

Rear Axle

The rear axle is of the semi-floating type with hypoid final drive gears. The bevel gear ratio is 4.875 to 1 (8/39).

AXLE SHAFTS

Removal and Installation.

Take down the axle shafts as follows.

Jack up the car and remove the wheel, then slide off the cotter pin and back out the hub and axle shaft lock nut.

For more ease in this step apply the brakes to lock the wheel hub.

Insert tool **A. 47048** as shown in fig. 65, setting a washer between the axle end and the reaction screw of tool.

Depress the brake pedal and at the same time work on the reaction screw of tool till the hub starts out.

Remove the brake caliper by backing out its mounting screws from carrier plate.

Withdraw the wheel hub as shown in fig. 66.

Remove the caliper carrier plate-to-rear axle screws.

Pull the axle shaft using puller **A. 47017** equipped with item /3.

Install the axle shafts in reverse order to removal and tighten the lock nut with 43.4 ft.lbs (6 kgm) of torque.

The caliper carrier plate mounting screws to rear axle must be drawn up with 43.4 ft.lbs (6 kgm) of torque and the caliper mounting screws to carrier plate must be torqued to 72.3 ft.lbs (10 kgm).

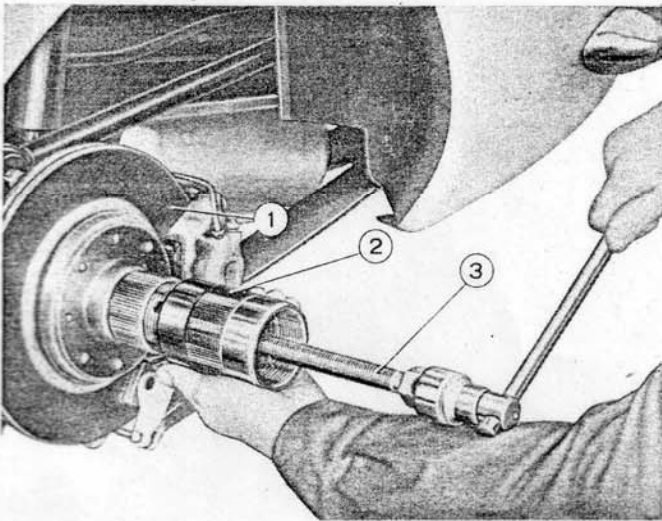


Fig. 65. - Pulling the rear wheel hub.

1. Wheel hub and brake disc - 2. Tool A. 47048 - 3. Tool reaction screw.

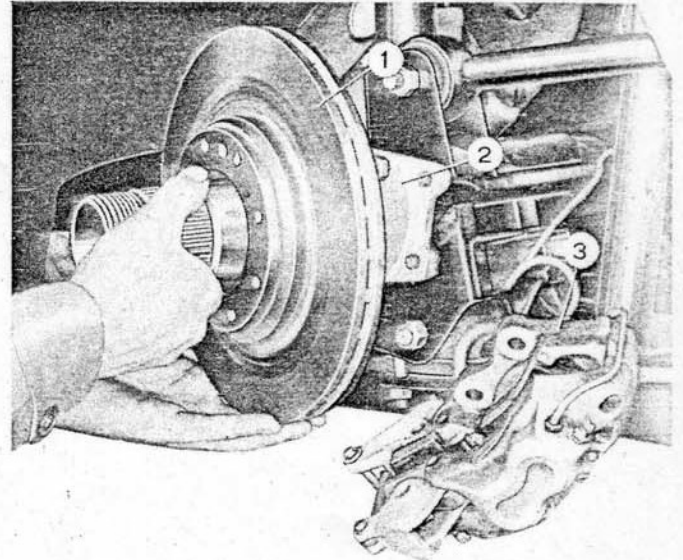


Fig. 66. - Removing rear wheel hub.

1. Wheel hub and brake disc - 2. Axle shaft bearing and brake caliper carrier plate - 3. Brake caliper.

NOTE - The axle shaft bearing is raised from its housing in rear axle and, when fitted in place, the bearing should show a clearance of .0000" to .0047" (0 to 0.12 mm) to its shoulder face on housing (fig. 68). Correct clearance is obtained with a shim (5, fig. 68) situated between bearing and caliper carrier plate.

This shim comes in the following thicknesses: .0591"-.0598"-.0606"-.0614"-.0622"-.0630"-.0638"-.0646"-.0653"-.0661"-.0669" (1.50-1.52-1.54-1.56-1.58-1.60-1.62-1.64-1.66-1.68-1.70 mm).

Inspection and Repair.

Check the ball bearing for soundness and no excessive side or end play, otherwise noisiness may result.

Using a feeler gauge, check that both the ball bearing (7, fig. 68) and the lock nut (2) have not slid out of place on axle shaft. The ball bearing should closely adhere to the raised stop on shaft and the lock nut should shoulder the bearing.

The bearing is installed on the arbor press as well as the lock nut, which must be pre-heated.

In view of above conditions, removal and installation of axle shaft assemblies must be made only if recommended tool equipment is available.

Therefore, should any component of axle shaft assembly need replacement, apply to a FIAT service workshop equipped with specific facilities or renew the whole assembly.

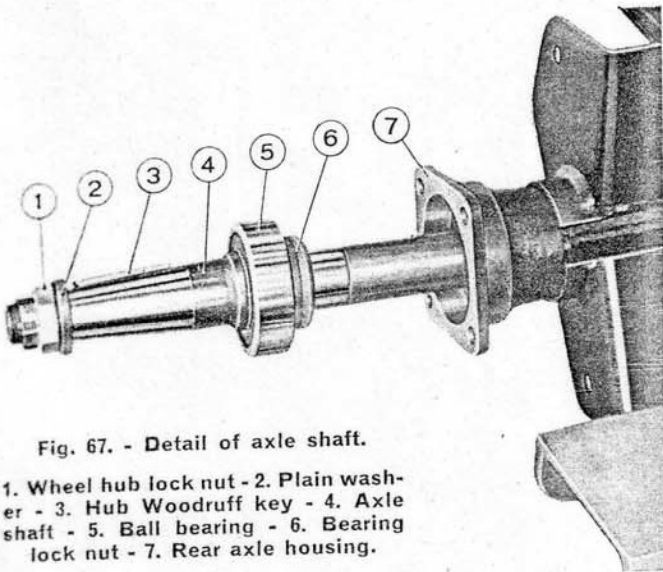


Fig. 67. - Detail of axle shaft.

- 1. Wheel hub lock nut - 2. Plain washer - 3. Hub Woodruff key - 4. Axle shaft - 5. Ball bearing - 6. Bearing lock nut - 7. Rear axle housing.

To check on the tightness of axle shaft lock nut, place the assembly on fixture **A. 95601** and fasten the nut with the fixture clamp.

Touch a dial indicator to the end of axle shaft and set it at zero.

With a torque wrench, apply a torque of 57.9 to 61.5 ft.lbs (8 to 8.5 kgm).

No clearance must be found, in such conditions, between the lock ring and bearing cone.

Relieve the shaft and check that the indicator needle has shifted back to zero to be sure that the lock nut has not spun about the shaft.

Should the indicator needle fail to return to zero, this is an indication that the lock nut has moved out of place on the shaft and replacement of the assembly is required.

Removal and Installation of Rear Axle.

To remove the rear axle proceed as follows:

- jack up the car at rear and remove wheels;
- disconnect the manual brake cable from brake calipers;
- remove reaction struts and shock absorbers from rear axle;
- disconnect the propeller shaft from bevel pinion flanged sleeve;
- disconnect the pressure regulator link at joint on rear axle;
- disconnect the brake fluid hose from « T » connector on rear axle and plug up the hose to avoid fluid losses;
- remove the semi-elliptic spring mounting bracket nuts to rear axle;
- disconnect the semi-elliptic spring at front from body mounting bracket and remove the rear axle assembly.

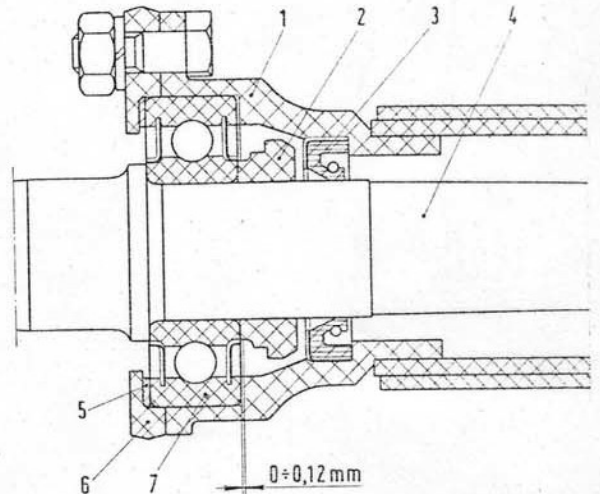


Fig. 68. - Scrap view of rear axle housing and axle shaft bearing side section.

- 1. Axle housing - 2. Bearing lock nut - 3. Oil seal - 4. Axle shaft - 5. Shoulder ring - 6. Bearing and brake caliper carrier plate - 7. Ball bearing.

$$0 \pm 0,12 = 0'' \text{ to } .0047''$$

For installation, reverse the removal procedure recalling that the hydraulic lines should be bled as the ultimate operation.

DIFFERENTIAL UNIT

The FIAT-Dino differential is of the spin resistant type.

This differential, in addition to showing the advantages of the conventional type, incorporates a device which, with any car speed or road condition, chooses the best drive torque to be distributed to the wheels.

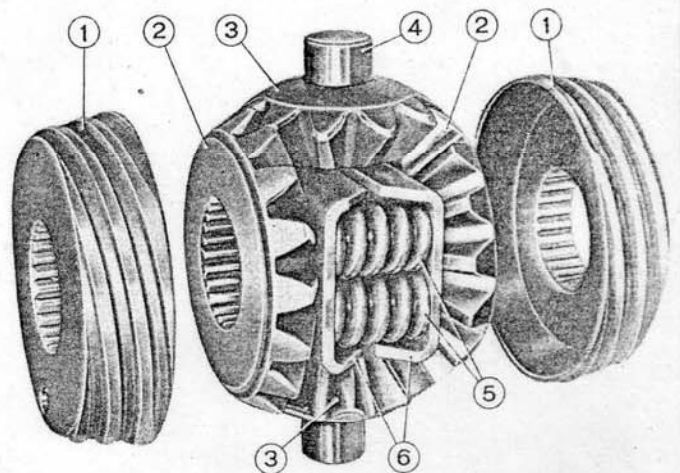


Fig. 69. - Differential cage gears.

- 1. Friction cones - 2. Side gears - 3. Pinion gears - 4. Pinion shaft - 5. Friction cone pre-load springs - 6. Spring seating plates.

The spin-resistant device consists (figs. 69 and 71) of a pair of friction cones loaded by four springs and housed in the differential cage outside side gears.

Friction cones in differential cage generate an opposing force to the action of differential, so to ensure an adequate traction power when either driving wheel shows an extremely low traction strength.

It means that, when a torque is applied to the axle, the initial load of springs on friction cones is boosted by inherent forces due to the separation of side gears from pinion gears, with the result that the resistance in differential augments gradually.

This is an automatic device and therefore there will be a greater counteraction to differential as the drive torque increases.

In other words, when either driving wheel shows torque in a conventional differential, the traction power, too, will be nil. Conversely, with the **spin-resistant** differential, if no drive torque is applied to one wheel, the other wheel, thanks to the action of locking device, will show a torque amounting to 25% of maximum effective torque and a quarter of traction force is thus available to drive the car.

In the following text are outlined some conditions in which outstanding advantages are obtained from **spin-resistant** differential.

On bad roads it may happen that one driving wheel rebounds clear of the ground; hence it will revolve faster than the other wheel footing on surface.

In the **spin-resistant** differential the speed at both wheels is the same, thus doing away with any bounces and skids of the car; also the shocks on axle are reduced extensively.

Braking a car with the driving wheels on an uneven surface may endanger the steering control of the driver.

In such conditions the **spin-resistant** differential prevents skidding inasmuch as no wheel can be locked before the other and a remarkable improvement in the braking is thus obtained.

When cornering at high speed, load transfer toward the outer wheel entails lesser hold for the inner wheel with consequent loss of power for both driving wheels.

The **spin-resistant** differential corrects this condition by delivering more power to the outer wheel than the inner wheel so that car stability is improved.

The breakage of an axle shaft usually strands over the car.

Thanks to the **spin-resistant** differential, all the engine torque is directed to the active wheel and the car can be safely driven to the nearest service workshop.

Checking the Spin-Resistant Device.

To check on the efficiency of the differential spin-resistant device proceed as follows.

With transmission in neutral, jack-up either rear wheel and take it down.

Fit a torque wrench to the hub nut and have the

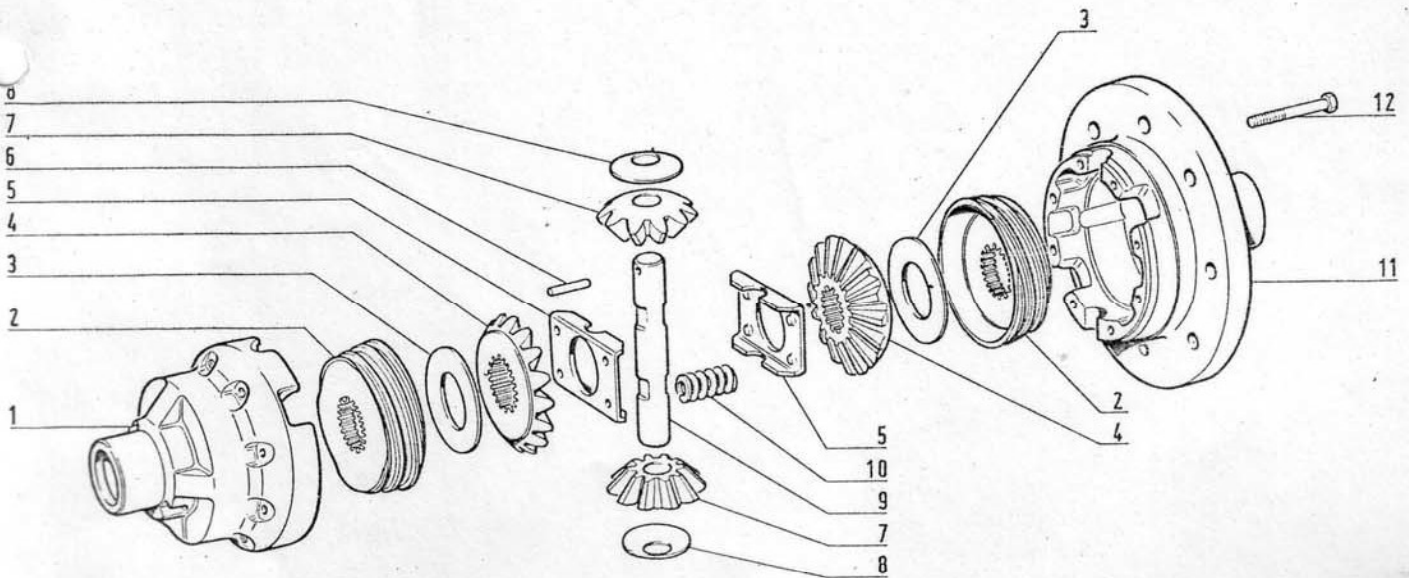


Fig. 70. - Exploded view of differential cage assembly.

1. L. H. cage - 2. Friction cones - 3. Friction cone washers (if any) - 4. Side gears - 5. Spring seating plates - 6. Pinion shaft lock pin - 7. Pinion gears - 8. Pinion gear backing washers - 9. Pinion shaft - 10. Friction cone pre-load spring - 11. R. H. cage - 12. Cage retaining screw.

axle shaft turn in the direction of running: the starting torque should not be less than 43.4 to 65.3 (6 to 9 kgm).

Any operation noises in the differential assembly are most probably caused by an improper grade of the oil in the case.

It is therefore imperative that the rear axle oil used is of the recommended grade: FIAT W 90/DA (SAE 90 EP).

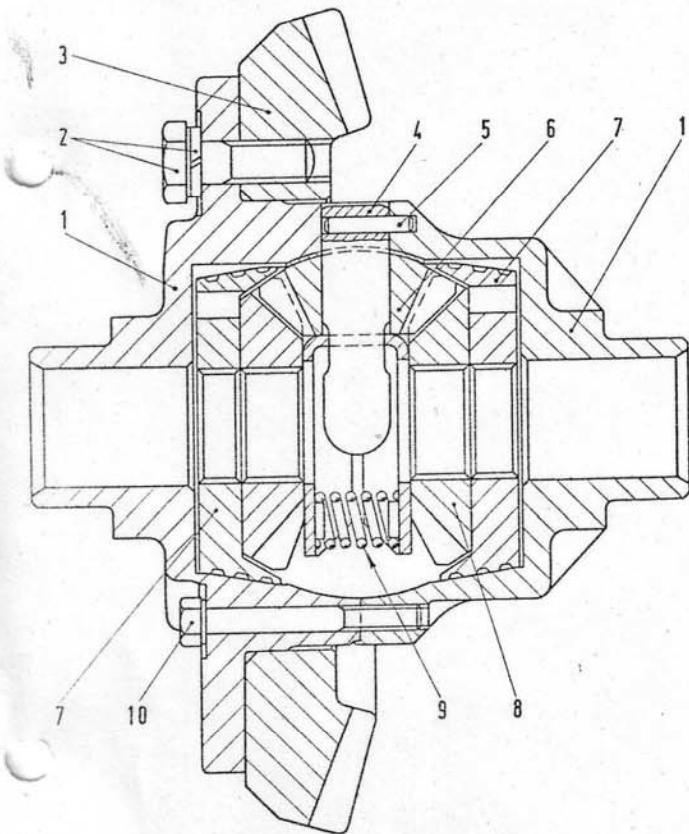


Fig. 71. - Section through differential cage assembly.

- 1. Cage halves - 2. Ring gear screw and washer - 3. Ring gear - 4. Pinion shaft - 5. Pinion shaft lock pin - 6. Pinion gear - 7. Friction cones - 8. Side gear - 9. Friction cone pre-load spring - 10. Differential cage retaining screw.

If the oil grade is correct, noise can be diagnosed as in conventional differentials.

Checking and Servicing the Differential Cage.

Disassemble the differential cage and chalk up the friction cones and shimming washers (if any), because irregular operation of the assembly may be experienced if these items are upset on reassembly.

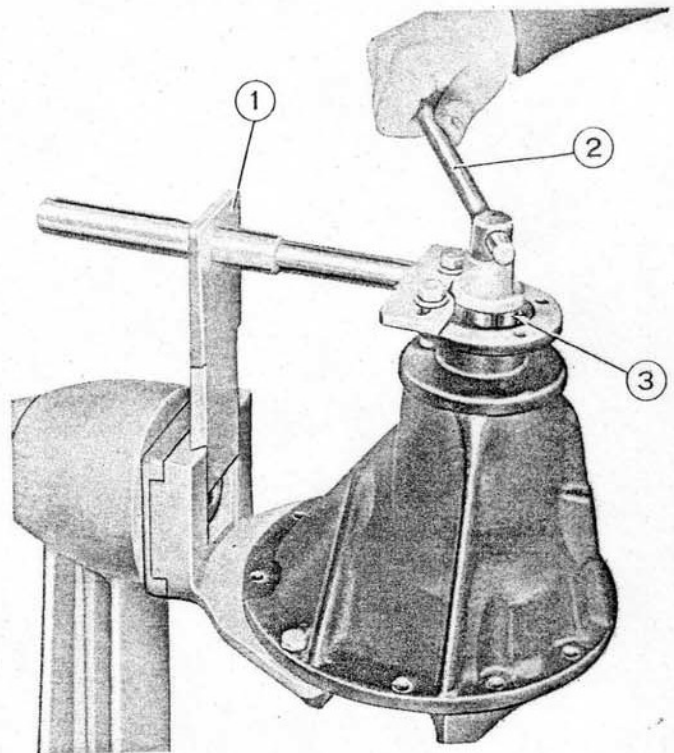


Fig. 72. - Removing bevel pinion nut.

- 1. Tool Arr. 22206/4 A - 2. Pinion nut wrench - 4. Bevel pinion nut.

Check as follows:

- friction cone seats in cage should be thoroughly smooth and free of deep notches; light scores can be tolerated;
- contact faces of helical splines in cones should be in the same condition as the faces in cage;
- in case damage or excessive wear are found in above faces, renew both parts recalling that cage halves are supplied for replacement in matched sets with friction cones and shimming washers; also, exchange of cones is not permitted.

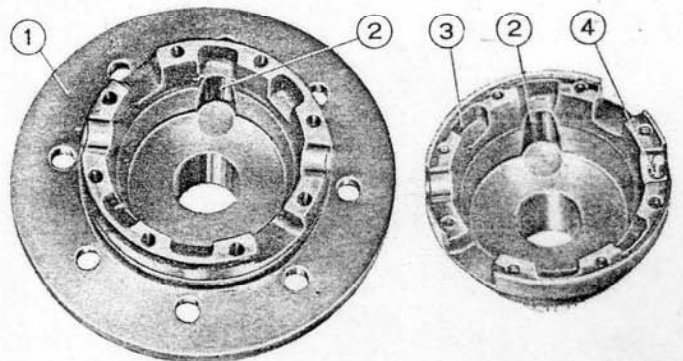


Fig. 73. - Differential cage halves.

- 1. R. H. cage half - 2. Gear oil wells - 3. L. H. cage half - 4. Pinion shaft lockpin.

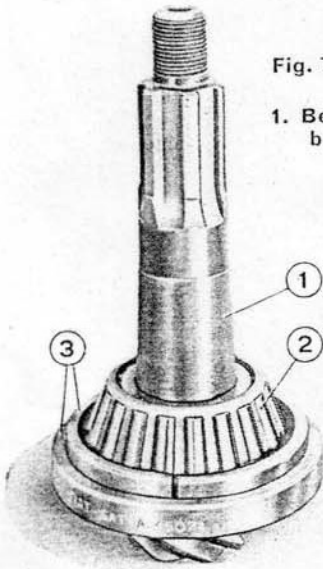


Fig. 74. - Bevel pinion bearing remover in position.

1. Bevel pinion and shaft - 2. Roller bearing - 3. Remover A. 45024.

Assembly.

For a correct assembly of differential cage clamp either tool in the set A. 70156 (4, fig. 75) in a vise and slide in the components of the cage.

Prior to locking the cage retainer screws, place the other tool so that the splines of the side gears and friction cones are lined up.

This will avoid undue strain on spring shoulders from axle shafts being driven in forcibly.

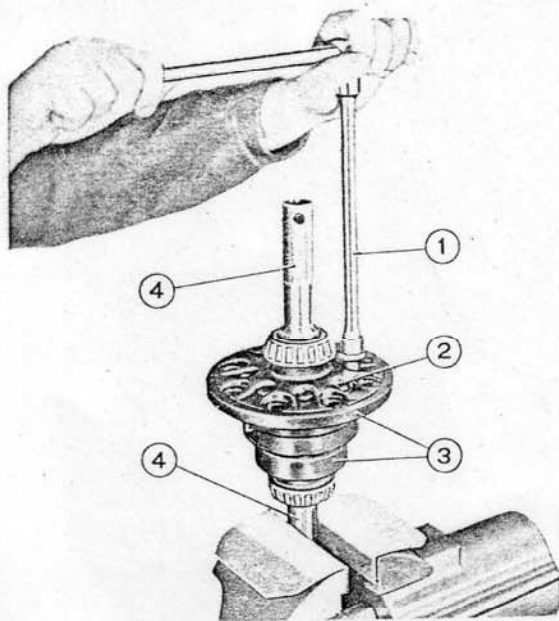


Fig. 75. - Assembling the differential cage.

1. Wrench, differential cage retainer screws - 2. Differential cage retainer screw - 3. Differential cage halves - 4. Pair of tools A. 70156, positioning side gears and friction cones.

NOTE - After the differential assembly has been fitted to the axle housing, on no account an axle shaft should be turned about until both shafts have been set in the correct position. The rotation of an axle shaft in the absence of the other misplaces the splined paths and prevents the latter from being fitted.

BEVEL GEAR SET

The bevel gear does not call for particular recommendations as far as disassembly is concerned. For differential assembly and adjustment, adhere to the following procedures:

1) Determining the thickness of drive pinion thrust washer.

Gauge the thickness of the drive pinion thrust washer by installing dummy pinion A. 70154, to which a dial indicator is affixed.

Touch the indicator plunger to the cup seat of both differential cage bearings.

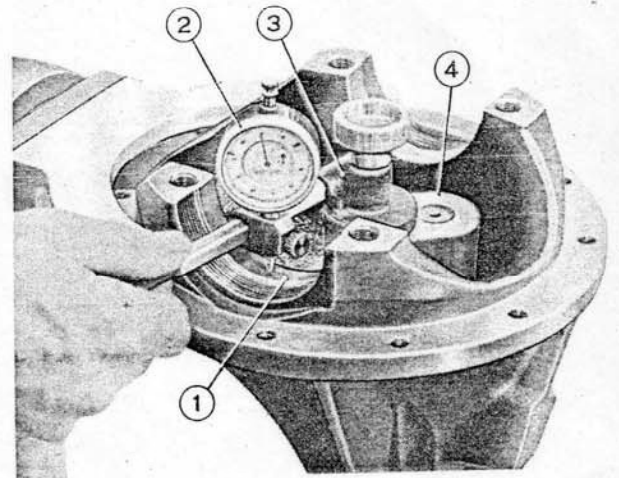


Fig. 76. - Determining the thickness of bevel pinion thrust washer.

1. Differential cage bearing bore - 2. Dial indicator - 3. Indicator holder - 4. Dummy pinion A. 70154.

The average resulting value corresponds to the difference between the theoretical and the actual distance of the differential cage bearing bore centerline to the pinion rear bearing cone shoulder face. Add to or subtract from such amount, the value (in hundredths of a mm) scribed electrically on drive pinion:

— if the number stamped on drive pinion is preceded by the « plus sign », the thickness of the thrust

washer is obtained by « subtracting » this figure from the indicator reading;

- conversely, if the number stamped on drive pinion is preceded by the « minus sign » the thickness of the thrust washer is obtained by « adding » this figure to the indicator reading.

NOTE - Rear roller bearing thrust washers are supplied for service in the following thicknesses: .1240"-.1260"-.1280"-.1299"-.1319"-.1339"-.1358"-.1378"-.1398"-.1417"-.1437"-.1457"-.1476"-.1496"-.1516"-.1535"-.1555"-.1575"-.1594" (3.15 - 3.20 - 3.25 - 3.30 - 3.35 - 3.40 - 3.45 - 3.50 - 3.55 - 3.60 - 3.65 - 3.70 - 3.75 - 3.80 - 3.85 - 3.90 - 3.95 - 4.00 - 4.05 mm).

2) Drive pinion bearing pre-load.

To preload drive pinion bearings lock the pinion in place and, using a torque wrench, tighten the pinion nut to a torque ranging between 108.5 and 180.8 ft.lbs (15 to 25 kgm).

The correct rolling torque reading, on preload check, should be from 1.0 to 1.2 ft.lbs (0.14 to 0.16 kgm).

3) Preloading differential cage bearings and adjusting ring gear-to-pinion backlash.

These operations must be carried out at the same time, using fixture **A. 95688** (fig. 77) and wrench **A. 55016**.

The fixture **A. 95688** is secured to the differential carrier by means of a screw and by tightening holder stud (8, fig. 77).

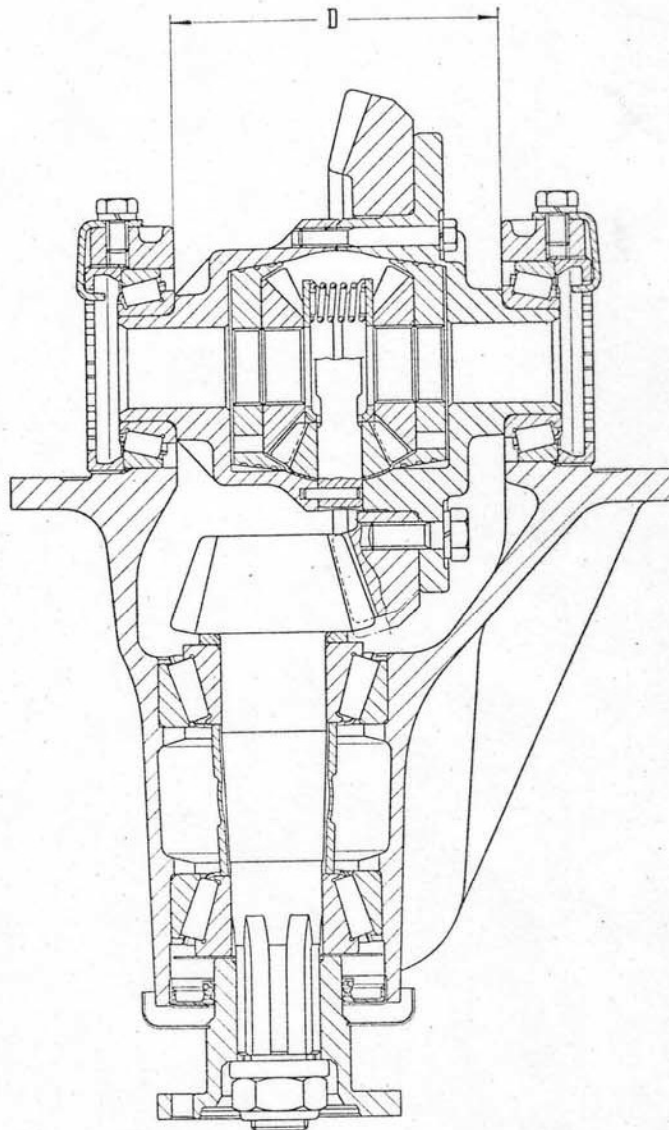


Fig. 78. - Differential cage roller bearing preloading diagram.

D. Distance between differential carrier caps: tighten adjusters until distance "D" is increased by .0039" to .0047" (0.10 to 0.12 mm).

Move holder (7) until cranked lever (6) contacts the cap and tighten knob (8); then, slacken knobs and adjust holder (3) until plunger of gauge (2) rests against one of the ring gear teeth; next, tighten the knobs.

Note that fixture **A. 95688** must be fitted with bearing adjusters slightly in contact with bearings, that is without preload.

Using wrench **A. 55016** tighten one of the two adjusters: in so doing, the differential carrier pedestals are slightly spread (distance D, fig. 78) and this is shown on dial gauge (1, fig. 77) via cranked lever (6).

The adjuster must be tightened until distance **D** is increased by .0039" to .0047" (0.10 to 0.12 mm).

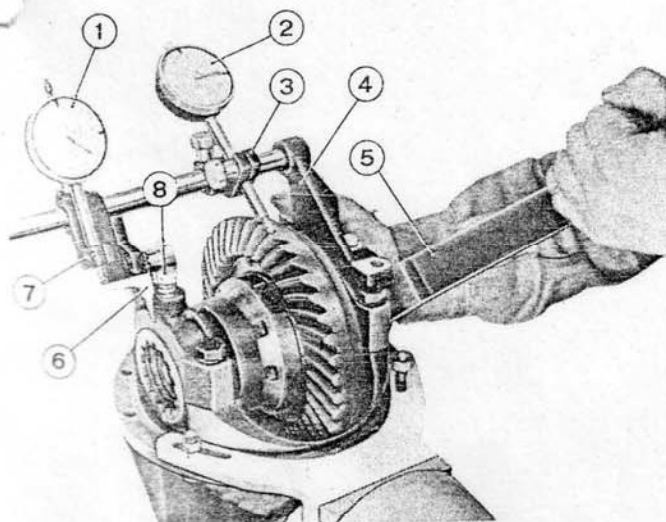


Fig. 77. Using fixture **A. 95688** to adjust differential cage bearing preload.

1. Dial indicator for preload check - 2. Dial indicator for backlash check in final drive gear - 3. Dial indicator holder - 4. Fixture holder - 5. Wrench **A. 55016** for bearing adjusters - 6. Cranked lever - 7. Dial indicator holder - 8. Fixture holder stud.

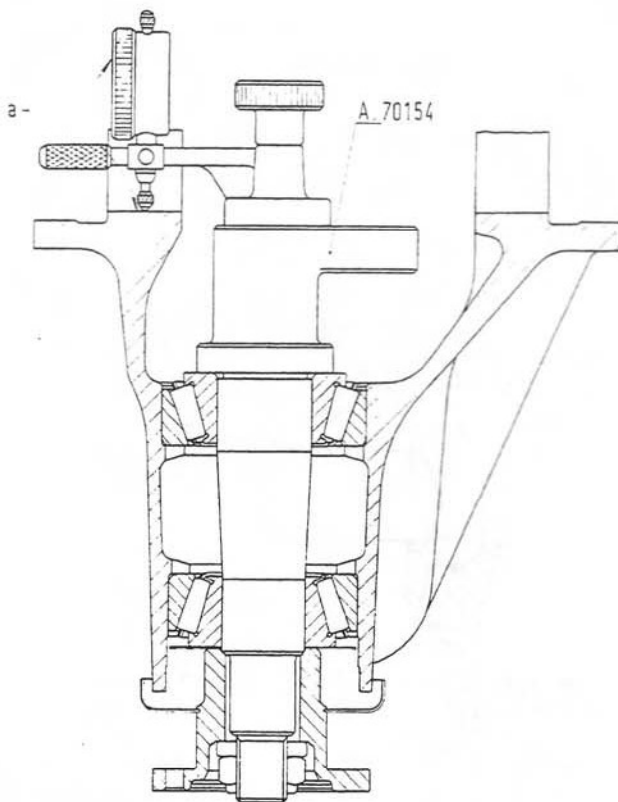


Fig. 79. - Diagrammatic view showing how dummy pinion A. 70154 and dial indicator should be fitted to determine drive pinion rear bearing thrust washer thickness.

a = Dial indicator reading, from which figure stamped on bevel pinion should be subtracted.

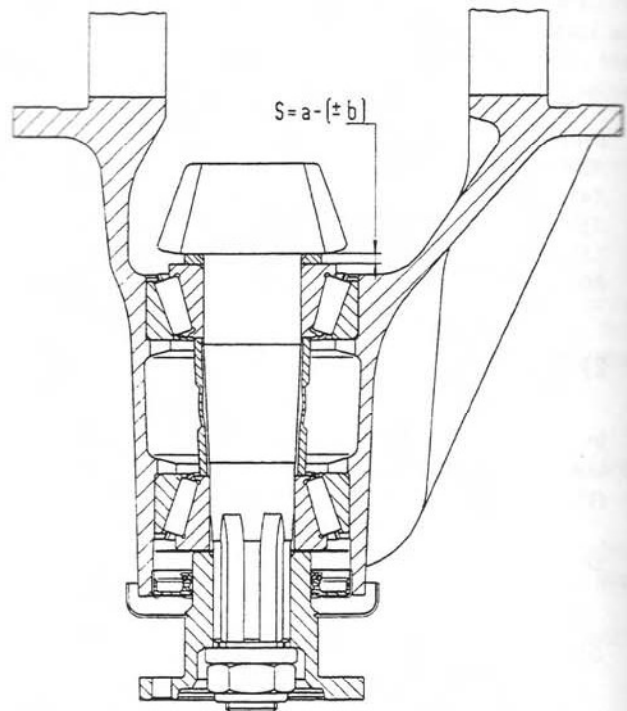


Fig. 80. - Diagram of bevel pinion assembly.

Where: S = thickness of rear bearing thrust washer;
a = dial indicator reading (fig. 79);
b = number stamped on bevel pinion.

HOW TO FIGURE THE THICKNESS OF BEVEL PINION REAR BEARING THRUST WASHER

If « a » is the reading on dial indicator (fig. 79), and « b » the value stamped on pinion, thickness « S » of thrust washer to be fitted is obtained as follows:

$$S = a - (+ b) = a - b$$

$$\text{or } S = a - (- b) = a + b$$

In other words:

- if number on pinion is preceded by **plus (+) sign**, the thickness of thrust washer is obtained by **subtracting** the number from dial indicator reading;
- if number on pinion is preceded by **minus (-) sign**, the thickness of thrust washer is obtained by **adding** the number to dial indicator reading.

Example:

$$\text{take } a = 3.90 \text{ mm (indicator reading), and}$$

$$b = -5 \text{ (centesimal value on pinion)}$$

$$\text{then } S = a - (- b)$$

$$S = 3.90 - (-0.05)$$

$$S = 3.90 + 0.05$$

$$S = 3.95$$

Hence, in a case like this, a thrust washer 3.95 mm thick should be fitted.

NOTE - Every time the differential carrier is taken down from axle, a new gasket must be fitted before carrier is reinstalled.

After thus obtaining the specified preload of inner case bearings, check also ring gear-to-pinion backlash, which must range from .0039" to .0059" (0.10 to 0.15 mm), as follows:

- lock the drive pinion with tool Arr. 22206/4 (fig. 72);
- move the ring gear in a way to contact pinion;
- set to zero the pointer of dial indicator (2, fig. 81) whose plunger must contact the flank of a ring gear tooth, as previously adjusted;
- then move the ring gear the other way and check on indicator (2) the amount of lash, which should be from .0039" to .0059" (0.10 to 0.15 mm).

If the backlash is out of specification, loosen one adjuster and tighten the opposite an equal amount, to move the ring gear away from or toward the pinion.

To prevent any alteration of the preload previously applied, it is essential to turn one adjuster the same amount as the other, but in opposite directions.

For setting operations other than above, covering data are tabulated hereafter.

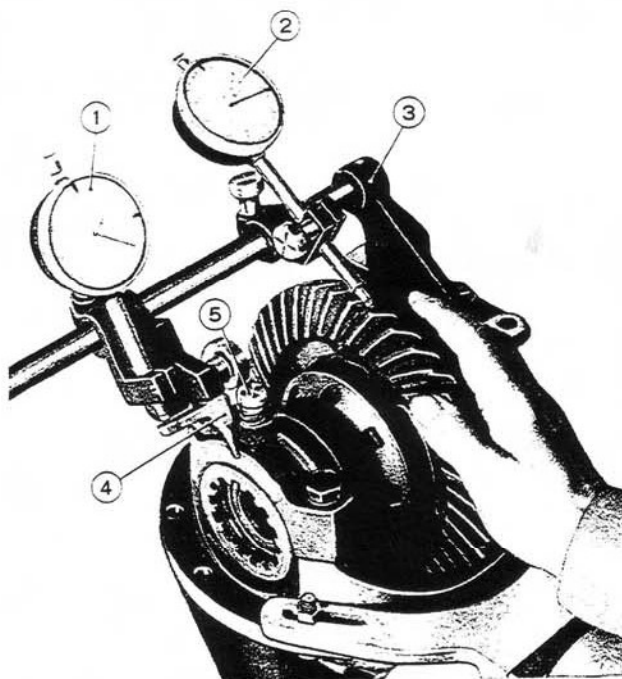


Fig. 81. - Checking backlash between pinion and ring gear. 1. Dial indicator for checking bearing pre-load - 2. Dial indicator for checking pinion-ring gear tooth backlash - 3. Holder for fixture A. 95688 - 4. Relay lever - 5. Fixture fixing stud.

REAR AXLE SPECIFICATIONS

Type	semi-floating
Differential	spin resistant
Final drive set	hypoid
Gear ratio	4.875 to 1 (8/39)
Bevel pinion bearings	two
Bearing type	taper roller
Bearing preload setting	by collapsible spacer and tightening pinion shaft nut with torque wrench
Pinion bearing preload (pinion shaft nut torque)	108.5 to 180.8 ft.lbs (15 to 25 kgm)
Pinion bearing rolling torque	1 to 1.2 ft.lbs (0.14 to 0.16 kgm)
Differential case bearings	two
Bearing type	taper roller
Adjustment	threaded rings
Bearing preload: differential carrier pedestal spread0039" to 47.00" (0.10 to 0.12 mm)
Ring gear and pinion	matched set
Ring gear-to-pinion backlash0039" to .0059" (0.10 to 0.15 mm)
Axle shaft bearing type	ball
Rear tread	53.15" (1,350 mm) (*)
Lube oil } grade	FIAT W 90/DA (SAE 90 EP)
} capacity	4 G.B. gals - 4 U.S. gals 14 (3.3 lt - 3.0 kg)

(*) The rear tread for cars fitted with wheel studs is 53.62" (1,362 mm).