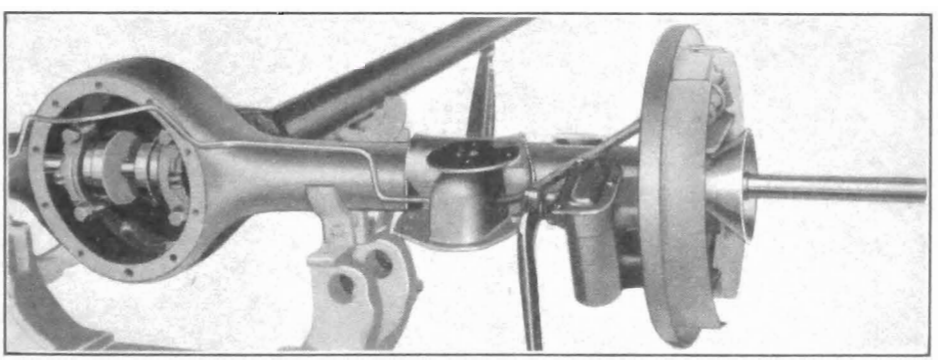


Fig. 4-22. Alignment Tool J-1105 in Use

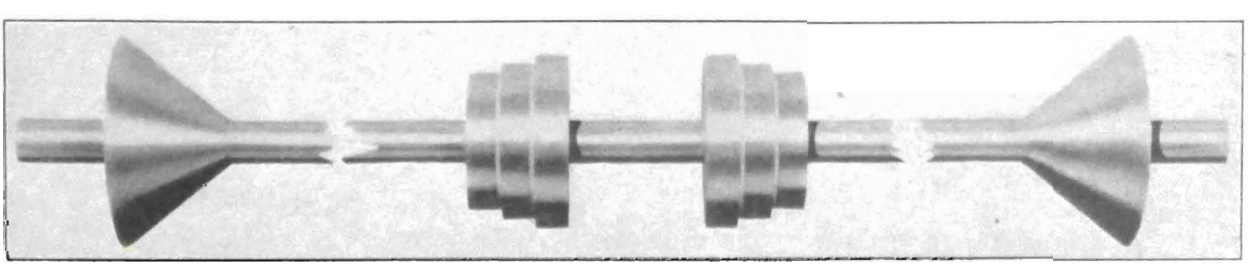


Fig. 4-23. Axle Housing Alignment Tool, J-1105

check contact marks on gears. See Fig. 4-10.

3. Check mating numbers on ring and pinion to see that these parts are actually a matched set. Mating number on pinion tooth should be same as number etched on back side of ring gear. See Fig. 4-7.
4. **Check differential side bearing adjustment.** See "Differential Side Bearing."
5. **Measure backlash.** See "Axle Gear Backlash Adjustment."
6. **Check pinion setting.** See "Pinion Setting."
7. **Remove pinion and propeller shaft assembly.** Use jaw type puller J-1020-B or pry out with tool J-1590. See Fig. 4-24. The J-1590 puller is meant for shops which do not care to invest in jaw type tool. The J-1590 puller will work satisfactorily on majority of pinions.
8. Thoroughly wash all bearings with a clean solvent, apply small quantity of lubricating oil and check for smoothness, looseness, or other defects.
9. **While the pinion and propeller shaft assembly is out, propeller shaft should be checked for straightness.** See "Propeller Shaft Straightening."

The procedure to follow after making above checks depends entirely on what was found wrong. Therefore, follow manual instructions on units involved when building up the axle assembly.

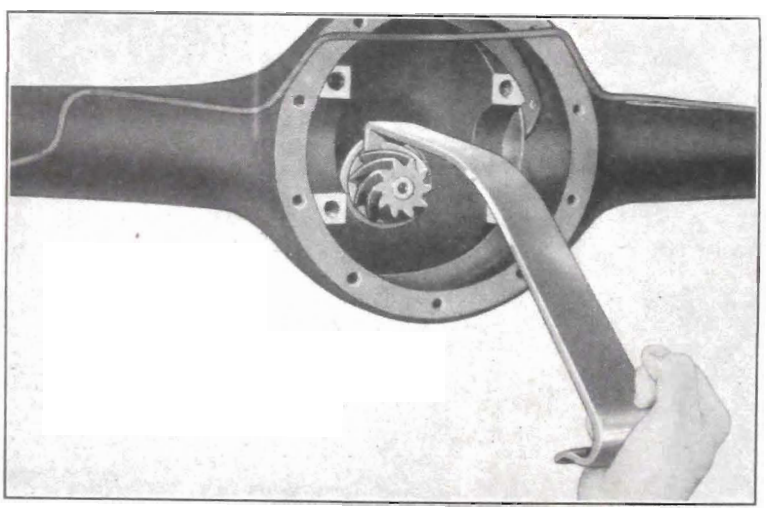


Fig. 4-24. Pinion Pry-Out Tool, J-1590

SPECIFICATIONS—REAR AXLE

ITEMS	SERIES 40-A	SERIES 40-B	SERIES 50	SERIES 60	SERIES 70	SERIES 90
REAR AXLE						
Type	←—Hypoid—Semi-Floating—→		←—Hypoid—Semi-Floating—→		←—Hypoid—Semi-Floating—→	
Propeller Shaft—Type	Tubular	Tubular	Tubular	Tubular	Tubular	Tubular
Wall Thickness	.065"	.065"	.065"	.065"	.065"	.065"
Diameter Center (O.D.)	2 5/8"	2 3/4"	2 3/4"	2 5/8"	2 3/4"	2 1/4"
Diameter at Splines—Front O.D.	1.167"-1.168"	1.167"-1.168"	1.167"-1.168"	1.167"-1.168"	1.167"-1.168"	1.167"-1.168"
Number of Splines	16	16	16	16	16	16
Enclosed or Open	←— Enclosed in Torque Tube —→		←— Enclosed in Torque Tube —→		←— Enclosed in Torque Tube —→	
Runout at Center—Assembly	.010"	.010"	.010"	.010"	.010"	.015"
Runout at Front Pinion Bearing	.002"	.002"	.002"	.002"	.002"	.002"
Torque Tube: O.D. at Front End	2"	2"	2"	2"	2"	2"
Diameter (O.D.)—Middle	3 15/32"	3 15/32"	3 15/32"	3 15/32"	3 15/32"	3"
Wall Thickness	.145"	.145"	.145"	.145"	.145"	.218"-.238"
Axle Housing—						
Diameter—O.D.—Minimum	3 3/16"	3 3/16"	3 3/16"	3 3/16"	3 3/16"	3"
Diameter—At Gear Housing	11 7/16"	11 7/16"	11 7/16"	11 7/16"	11 7/16"	12"
Wall Thickness	5/32"	5/32"	5/32"	3/16"	3/16"	7/32"
Axle Shaft—						
Diameter—Wheel Bearing	1.5316"-1.5321"	1.5316"-1.5321"	1.5316"-1.5321"	1.5316"-1.5321"	1.5316"-1.5321"	1.6260"-1.6266"
Diameter—Neck Portion	1 5/32"	1 5/32"	1 5/32"	1 5/32"	1 5/32"	1 7/32"
Diameter—Inner End at Spline	1.295"-1.300"	1.295"-1.300"	1.295"-1.300"	1.295"-1.300"	1.295"-1.300"	1.399"-1.404"
Number of Splines	12	12	12	12	12	13
Number of Side Gears and Pinions	Two	Two	Two	Two	Two	Two
Int. Parts Backlash—A/S Case	.000"-.008"	.000"-.008"	.000"-.008"	.000"-.008"	.000"-.008"	.000"-.008"
Side Pinion Axle—Diameter	3/4"	3/4"	3/4"	3/4"	3/4"	7/8"
Ring Gear & Pinion—Make & Type	Own—Hypoid	Own—Hypoid	Own—Hypoid	Own—Hypoid	Own—Hypoid	Own—Hypoid
Number of Teeth—Standard	49-12	49-11	49-11	51-13	49-12	41-9
Gear Ratio—Standard	4.083-1	4.454-1	4.454-1	3.923-1	4.083-1	4.555-1
Number of Teeth—Optional	——	49-12	——	——	——	——
Gear Ratio—Optional	——	4.083-1	——	——	——	——
Ring Gear—						
Ring Gear Riveted to Case	Yes	Yes	Yes	Yes	Yes	Yes
Ring Gear Diameter—Pitch	9.38	9.38	9.38	9.38	9.38	10
Drive Pinion—Type	Stem	Stem	Stem	Stem	Stem	Stem
Is Pinion Straddle Mounted	No	No	No	No	No	No
Pinion Adjustment—Fore & Aft.	Shims	Shims	Shims	Shims	Shims	Shims
Adjustment Gear & Pin. Backlash	Screw	Screw	Screw	Screw	Screw	Screw
Pinion & Ring Gear Backlash	.006"-.010"	.006"-.010"	.006"-.010"	.006"-.010"	.006"-.010"	.006"-.010"
Drive and Torque taken through	Torque Tube	Torque Tube	Torque Tube	Torque Tube	Torque Tube	Torque Tube
Oil Capacity	3#	3#	3#	3#	3#	4#
Oil Grade Recommended	S.A.E. 90 Hypoid for temperatures above minus 10 deg. F.; S.A.E. 80 Hypoid below 10 deg. F. Drain and refill every 10,000 miles or twice a year.					
Lubrication Drain	← Bolt at bottom of housing →		← Bolt at bottom of housing →		← Bolt at bottom of housing →	