SECTION 6-D

PROPELLER SHAFT

CONTENTS OF SECTION 6-D

6-10 DESCRIPTION OF PROPELLER SHAFT

Power is transmitted from the transmission output shaft to the differential by either one of two type propeller shaft assemblies: One type, used on synchromesh cars, consists of a solid piece of tubular steel; the second type incorporates torsional rubber dampers and is used with automatic transmission cars. On either type a universal joint and splined yoke is located at the transmission end, and a second universal joint is used at the differential end. See Figure 6-44.

Two U-bolt type clamps are used to attach the rear universal joint to the pinion flange at the differential. The front universal joint attaches to the output shaft of the transmission by means of a splined yoke which permits fore and aft movement of the propeller shaft as the rear axle assembly moves up and down. This splined yoke connection is lubricated internally with transmission lubricant. An oil seal at the transmission prevents loss of lubricant and protects the splined yoke from harmful foreign material.

The propeller shaft assembly requires very little periodic service. The universal joints are lubricated for life and cannot be lubricated while on the car. A

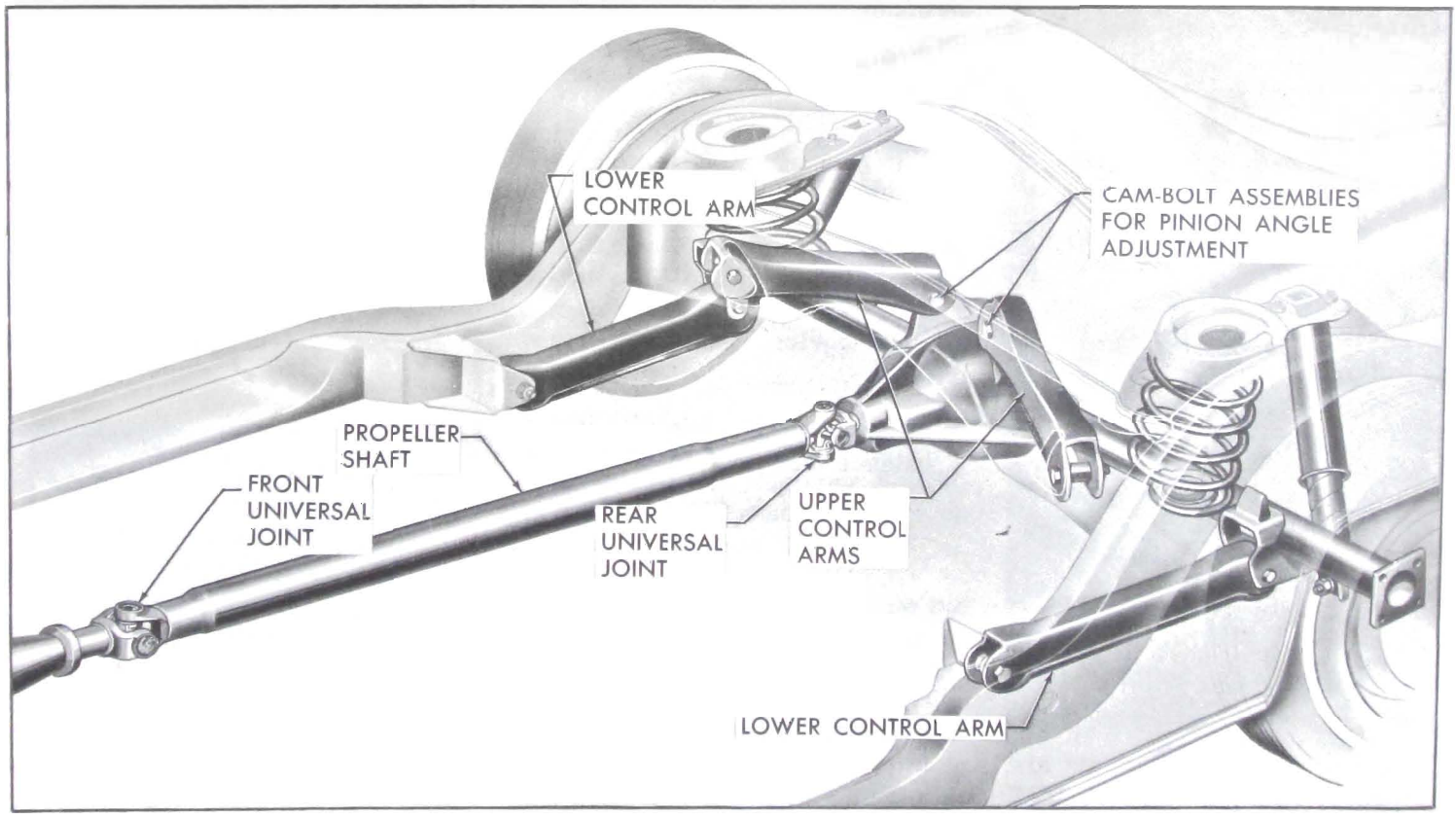


Figure 6-44—Propeller Shaft Assembly

service kit which consists of a spider with bearing assemblies and snap rings must be installed on the car if a universal joint becomes worn or noisy. If it becomes necessary to repair universal joint, the entire propeller shaft must be removed from the car. Care should be taken to avoid jamming or bending of any parts of the assembly.

If car is to be undercoated, propeller shaft must be kept completely free of undercoating material. Undercoating material or any other foreign material could upset the propeller shaft balance and produce serious vibration.

6-11 PROPELLER SHAFT TROUBLE DIAGNOSIS

COMPLAINT	POSSIBLE CAUSE	REMEDY
Shudder on acceleration low speed	Improperly adjusted rear joint angle	Check and adjust using Kent-Moore alignment gauge.
Roughness or vibration any speed	Bent or dented shaft	Replace
	Tight universal joints	Impact yokes with hammer to free up. Replace joint if unable to free up or if joint feels rough when rotated by hand. See Figure 6-51.
	Worn universal joints	Replace
	U-Joint retainer bent against bearing cup	Replace
	Undercoating on shaft	Clean up shaft
	Incorrect U-bolt torque	Check and correct - 15-18 ft. lbs.)
	Burrs or gouges on companion flange snap ring location surfaces	Replace companion flange if it can't be reworked
	Incorrect rear joint angle (usually too large an angle)	Check and adjust using Kent-Moore alignment gauge.
	Tire unbalance	Balance wheel and tire assembly or replace from known good car.
	Shaft or companion flange unbalance combination	1. Check for missing balance weights. 2. Remove and reassemble shaft to companion flange 180° from initial location. 3. Rebalance in car using (2) hose clamp method. See paragraph 6-18.
Roughness usually at low speeds, light load, 15-35 MPH	Improperly adjusted joint angles usually rear joint angle is too large.	Check and adjust rear joint angle using Kent-Moore alignment gauge.

6-11 PROPELLER SHAFT TROUBLE DIAGNOSIS (Cont'd.)

COMPLAINT	POSSIBLE CAUSE	CORRECTION
Roughness usually at low speeds, light load, 15-35 MPH (Cont'd)	U-bolt clamp nuts excessively tight.	Check and correct torque (12-15 lb. ft.)
Knock or click	Loose upper or lower control arm bushing bolts	Tighten bolts
Scrapping noise	Slinger on companion flange rubbing on rear axle carrier	Straighten out slinger to remove interference.

6-12 REMOVAL OF PROPELLER SHAFT

1. Remove U-bolt nuts and U-bolts from rear pinion flange. NOTE: If universal spider bearings are not retained on spider with connecting strap, use tape or wire to retain bearings. Mark propeller shaft and companion flange so that shaft can be re-installed in same position.

2. Remove entire propeller shaft assembly by sliding rearward to disengage splines on transmission main shaft.

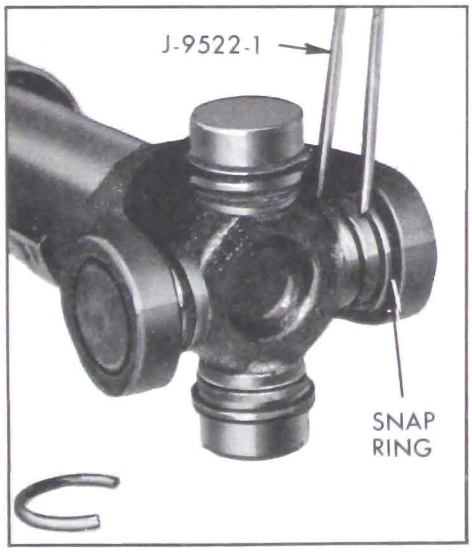


Figure 6-45—Removing Snap Rings From Propeller Shaft

6-13 DISASSEMBLY OF PROPELLER SHAFT

1. Remove snap rings from the bearings. The snap rings are on the inside of the yoke and can be removed with the aid of Tool J-9522-1. See Figure 6-45.

2. Set up J-6180-01 Power Ram and J-6207 Hydraulic Pump in preparation for removing the propeller shaft bearings. With this use Axle Bearing and Retainer Replacer J-8853 as a base plate. Attach Adapter J-9522-2 onto the ram screw. See Figure 6-46.

3. Position the propeller shaft universal joint into the fixture as set up in Step 2 with a bearing over the hole in Replacer J-8853. Install Spider Press J-9522-4 on spider. See Figure 6-46.

With tools in position actuate the pump and force the spider against the lower bearing, pushing the bearing as far out of the universal joint and through the hole in Tool J-8853 as possible.

4. Release the pump and remove the propeller shaft. Install Spacer J-9522-6 over the spider journal at the space provided with bearing forced partially through the yoke. See Figure 6-47. Reposition the propeller shaft in the fixture as before and force the bearing completely out of the yoke with the added assistance of the spacer.

5. Release pump and propeller

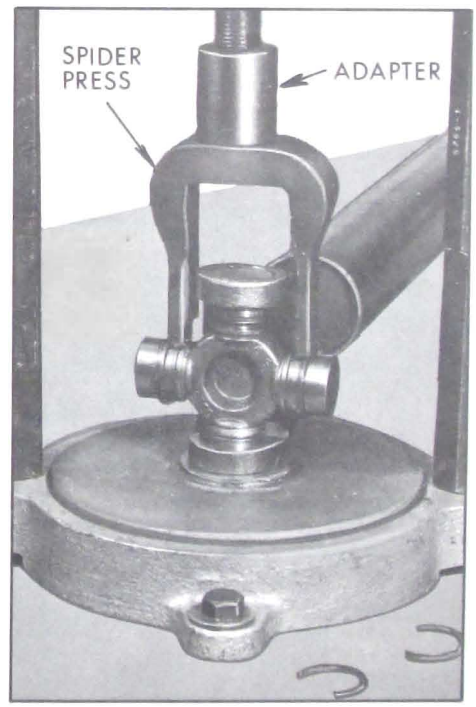


Figure 6-46—Pressing Out U-Joint Bearing

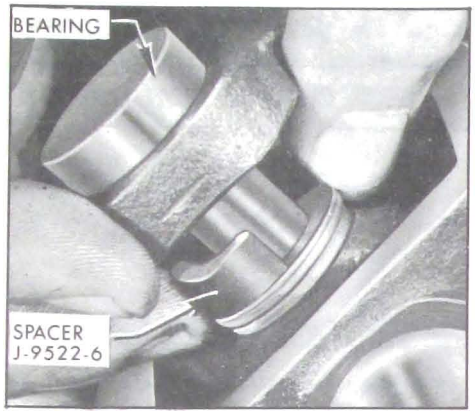


Figure 6-47—Installing Spacer

shaft. Install Guide J-9522-9 through the bearing hole in the yoke and over the journal end of the spider. See Figure 6-48. This guide assures alignment of the spider while removing the opposite bearing.

6. Install Spacer J-9522-6 adjacent to the bearing as in Step 4 and remove the bearing. See Figure 6-49.

7. Repeat Steps 3, 4, 5 and 6 to remove other bearings until the propeller shaft is disassembled to a point desired.

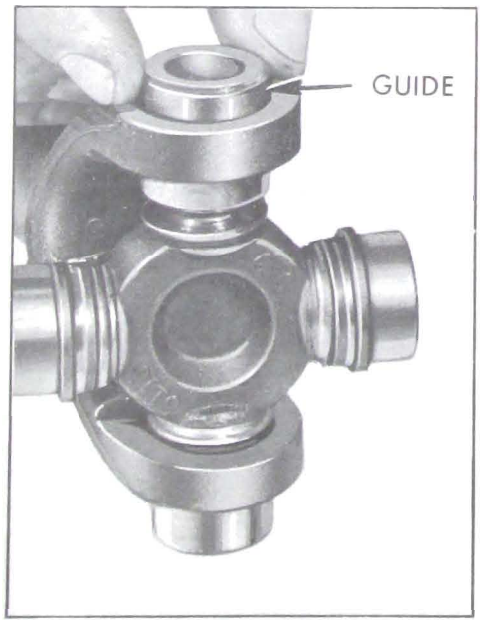


Figure 6-48—Installing Guide on U-Joint

8. Wash all parts in cleaning fluid. Inspect all bearings and races for wear; inspect splined yoke for wear and freedom from dirt. Replace any damaged parts.

6-14 ASSEMBLY OF PROPELLER SHAFT

When inspection indicates any worn or damaged universal joint parts, always install a complete universal joint repair kit. Repair kits are listed in the Buick Parts Book under Gr. 5.442 and include a spider, four bearings, and four snap rings.

1. Position the new spider inside the yoke; it may face either direction. Make certain that the spider dust shields are not damaged upon installation.

2. Make certain that the bearings have a full set of rollers, are packed with lubricant, and that the seals are in position. Multipurpose Universal Joint bearing grease #2 grade should be added to bearings if they might be dry, although new bearings are normally pre-lubricated as received from the source.

Place the assembly in position with Power Ram J-6180 and Pump J-6207 as shown in Figure 6-50. Position the bearing straight over the hole in the yoke. Carefully pull up the spider so that the spider journal enters the loose bearing. With the pump, force the bearing into the yoke continuing to hold the spider up in this bearing. Failure to do this could cause the bearing needles to become dislodged if the journal was engaged incorrectly.

When the bearing is correctly positioned in the yoke turn the assembly over. Again place the bearing over the hole in the yoke. Carefully slide the spider partially out of the previously seated bearing and start it carefully into

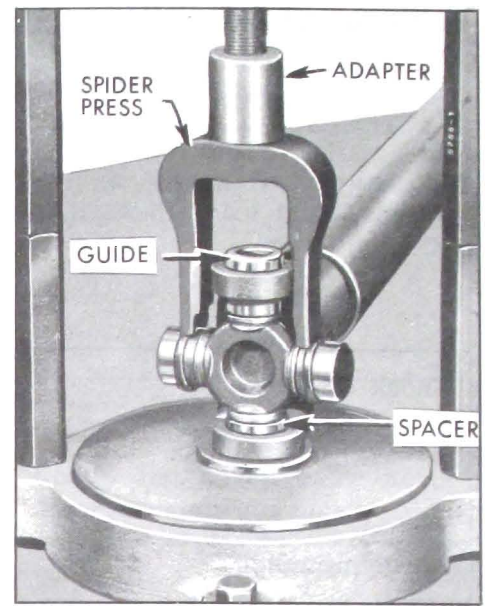


Figure 6-49—Removing Bearing With Guide and Spacer in Place

the bearing being installed. This is to prevent the needles from the bearing from burring the edge of the spider journal if forced over this journal other than straight. Even slight burring of the journal can cause premature failure.

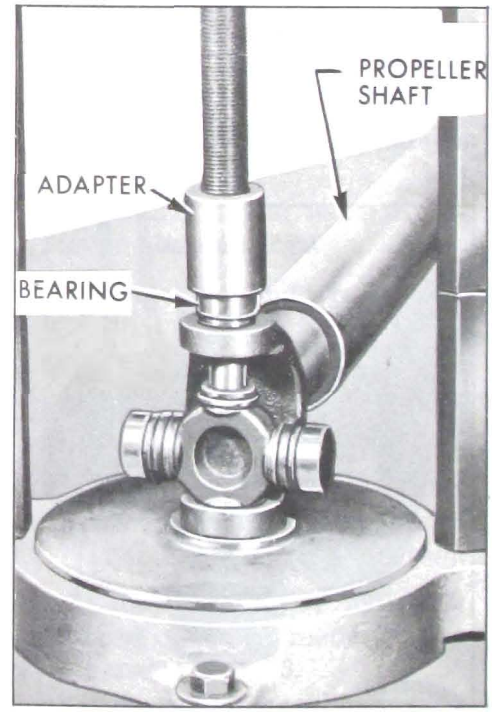


Figure 6-50—Pressing Bearing Into Place

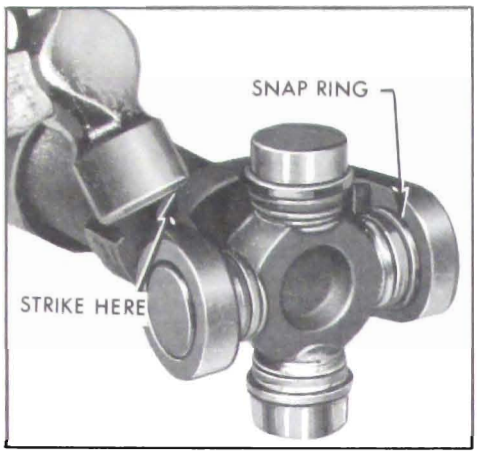


Figure 6-51—Seating U-Joint Snap Rings

While pressing bearings into position, move the spider back and forth to make certain that the spider journals engage the bearings squarely to avoid damage and binding. If binding exists, remove the bearings and spider and examine for dislodged rollers or damaged journals.

3. Install the balance of the bearings necessary to complete the assembly, observing the previous precautions, and install snap rings.

4. Strike the yoke with a hammer to fully seat the snap rings against the yoke. Turn the spider to make certain that it is free. See Figure 6-51.

6-15 INSTALLATION OF PROPELLER SHAFT ASSEMBLY

1. Apply engine oil to splined propeller shaft yoke, and then slide yoke and propeller shaft assembly onto transmission output shaft.

2. Position rear universal joint to rear axle pinion flange. Make certain spider bearings are properly aligned in pinion flange yoke. Use marks made prior to shaft removal to align shaft with companion flange.

3. Install U-bolts, lock washers, and nuts; torque nuts evenly to 12-15 ft. lbs. See Figure 6-52.

6-16 ADJUSTMENT OF REAR UNIVERSAL JOINT ANGLE

When torque is transmitted through any ordinary universal joint, the driven yoke fluctuates slightly in speed. In other words, although the driving yoke rotates at a constant speed, the driven yoke speeds-up and slows-down twice per revolution. This fluctuation of the driven yoke is in direct proportion to the angle through which the universal joint is operating; the greater the angle, the greater the fluctuation.

Whenever two universal joints are used, this fluctuation effect can be eliminated by staggering the joints so that the two driving yokes are 90° apart provided the two joints are transmitting torque through the same angle.

Therefore, when two universal joints are used, the angles through which they operate must be very nearly the same. This allows the alternate acceleration and deceleration of one joint to be offset by the alternate deceleration and acceleration of the second joint. When the two joints do not run at approximately the same angle, operation is rough and an objectionable vibration is produced.

In addition, universal joints are designed to operate safely and efficiently within certain angles. If the designed angle is exceeded, the joint may be broken or otherwise damaged.

The front universal joint angle is actually the angle between the engine-transmission centerline and the propeller shaft. This angle is determined by the design of the body assembly. Since this angle is not liable to change with use, no method has been established for adjusting this front joint angle.

The rear universal joint angle is carefully adjusted to specifications at the factory. This adjustment is made possible by cam bolts located in slotted holes at the rearward ends of each upper control arm. Rotating the cam bolts causes the upper axle brackets to move forward or backward in the slotted upper control arm holes. This forward or backward movement rotates the entire axle assembly which in turn causes the pinion flange and universal joint to move up or down. This vertical movement allows the pinion angle to be adjusted as required. See Figures 6-44 and 54.

If any irregular roughness or vibration is detectable in the drive line, the rear universal joint angle should be checked. Also, if a car is involved in a severe rear end collision, or if the rear axle housing or upper control arms are replaced, the rear universal joint angle should be checked and corrected if necessary.

Since it is very difficult to measure rear universal joint angle using a bubble protractor, a simple method has been developed using a spring-loaded steel cable stretched between the front of the chassis and the rear axle carrier. When the rear universal joint angle is adjusted correctly, this

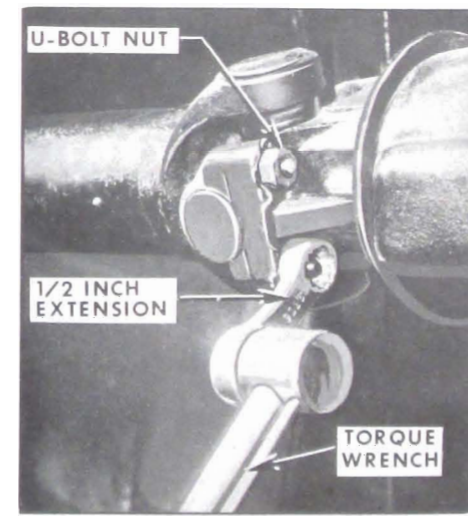


Figure 6-52—Using Extension to Torque U-Bolt Clamps

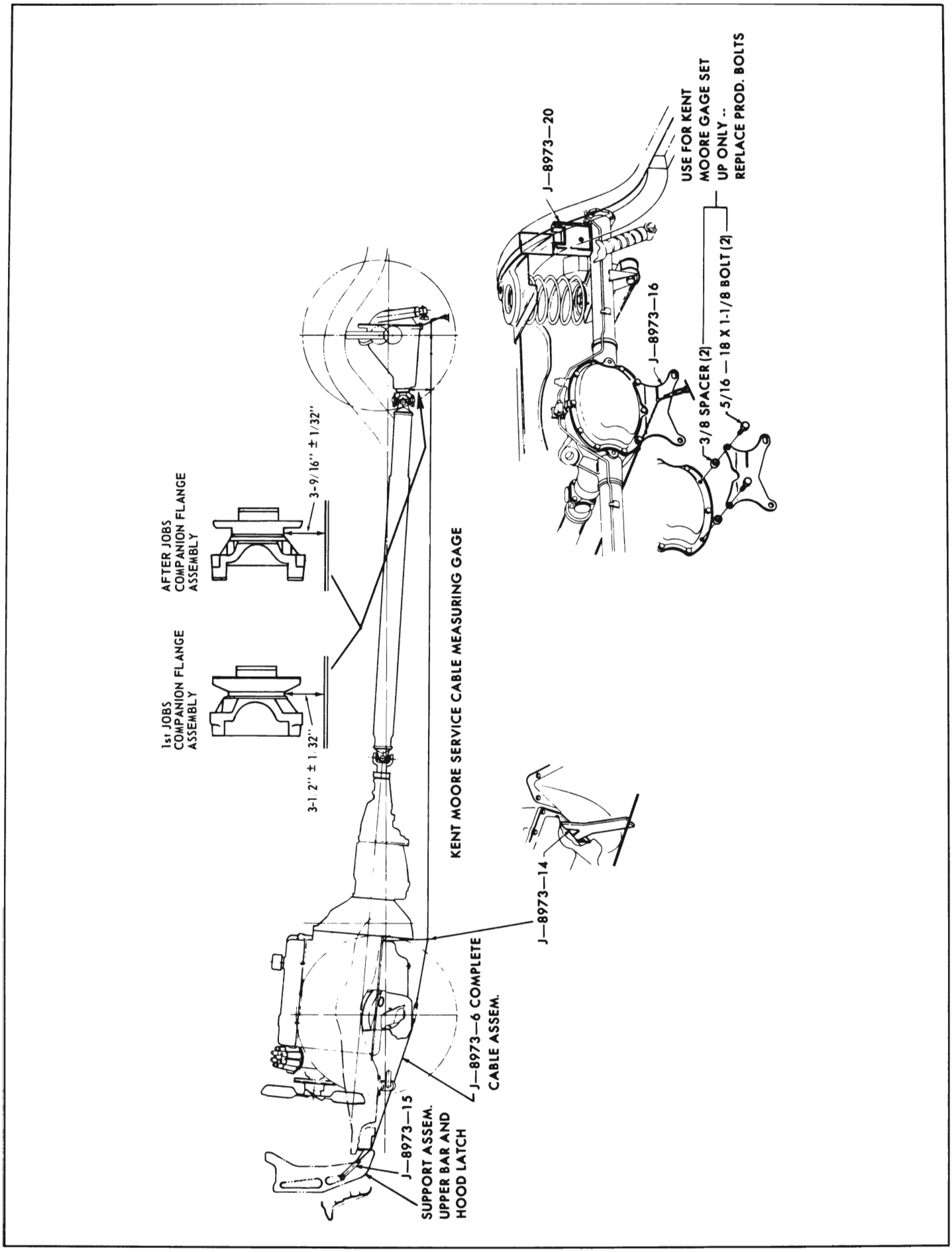


Figure 6-53—Checking Rear Universal Joint Angle

steel cable will clear the underside of the pinion flange by a definite amount. Therefore, if this single direct measurement is within specified limits, the rear universal joint angle is correct; if this measurement is out of limits, the joint angle is not correct.

Rear universal joint angle is checked using Alignment Set J-8973. This set also contains two pieces, J-8973-22 and J-8973-23 which are used for front end alignment only.

The spacer blocks in the set are designed to raise the rear of the car above normal trim height. Use of these blocks makes certain that the rear universal joint angle will be checked at a predetermined trim height. These blocks must be used since rear universal joint reading varies at different trim heights and the only reference dimension given is for the particular height block supplied.

The front end of the cable is equipped with two attaching brackets so that the cable may be used on all series 1964 Buicks. The rear end of the cable has stops attached at various points to allow the cable to be placed in tension on all wheelbase Buicks.

Check and adjust rear universal joint angle using the following procedure:

If the work is to be done with the aid of a hoist, a drive-on hoist is preferable. A frame contact lift hoist cannot be used because alignment spacers must be inserted between the axle tubes and the frame.

1. With car on hoist, raise rear of car and position spacer blocks with tips up so that they contact frame just ahead of rubber bumper; bottom of block should be parallel to axle. Hold blocks up against frame and allow car to settle until axle housing contacts block. NOTE: Use same blocks for Estate Wagons and Sedans. See Figure 6-53.

2. Remove differential cover bolt on either side of lowest cover bolt. Using two 5/16-18 x 1-1/8 bolts with 3/8" spacers, attach rear Bracket J-8973-16 so that slotted lower portion extends rearward at about a 45° angle.

3. Engage front attaching Bracket J-8973-15 in lower opening of vertical center support assembly located at front of radiator. Hook bracket into bottom of opening. See Figure 6-53.

4. Place Engine Height Plate J-8973-14 so that the upper end bears against the engine oil pan between the two rear oil pan bolts. See Figure 6-53. Place the cable in notch of height plate, pull cable tight and hook into rear bracket so one of the stops on the cable is to the rear of the bracket slot. It is important that the cable is fully in the slot and is taut and free of kinks.

5. Measure perpendicular distance from cable to surface immediately in front of slinger on rear pinion flange. The correct dimension is given in Figure 6-53.

6. If the distance measured in the preceding step is not within tolerances, adjust as follows: Loosen nuts retaining cam bolts which are located at rearward ends of each upper control arm. Turn both loosened cam bolts an equal amount to move rear universal joint up or down. When universal joint is positioned to give the proper vertical dimension on Alignment Set J-8973, tighten nuts and torque to 60-85 ft. lbs. See Figures 6-53 and 54.

7. Remove height rod, cable, bracket and spacer blocks. Reinstall differential cover bolts. Torque to 25-35 ft. lbs.

6-17 CHECKING PROPELLER SHAFT RUN-OUT

If there is noise or vibration at high speed which might be caused by a bent shaft (par. 6-11), or if

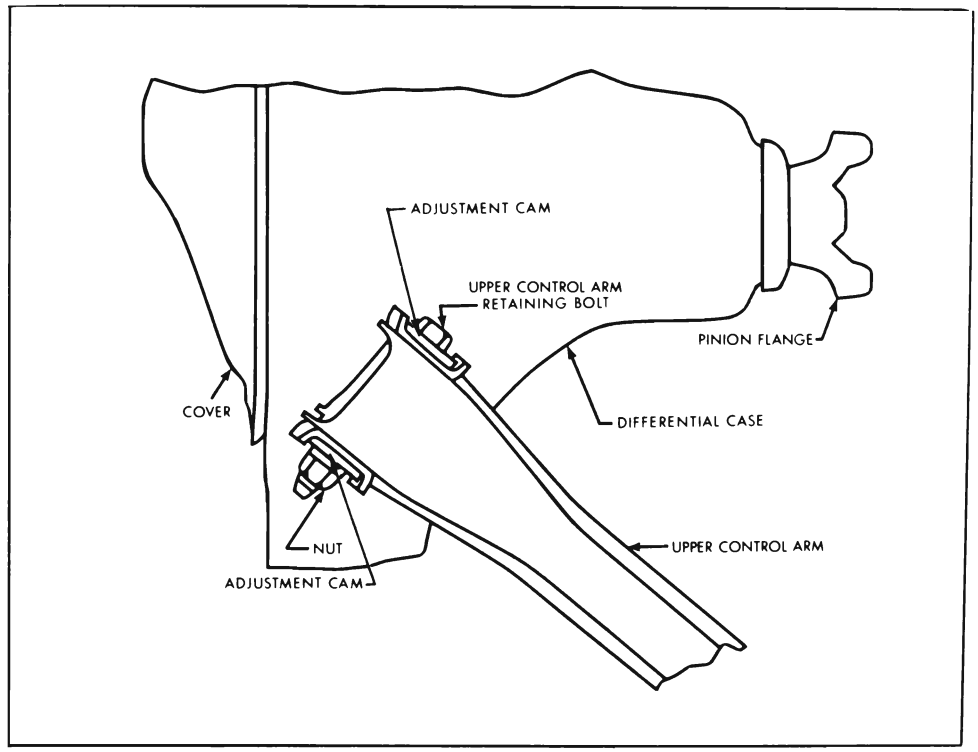


Figure 6-54—Upper Control Arm Cam Bolt Adjustment Assembly

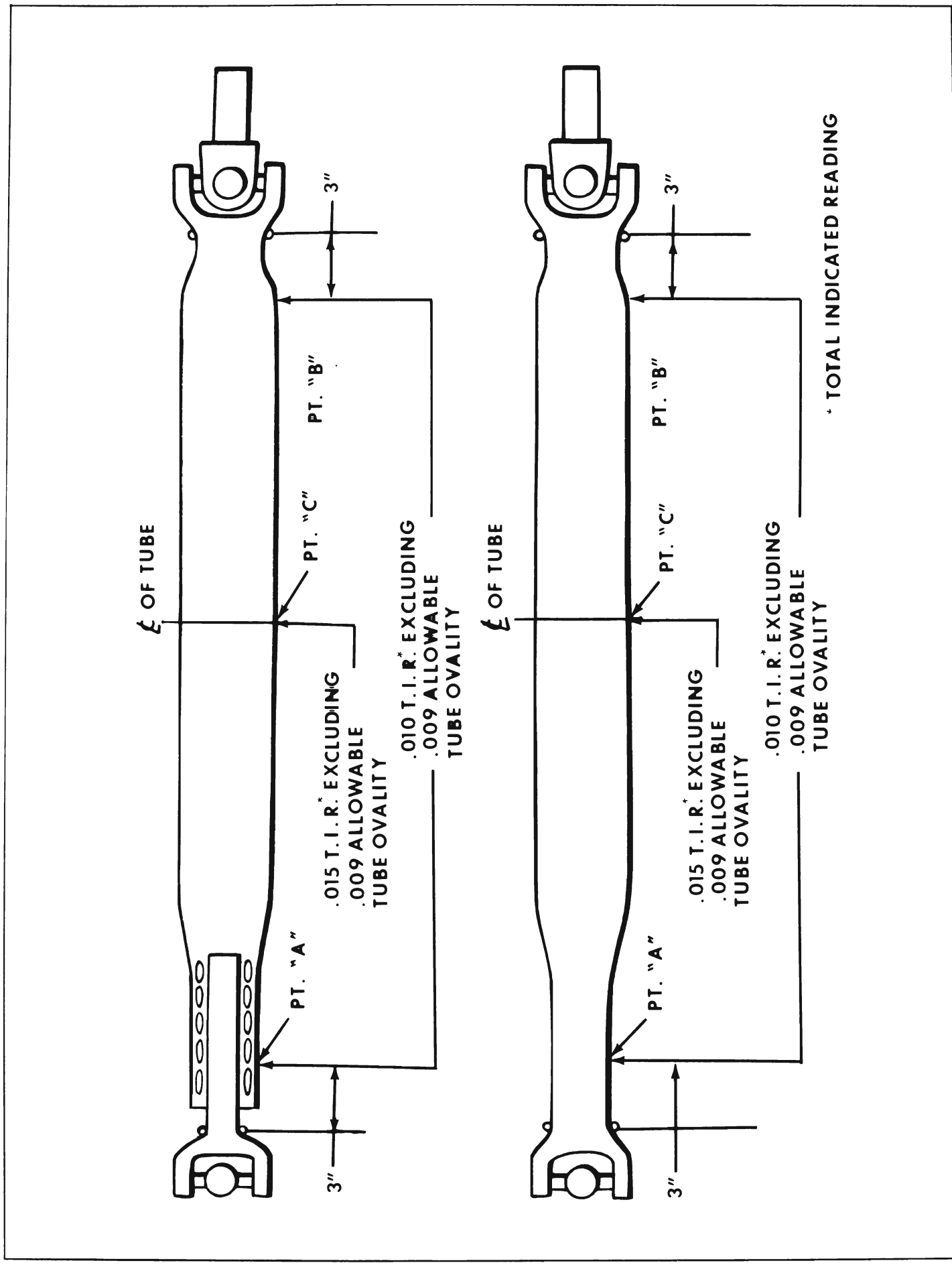


Figure 6-55—Propeller Shaft Run-Out Specifications

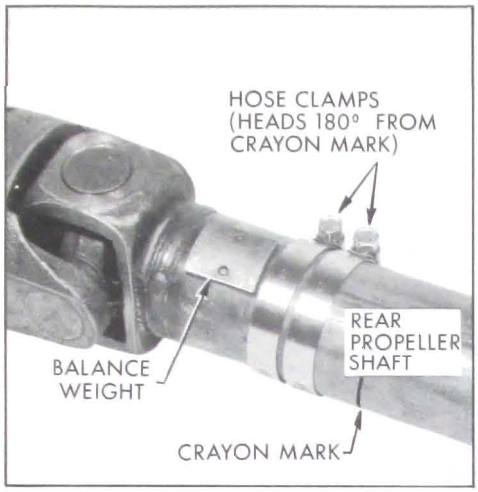


Figure 6-56—Hose Clamps in Position With Heads Opposite Crayon Mark

shaft has been damaged through rough handling or a collision, it may be checked for straightness as follows:

1. Raise car on a twin post hoist so that rear of car is supported on rear axle housing with wheels free to rotate.

2. Mount a dial indicator on a movable support that is high enough to permit contact of indicator contact button with propeller shaft. Readings are to be taken at points indicated in Figure 6-55.

3. With transmission in neutral, check for run-out by having a second person turn rear wheel so that propeller shaft will rotate. At points "A" and "B" run-out should not exceed .010. At point "C" run-out should not exceed .015". Care must be taken not to include indicator variation caused by ridges, flat spots, or other variations of the tube.

4. If run-out exceeds specifications because the propeller shaft is bent, it is probably more economical to replace propeller shaft than to attempt straightening it. However, if run-out is within specifications and noise or vibration problem exists, see paragraph 6-18 for propeller shaft corrective balancing procedure.

6-18 PROPELLER SHAFT BALANCING PROCEDURE

1. Place car on a twin post hoist so that rear of car is supported on rear axle housing with wheels free to rotate.

2. A car is normally more sensitive to excessive unbalance at the rear so that checking should begin at the rearward end of propeller shaft. Therefore, locate the heavy side of propeller shaft by holding crayon or colored pencil close to rearward end of shaft while shaft is rotating (speedometer indicating 40-50 MPH). Carefully bring crayon up until it just contacts rotating shaft. If carefully done, only the heavy side (point of maximum run-out) will be marked by crayon. This normally gives a good indication of which side of shaft is heavy for unbalance and indicates a starting point for initial location of clamps.

3. Install two Whittek #28 hose clamps (Gr. 1.166, Part #1351813) on propeller shaft as shown in Figure 6-56. Position each clamp with heads 180° from crayon marking. Tighten clamps.

4. Run the car through the speed range to 65 - 70 MPH. If no unbalance is felt, nothing further need be done on the hoist. However, if unbalance still exists,

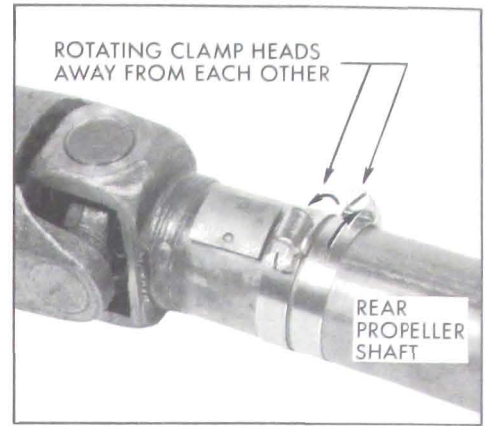


Figure 6-57—Rotating Hose Clamp Heads From Each Other

rotate both clamps to the opposite side of the shaft and retighten. Run car again and notice if the unbalance feel is better or worse; if worse, return the clamps to the original position. Apparently the combined weight of the two hose clamp heads was excessive, so to reduce this excess, rotate the clamp heads away from each other 45° (one each way from the original position). See Figure 6-57. Run car and note if unbalance has improved.

5. Continue to rotate the clamps apart in smaller angular increments until the car feel for unbalance is best.

CAUTION: Do not run car on hoist for extended periods due to danger of overheating the transmission or engine.

6. Roadtest the car again for final check of balance.

NOTE: Slight vibration felt in the car on the hoist may not show up in a roadtest which is after all the final determining factor.


J-9522-1


J-8853


J-9522-4


J-9522-6

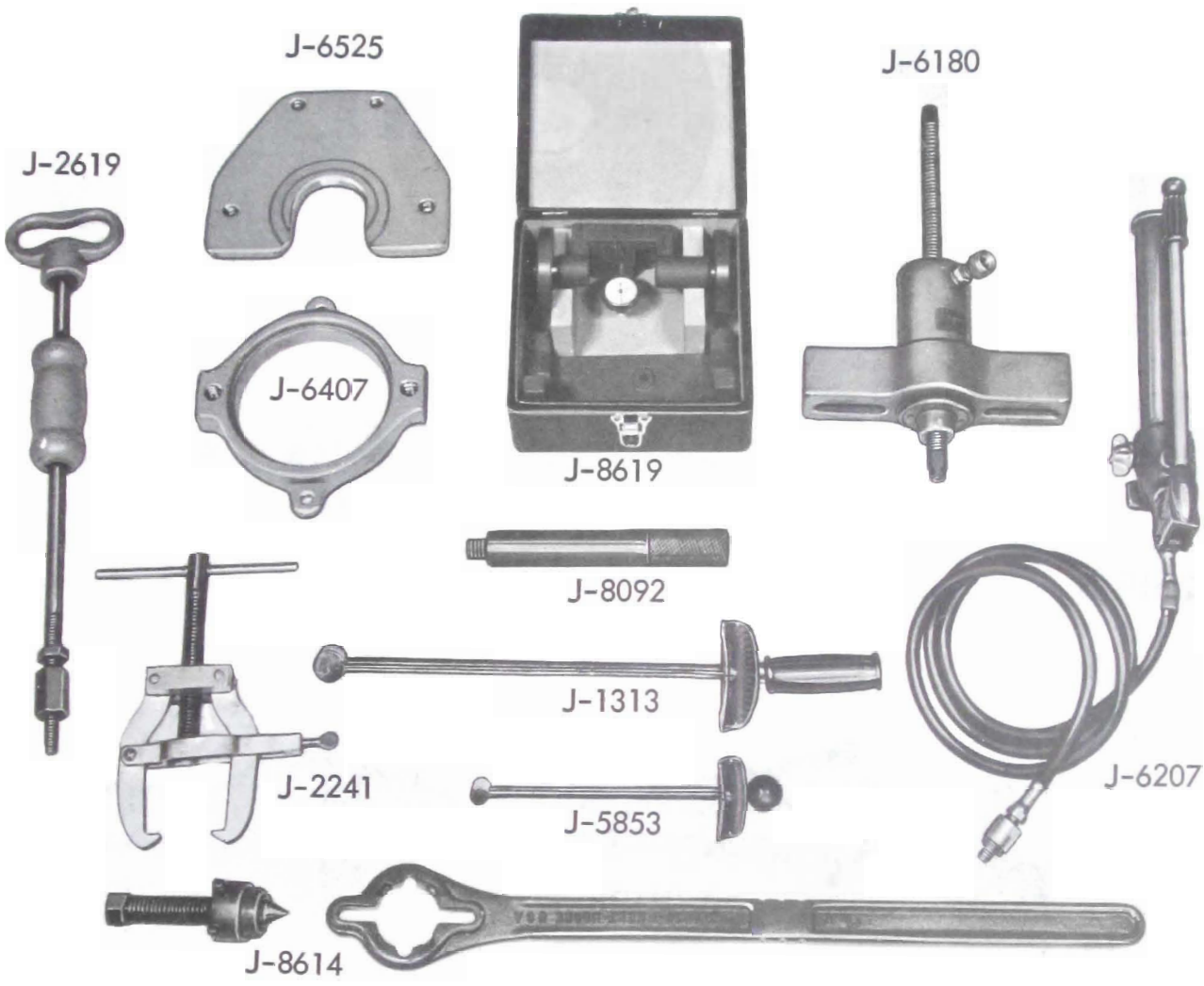

J-9522-9


J-9522-2

Propeller Shaft Tools

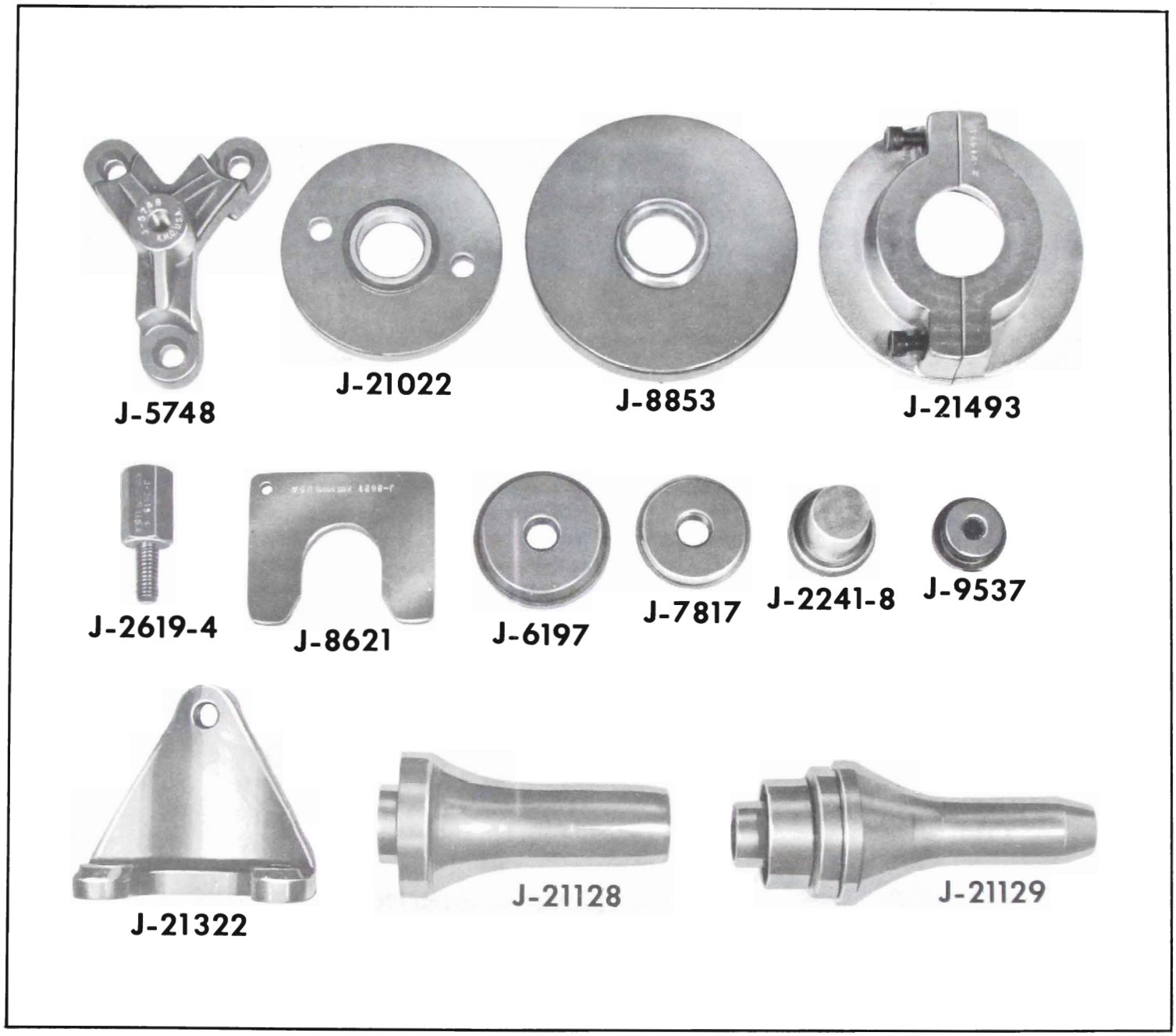
J-8853	Axle Bearing & Bearing Retainer Replacer
J-9522-1	Snap Ring Remover
J-9522-2	Power Ram Adapter
J-9522-4	Spider Press
J-9522-6	Bearing Spacer
J-9522-9	Bearing Guide

Figure 6-58—Propeller



J-1313 Torque Wrench (0 - 150 ft. lb.)
J-2241 Side Carrier Bearing Puller
J-2619 Slide Hammer
J-5853 Torque Wrench (0 100 in. lb.)
J-6180 12 Ton Power Ram
J-6207 Hydraulic Pump
J-6407 Press Plate Holder
J-6525 Axle Shaft Bearing Remover
J-8092 Driver Handle
J-8614 Companion Flange Holder and Puller
J-8619 Pinion Setting Gauge

Figure 6-59—Rear Axle Tools



Rear Axle Tools (Group 2)

J-5748	Axle Shaft Remover
J-6197	Rear Pinion Bearing & Race Installer
J-7817	Front Pinion Bearing & Outer Race Installer
J-8621	Axle Shaft Bearing Puller Plate
J-8853	Axle Shaft Retainer & Ring Installer
J-9537	Side Bearing Puller Support
J-21022	Rear Pinion Bearing Installer
J-21128	Pinion Oil Seal Installer
J-21129	Axle Shaft Oil Seal Installer
J-21322	Differential Case Remover
J-21493	Rear Pinion Bearing Remover
J-2241-8	Differential Side Bearing Installer
J-2619-4	Ram Screw Adapter

Figure 6-60—Rear Axle Tools (Group 2)