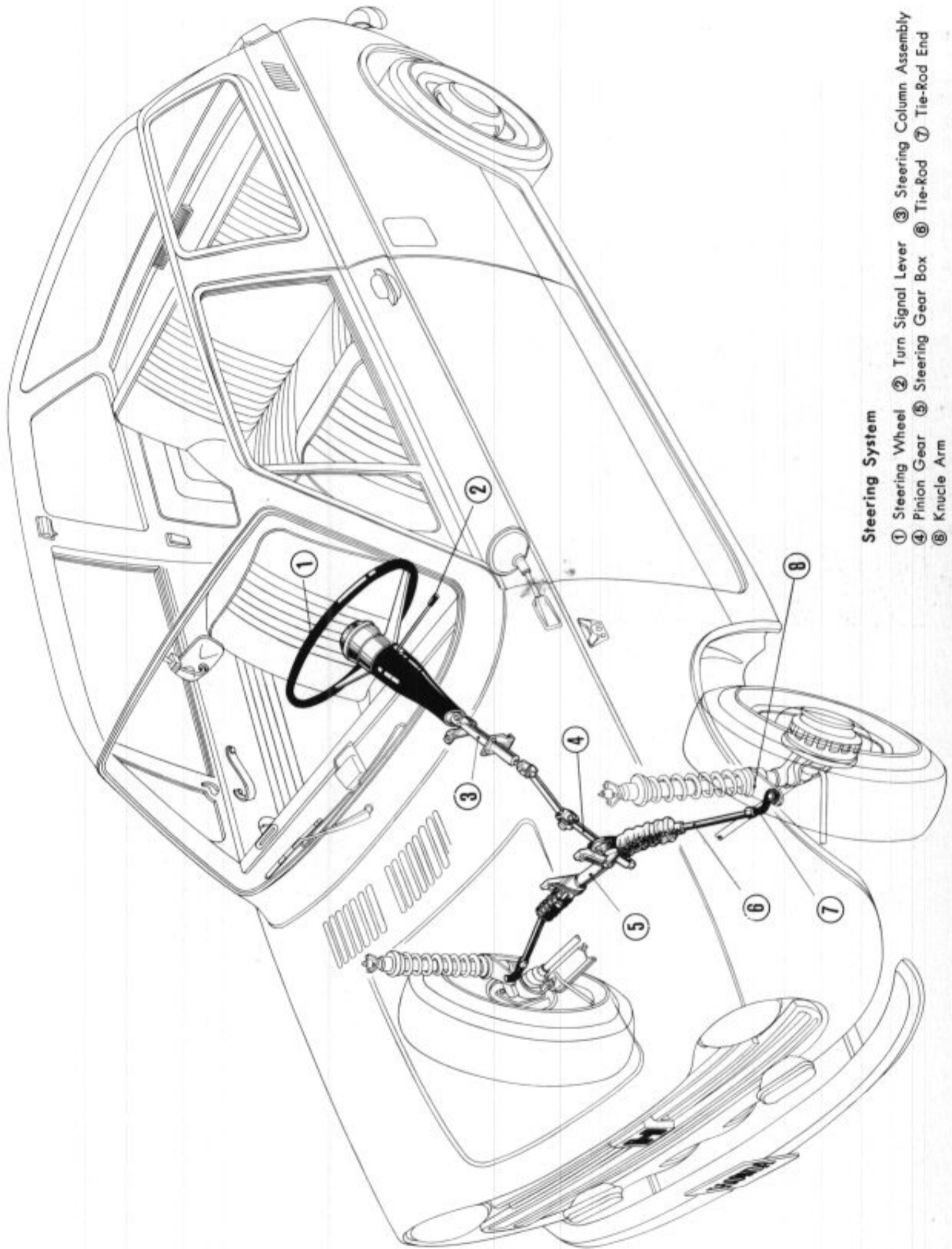


SECTION 10

STEERING

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Steering System

- ① Steering Wheel
- ② Turn Signal Lever
- ③ Steering Column Assembly
- ④ Pinion Gear
- ⑤ Steering Gear Box
- ⑥ Tie-Rod
- ⑦ Tie-Rod End
- ⑧ Knuckle Arm

10-2 STEERING

A. General Description

The steering assembly is a rack and pinion type. The steering column is divided with two universal joints and is bent. This mechanism and also the crash pad on the steering wheel protect the driver in the case of a head-on collision. The steering gear box is located on the firewall and is positioned horizontally with four bolts. The pinion gear is connected to the steering column with serration and secured with clamp bolts. Thrust applied to the pinion gear is received by the U-shaped thrust plate fitted to the groove near the pinion gear head, and end play of the pinion gear is adjusted by pinion adjusting bolt.

Backlash between the pinion gear and rack increases due to wear. Backlash is adjusted by adjusting bolts on the back of the rack (near both ends of the steering gear box).

The pinion gear and rack gear ratio is 15.2. The steering wheel diameter is 380mm (14.96 in). On both ends of rack, rack ends having ball joint connections are threaded and connected, and secured with lock washers. In addition, the tie-rod connected to the rack end ball joint is also threaded and secured to the tie-rod end by a lock nut. When adjusting toe-in, loosen this lock nut and adjust the length of the tie-rod by threading in or out.



Fig. 10A-1

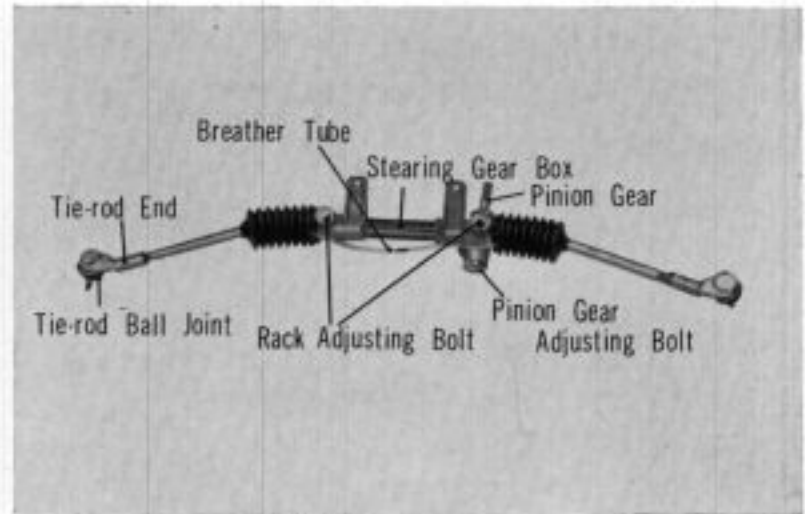


Fig. 10A-2

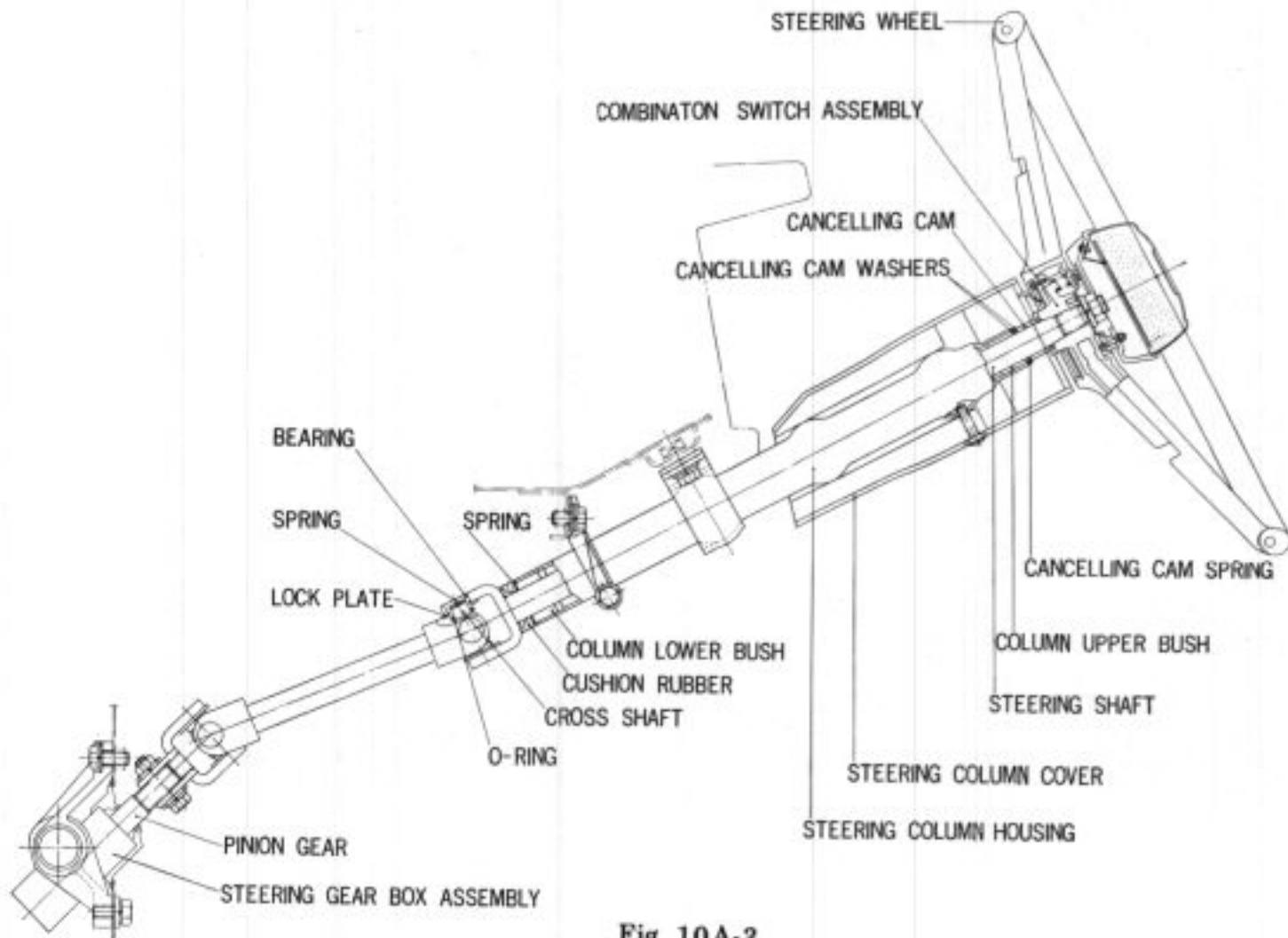


Fig. 10A-3

B. Technical Data

(Specification)

TYPE	Rack and Pinion
STEERING GEAR RATIO	17.4 : 1
STEERING WHEEL DIAMETER	0.380m (14.96 in)
TURNS LOCK TO LOCK	3.1
OUTSIDE WHEEL ANGLE	
WITH INSIDE WHEEL AT 27° 33'	35° 12'
TURNING CIRCLE	9.5 m

(Tightening torque)

Steering gear box mounting	2.0~2.4 kg-m (14.5~17.4 lb-ft)
Rack and ball joint-to-rack gear	4.5~5.0 kg-m (32.5~36.2 lb-ft)
Tie-rod end lock nut	4.5~5.0 kg-m (32.5~36.2 lb-ft)
Tie-rod ball joint	3.5~4.0 kg-m (25.3~28.9 lb-ft)
Steering wheel nut	3.0~3.5 kg-m (21.7~25.3 lb-ft)

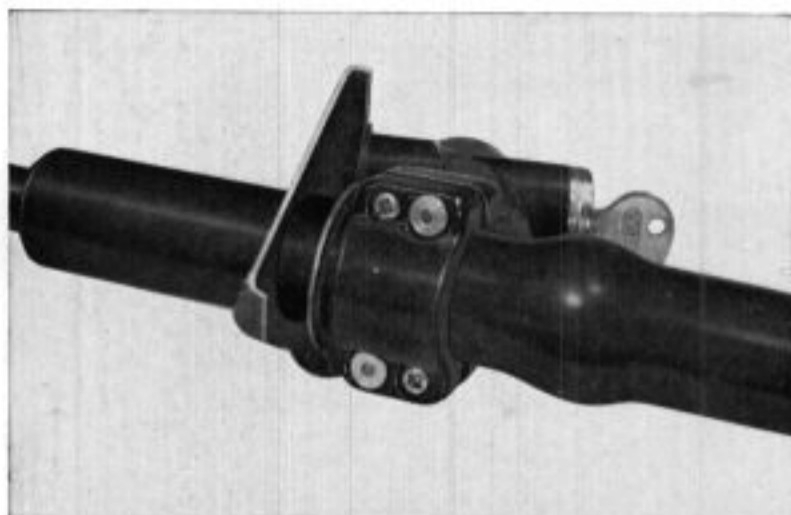


Fig. 10C-1

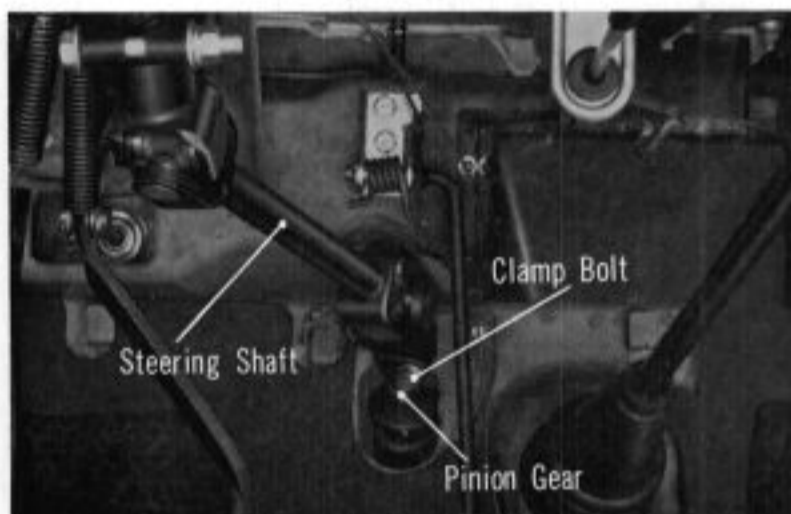


Fig. 10C-2

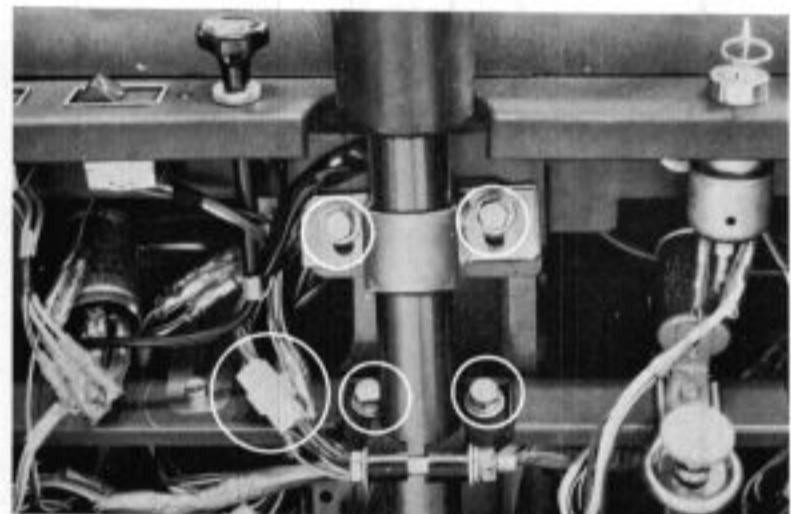


Fig. 10C-3



Fig. 10C-4

C. Steering Wheel

Description

The steering wheel center has a safety crash pad which protects the driver in case of accident. The steering column is suspended from the instrument panel with four bolts. For vehicles exported to Germany and other countries, the steering column is equipped with a locking mechanism and key. (Fig. 10C-1)

Removal and Disassembly

1. Removing column assembly
 - * Loosen clamp bolt at steering shaft and pinion gear connection.

- * Disconnect electrical wiring and remove the four bolts retaining the steering column to the instrument panel.

2. Disassembling steering wheel and column
 - * Remove the three screws and separate the crash pad.

- * Remove the screw and disconnect the horn plus lead. Remove the steering shaft nut.

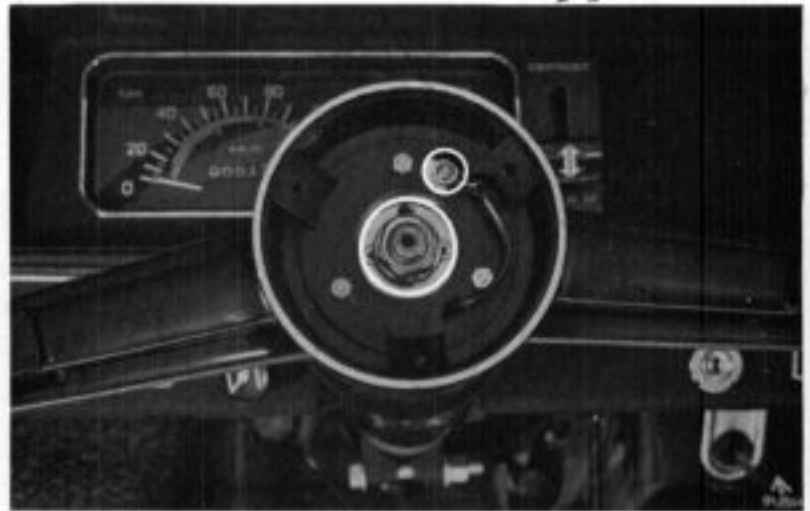


Fig. 10C-5

- * Remove two screws and separate the horn switch contact plate.



Fig. 10C-6

- * Remove the steering wheel by using the special tool ("steering wheel puller A" for the standard steering wheel and "steering wheel puller B" for the spoke steering wheel)



Fig. 10C-7

- * Remove the turn signal canceling cam and spring washers.

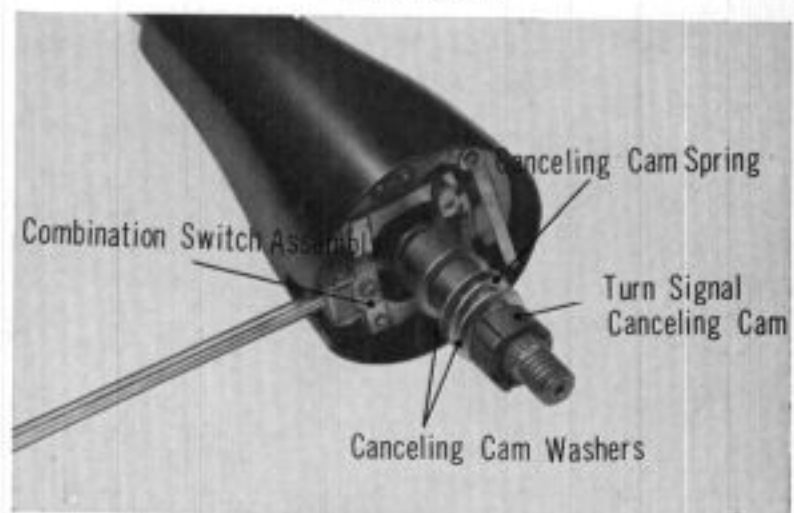


Fig. 10C-8

10-6 STEERING

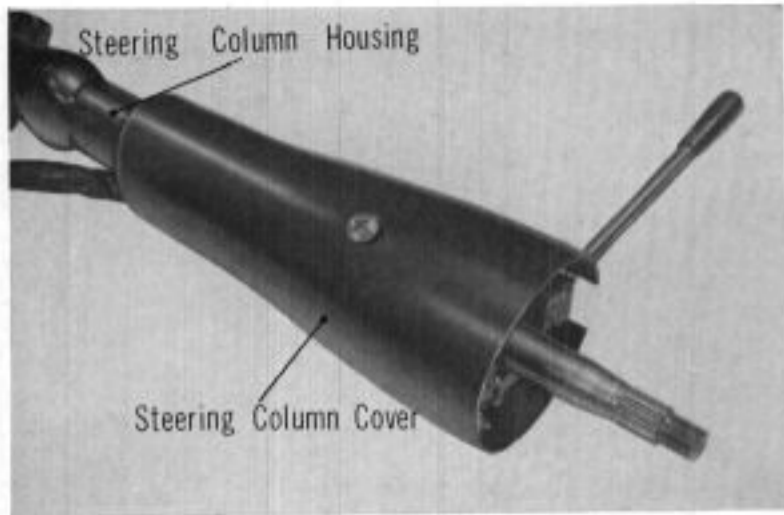


Fig. 10C-9

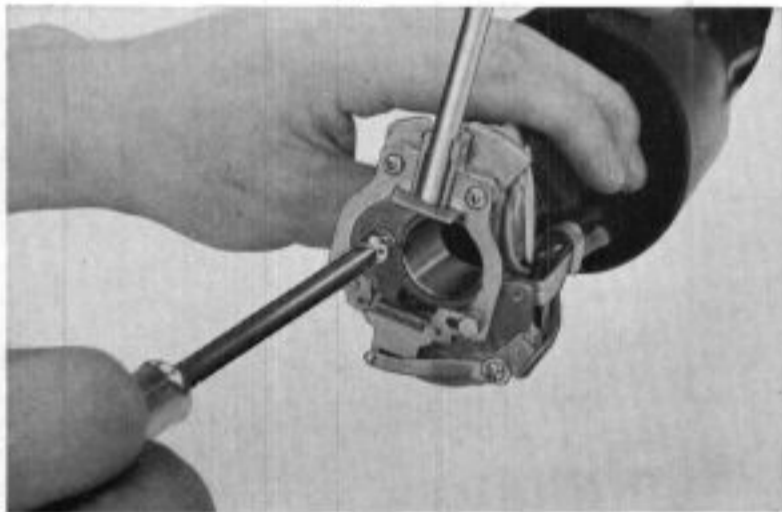


Fig. 10C-10

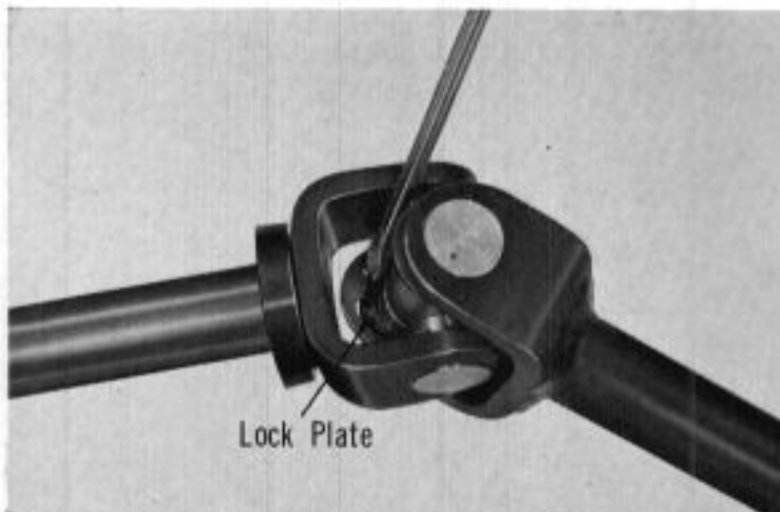


Fig. 10C-11



Fig. 10C-12

* To remove the steering column cover, remove one screw.

* Loosen the screw completely and tap the top of the screw with a screw driver, then the combination switch is separated from the steering column housing.

* Remove the lock plates with a screw driver to disassemble the universal joints.

Inspection

1. Check the steering wheel play in the axial direction. If found excessive:
 - * Check the steering column mounting bolts for looseness.
 - * Check the steering wheel nut for looseness.
 - * Check the cushion rubber for wear. (Fig. 10C-22)

2. Check the steering column top bushing for excessive wear. Excessive play due to worn bushing may cause rattling noise from the steering wheel.

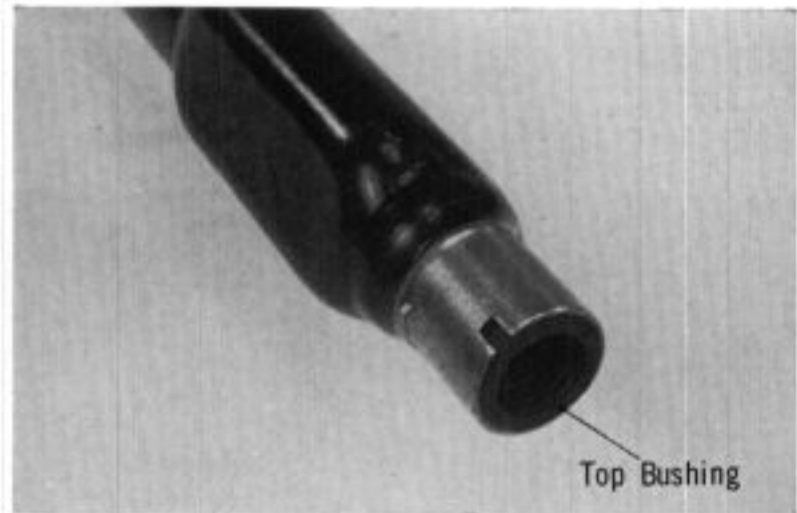


Fig. 10C-13

3. Check the universal joint of the steering shaft for excessive play as shown.

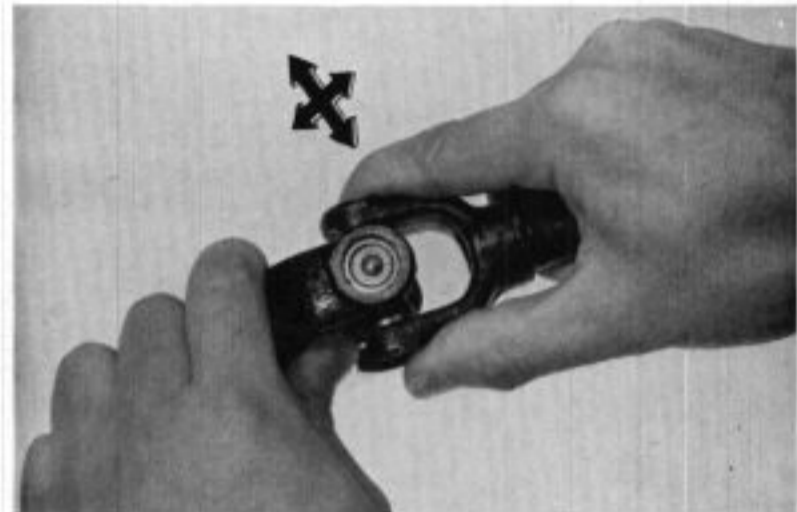


Fig. 10C-14

(Standard joint)

If an excessive play is found at the joint, trunnion caps and/or lock plate may be worn excessively. Replace the worn parts with new ones.

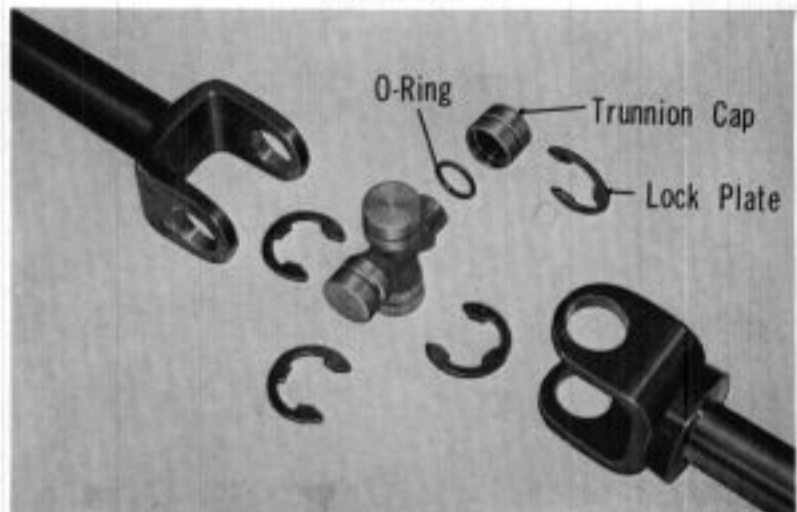


Fig. 10C-15

(Factory sealed - lubrication type joint)

This type of joint cannot be disassembled. If excessive play is found at the joints, punch the inner edge of the yoke with a center punch as shown in the picture. If the play cannot be eliminated by this job, the entire steering shaft assembly should be replaced.

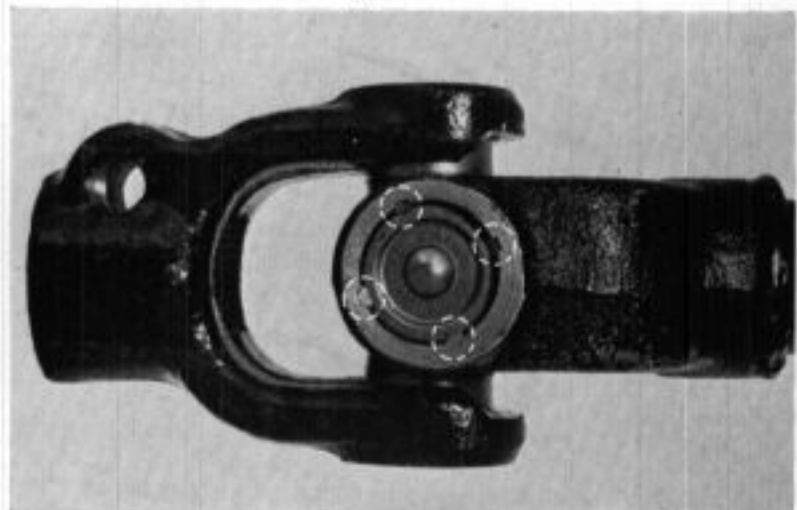


Fig. 10C-16



Fig. 10C-17

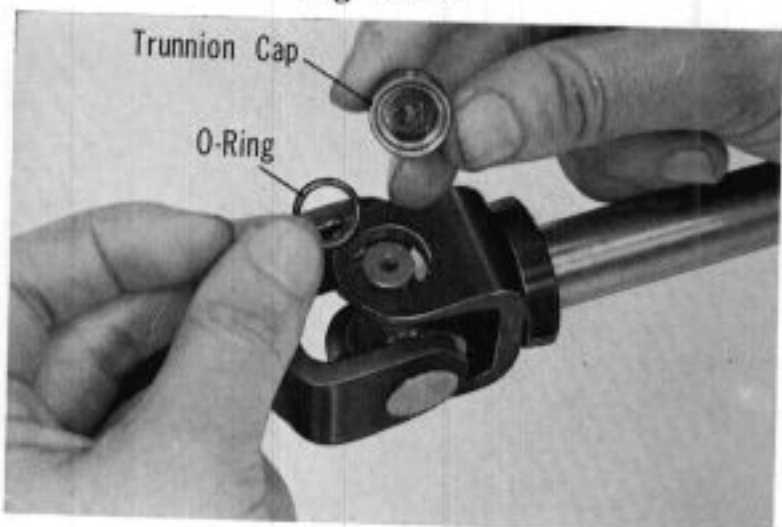


Fig. 10C-18

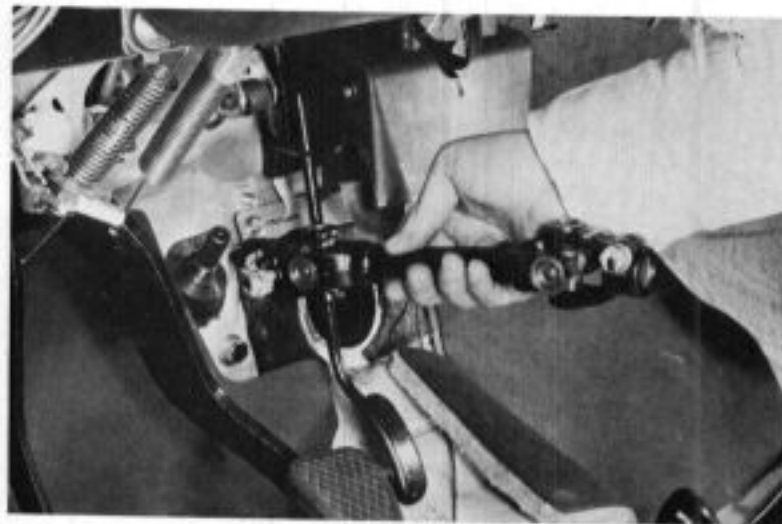


Fig. 10C-19

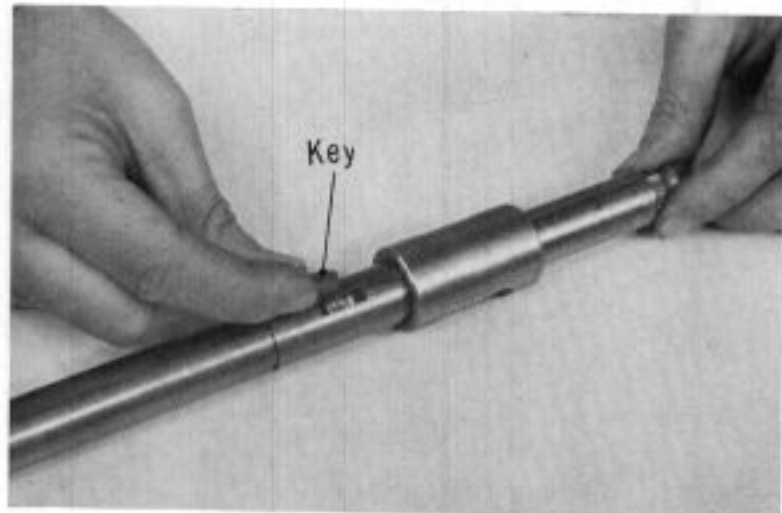


Fig. 10C-20

To relieve excessive tightness of the universal joints, tap the yoke lightly.

Assembly and installation

1. (Assembly of steering shaft universal joints)
Install the trunion cap after placing the O-ring in the groove.
To minimize the play, either select-assemble the lock plates or install wave springs (Fig. 10-A-3) inside two trunion caps locating them perpendicularly.
There are four different lock plates available as following.

	Thickness
Lock plate A	1.7mm (0.067 in)
Lock plate B	1.9mm (0.075 in)
Lock plate C	1.3mm (0.051 in)
Lock plate D	1.5mm (0.059 in)

2. (Installation of steering shaft)
Install the steering shaft with the longer serrated yoke toward the steering gear box.
3. (Assembly of steering column)
Install the key into the steering shaft to position the steering lock sleeve.

Steering lock sleeve is secured with a circlip at the top, and spring/circlip at the bottom.

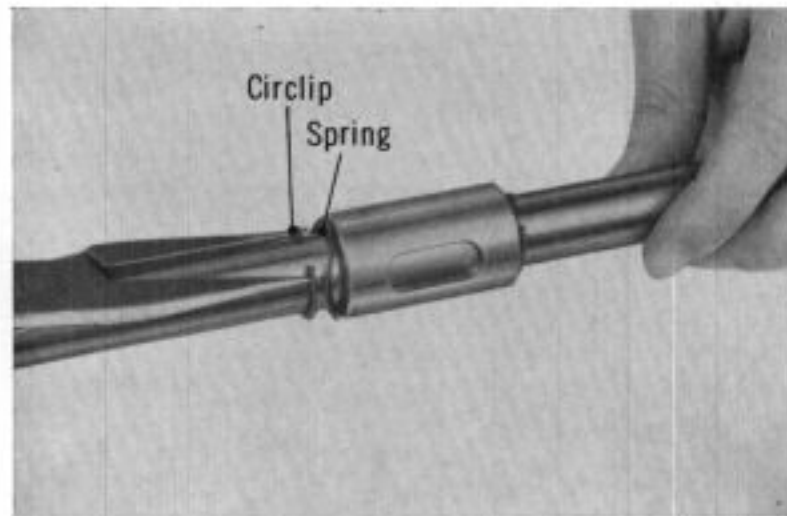


Fig. 10C-21

Insert the cushion rubber and the spring. The cushion rubber should be installed with the flat side upward.

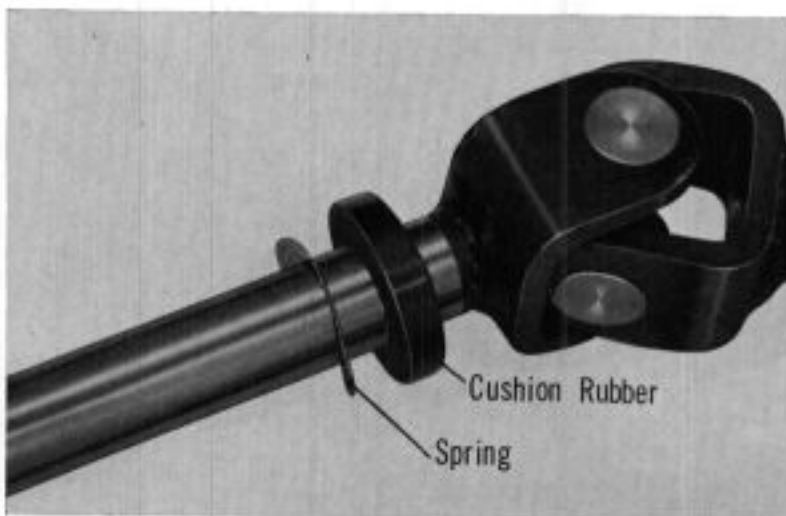


Fig. 10C-22

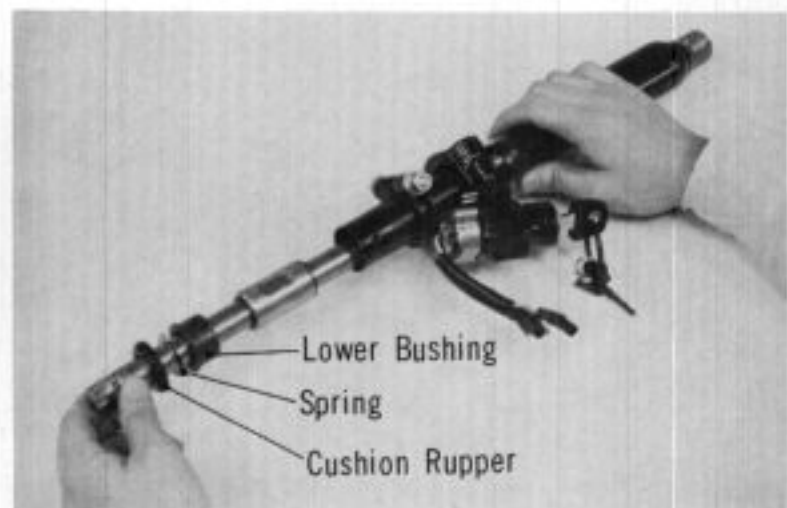


Fig. 10C-23

4. **Steering column lock alignment**
 (Vehicles equipped with anti-theft switch only)
 Set the front wheels in the straight ahead position.
 Remove the key and connect the steering column assembly to the lower steering shaft, Mount the steering column assembly into the position loosely.



Fig. 10C-24

10-8 STEERING

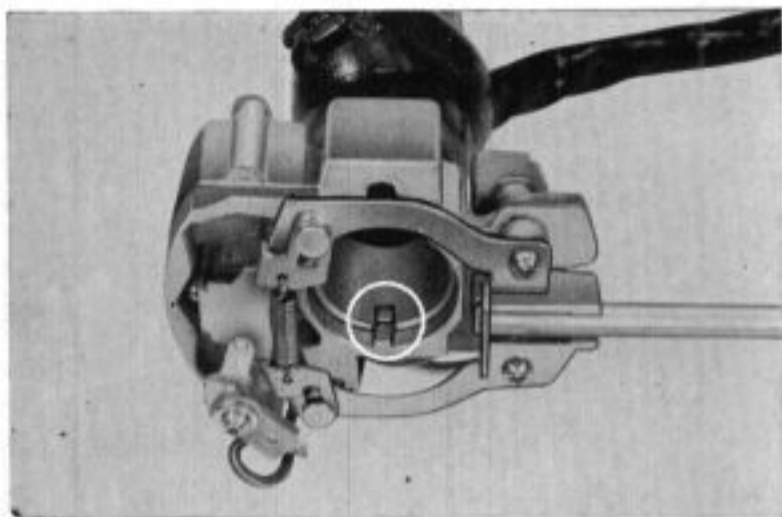


Fig. 10C-25

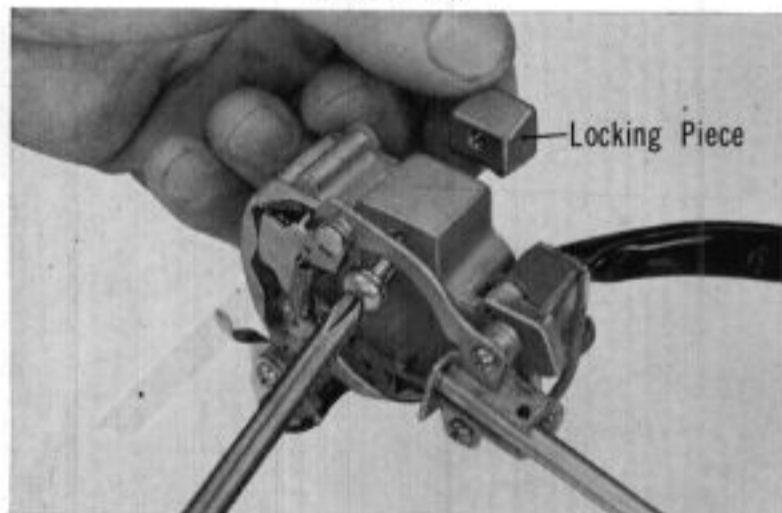


Fig. 10C-26



Fig. 10C-27



Fig. 10C-28

5. Align both grooves of the combination switch and the steering housing.

The tapered locking piece secures the combination switch to the steering housing. Note the circular side faces to the steering housing and tapered side faces the switch.

6. Apply grease to the cancelling cam.
Prior to installing cancelling cam, ensure the turn signal switch is in the neutral position. This will prevent damage to the switch when steering wheel is installed.

7. Set the front wheels in the straight ahead position and align the steering wheel spoke position.
Tighten the wheel nut to a torque 3.0~3.5kg-m (21.7~25.3 ft-lbs).

8. Prior to tightening the steering column mounting bolts, position the steering column housing in the proper position and eliminate the play between the steering shaft and the housing. If the steering wheel operation is too tight, the cushion rubber may be compressed due to improper column housing positioning. Readjust if necessary.

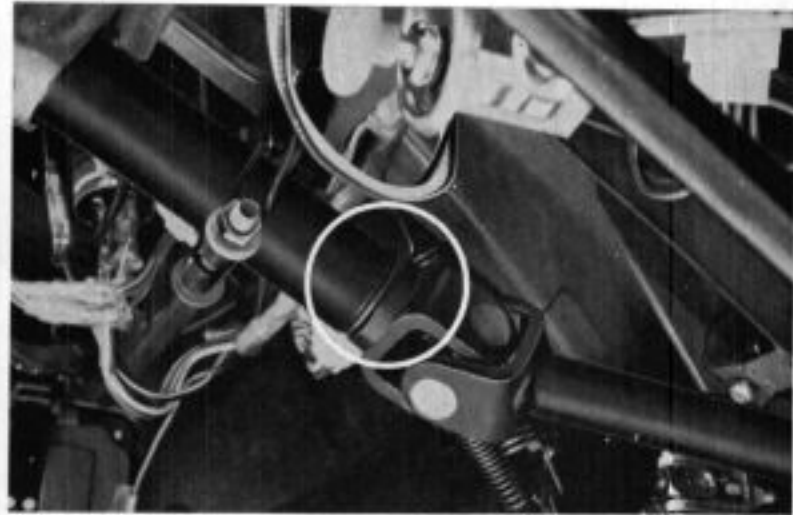


Fig. 10C-29

9. Position the column housing cover to have a clearance of 1~4mm between the steering wheel and the cover.

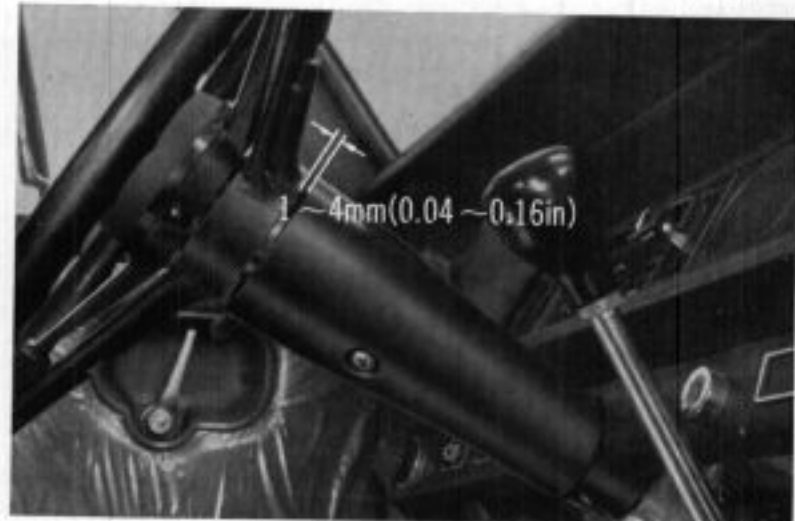


Fig. 10C-30

D. Steering Gear Box and Tie-Rods

Description

The gear is rack-and-pinion type and it is mounted on the firewall. The pinion gear is positioned and secured by means of the U-thrust plate and the lock bolt. There are rack adjusting bolts provided on both ends of steering gear box to allow pinion/rack gear backlash adjustment.

A breather tube is connected between right and left tie rod bellows to prevent the bellows from becoming negatively pressurized when turning the steering wheel. Should negative pressure exist, water and dust enter the bellows and result in rapid wear of the rack end ball joints.

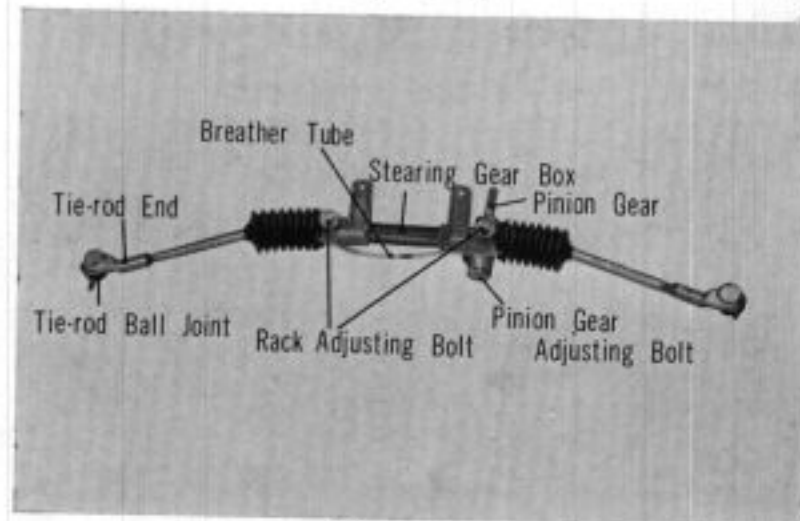


Fig. 10D-1

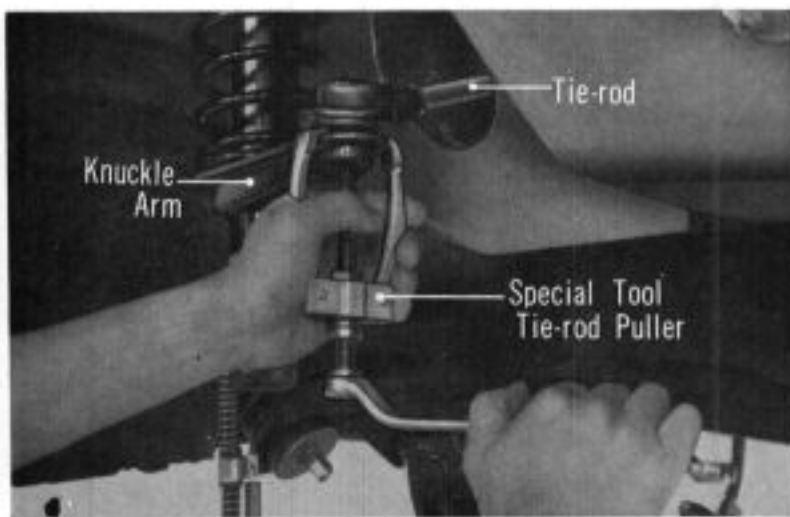


Fig. 10D-2



Fig. 10D-3

- * Remove the four bolts and separate the steering gear box from the firewall.

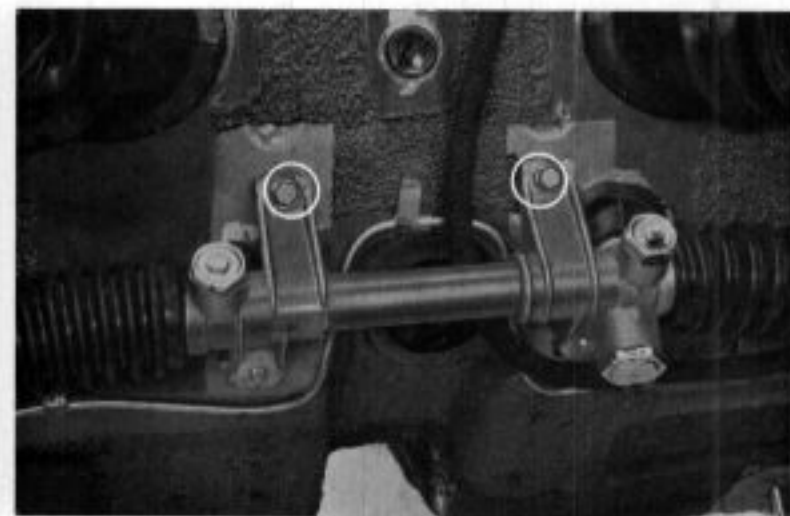


Fig. 10D-4



Fig. 10D-5

Removal and Disassembly

1. Removing steering gear box and steering linkages.

- * Remove the tie-rod from the knuckle arm with the special tool (tie rod end puller).

- * Disconnect the steering shaft and pinion gear after dismounting the steering column assembly from the instrument panel.

2. Disassembling steering gear box and steering linkages.

* Unlock the lock washer and remove the rack end from the rack.

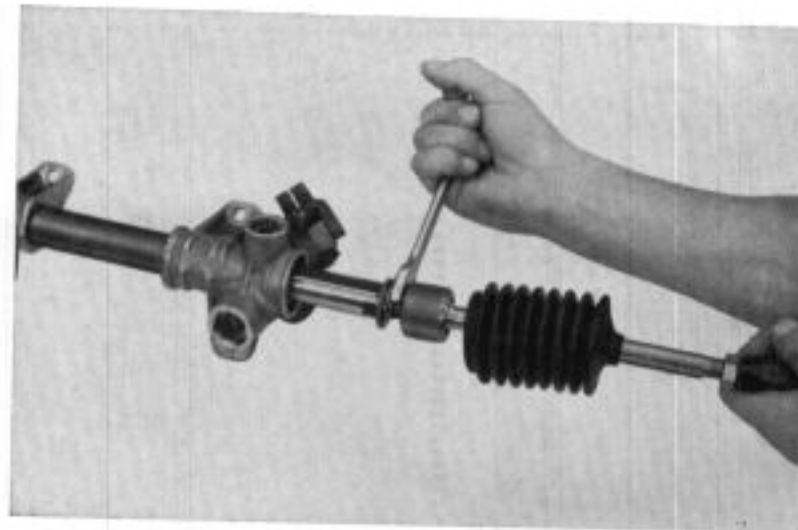


Fig. 10D-6

* Pull out the rack from the steering gear box.

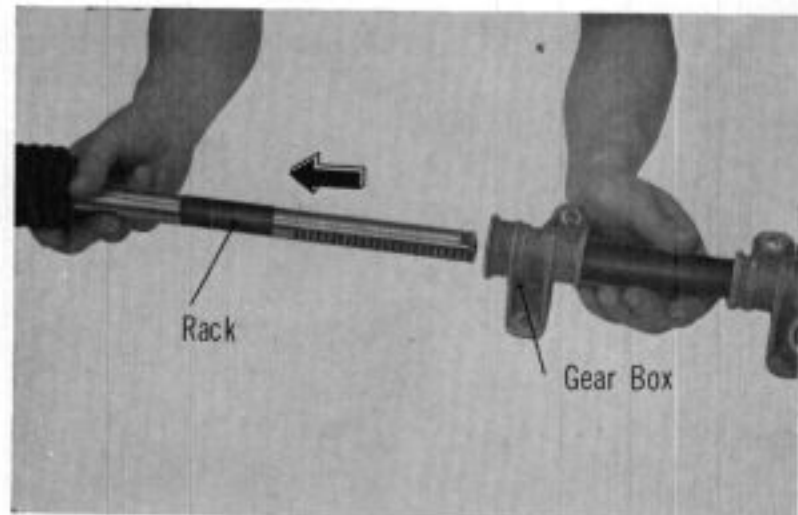


Fig. 10D-7

* Loosen the lock nut and remove the pinion and rack backlash adjusting bolt.

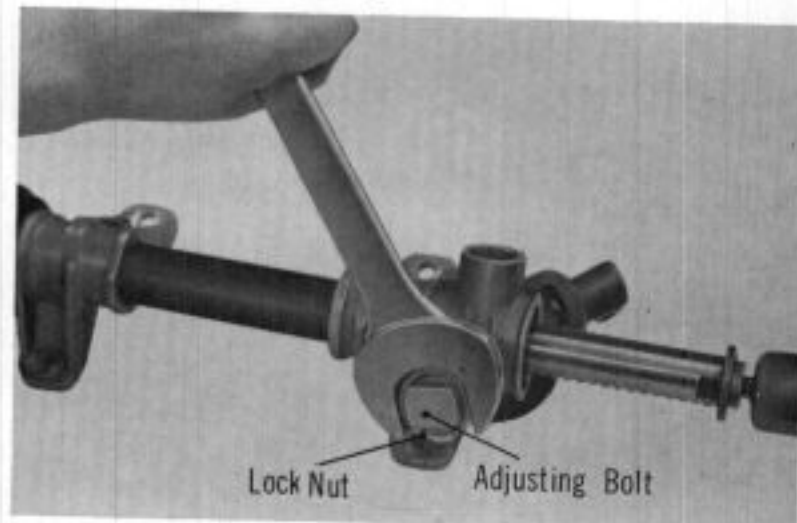


Fig. 10D-8

* Remove the pinion thrust plate and drive out the pinion gear from the gear box.

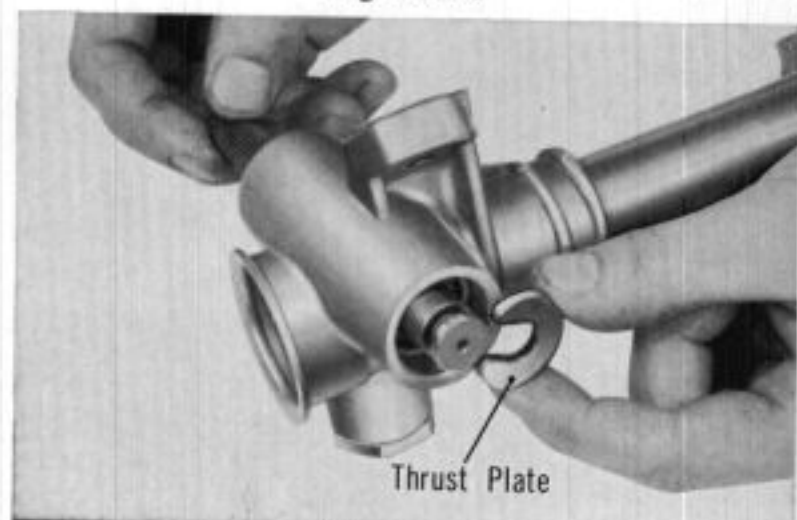


Fig. 10D-9

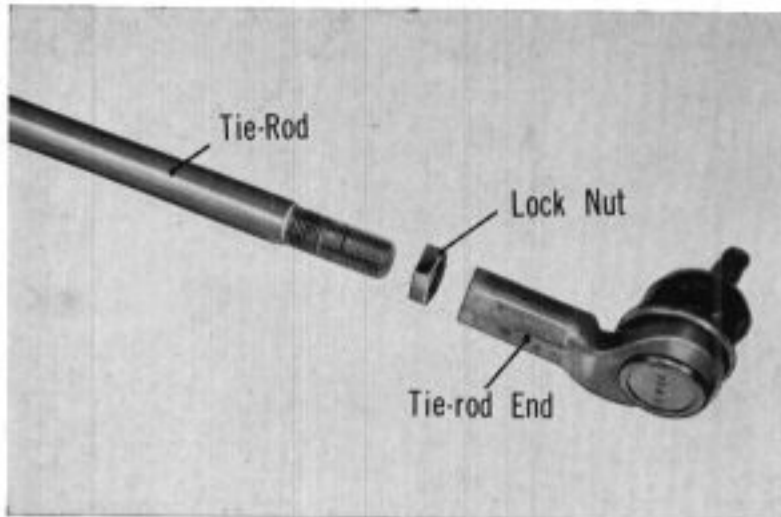


Fig. 10D-10

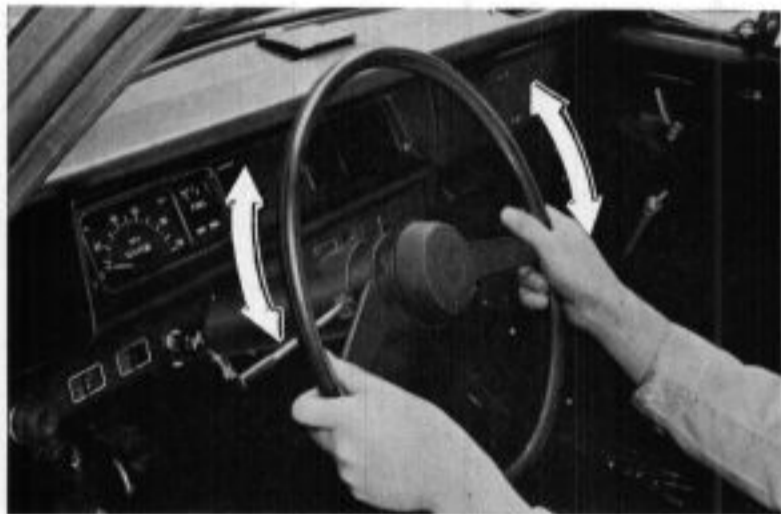


Fig. 10D-11



Fig. 10D-12a

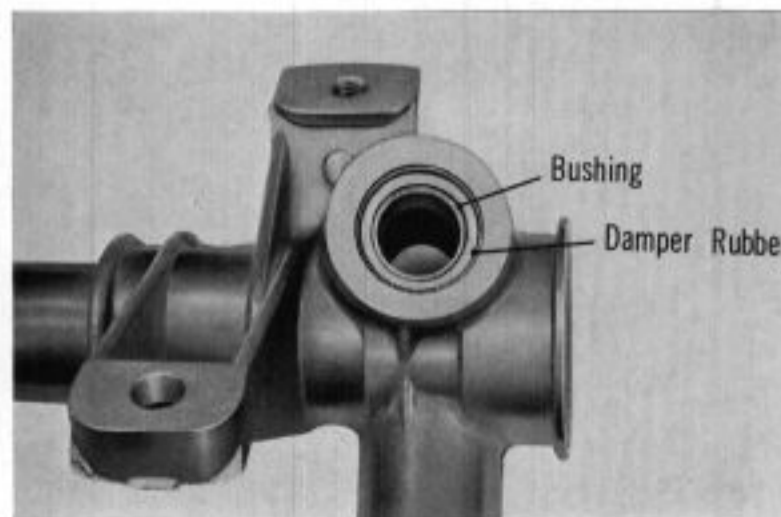


Fig. 10D-12b

* Loosen the lock nut and unscrew the tie-rod end.

Inspection

1. When the steering wheel is turned to the left and right with the front wheels straight forward, the distance at the periphery of the steering wheel immediately before the front wheels start to turn is 1 to 3mm (0.04 to 0.12 in).
If the value is beyond the specification, the probable causes are
 - (1) Worn steering shaft universal joints
 - (2) Worn steering gears
 - (3) Worn steering linkages
 - (4) Worn wheel bearings.
2. Check the pinion gear for any play in the axial and the radial directions.
If axial play is found, check the U-thrust plate (Fig. 10D-9) and the steering gear box for wear and damage.

If excessive play exists in the radial direction, check both the pinion gear and the bushing wear. The pinion gear bushing is press fitted in the gear box with damper rubber incorporated. Check the damper rubber for wear, and make a replacement if found excessive.

When replacing the upper pinion gear bushing, always install an oversized cap to hold new pinion gear bushing securely.

- 3 Jack the front of the vehicle up, place the front wheels straight forward, apply a spring scale to the steering wheel and read the load when the front wheels begin to move.
Standard value: Less than 1.5kg (3.3 lbs).

If the reading value is beyond 1.5 kg, the probable causes are:

- (1) Improper pinion gear and rack gear backlash adjustment.
- (2) Improper steering column housing positioning. (Fig. 10C-20)
- (3) Tight rack end ball joint. (Fig. 10C-14b)

4. Check the rack end ball joint for looseness on the car as shown. A loose ball joint may cause a rattling noise from the steering gear box.

5. Inspect the rack end ball joint operation by swinging the tie rod to and fro. Measure the force required to move the tie rod by means of a spring scale.
Standard reading; 0.26~1.5kg (0.57~3.3 lbs)

6. Check the rack gear bushing for excessive wear. If the play is more than 0.06mm (0.00236 in), rattling noise may develop. Replace the steering gear box with a new part.

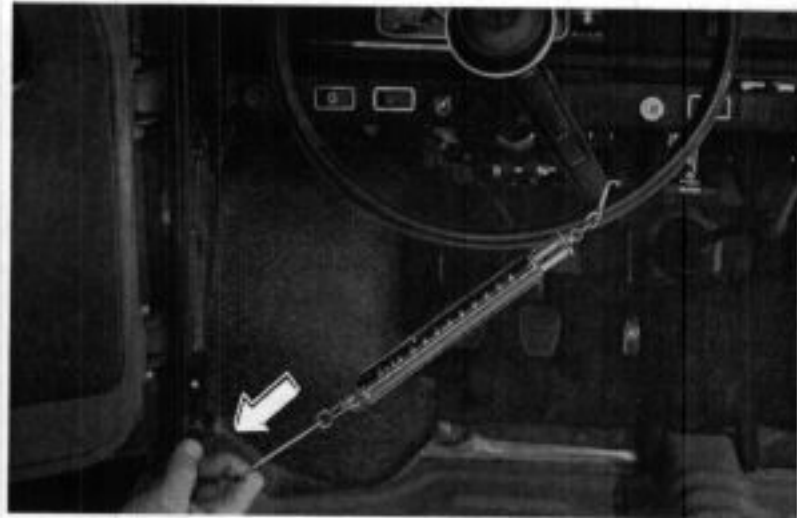


Fig. 10D-13

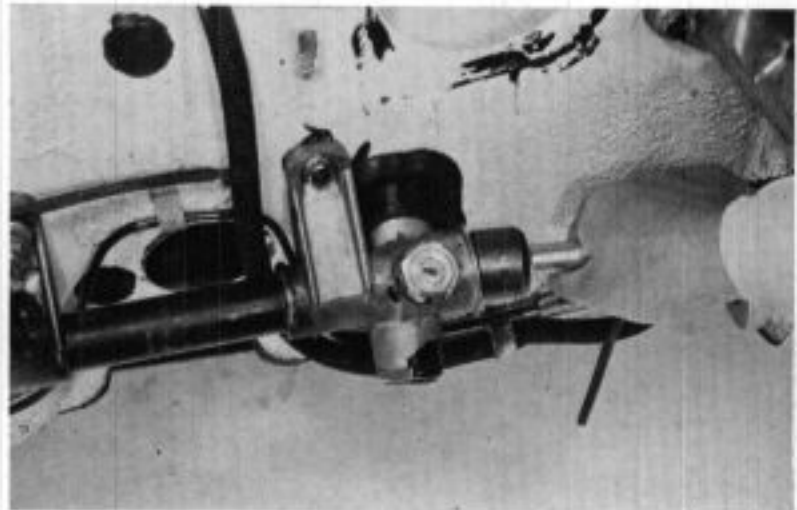


Fig. 10D-14a

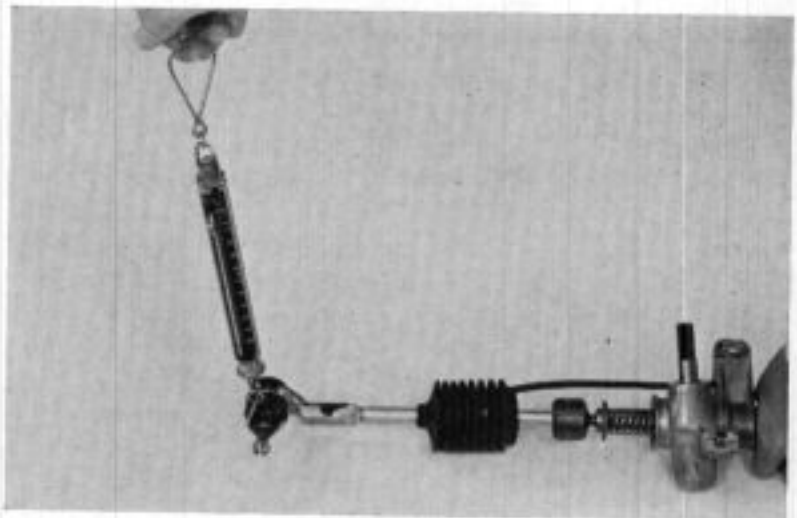


Fig. 10D-14b

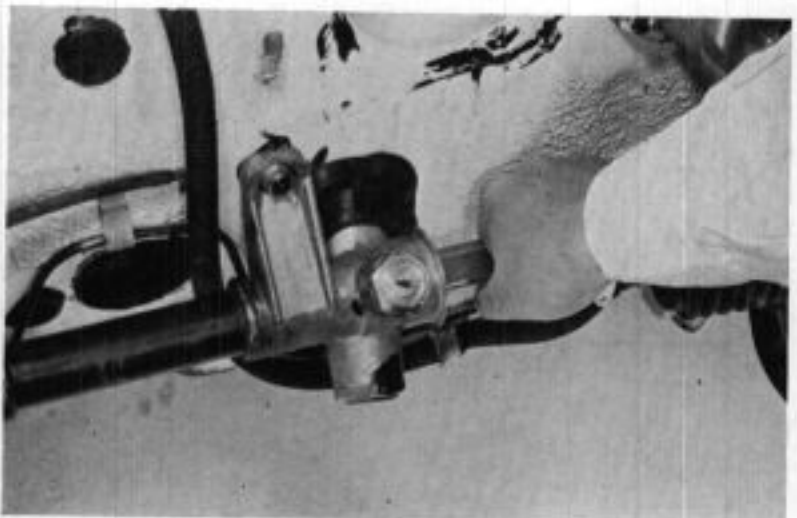


Fig. 10D-15

10-14 STEERING

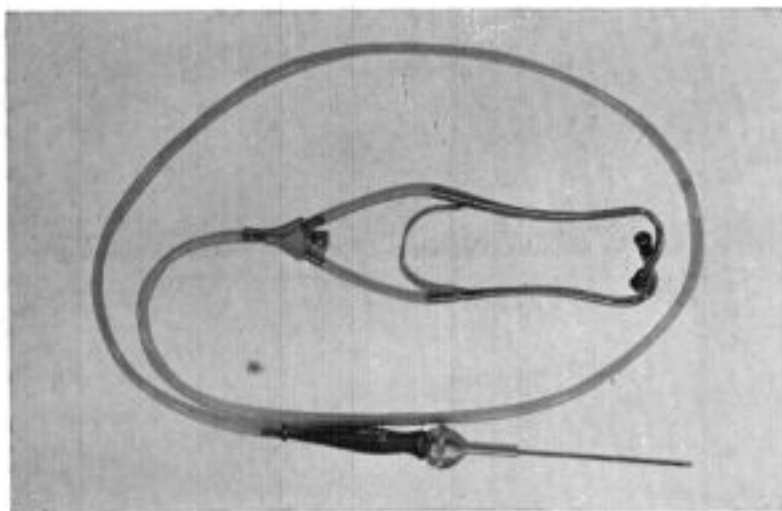


Fig. 10D-16

5. If noise is heard from the steering gear box or around it, locate the exact source of the noise with the sound scope. (Fig. 10D-16)

Place the sound scope to the right and left rack adjusting bolts, and check for noise by shaking the rack gear or moving the front wheel to and fro.

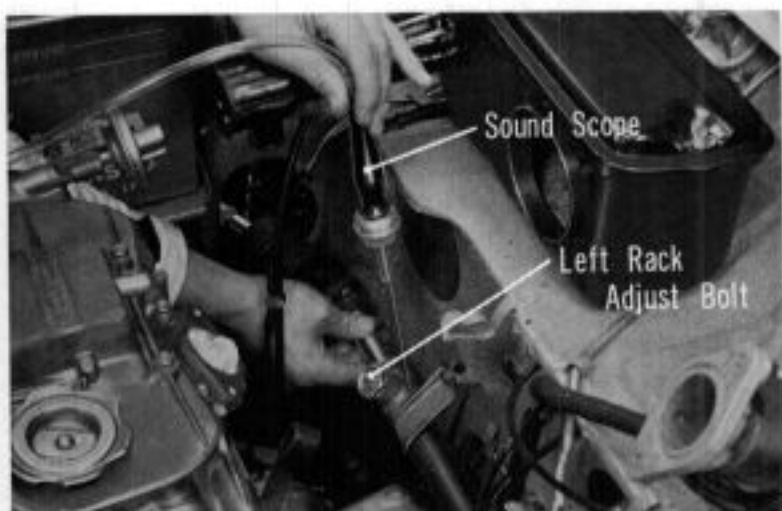


Fig. 10D-17

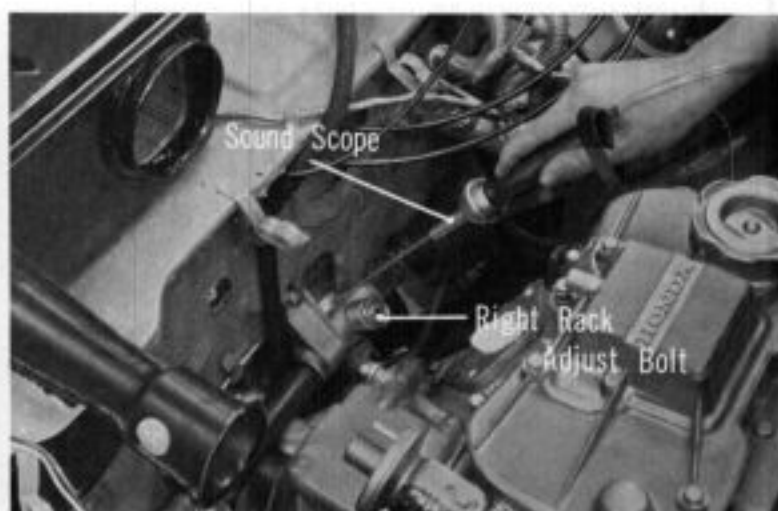


Fig. 10D-18

If the noise exists in these parts, add grease to the gear box through the grease nipple when the steering gear has such nipple; or when nipple is not provided, attach a greasing adapter (special tool) in place of the rack adjusting bolts and supply grease. Turn the steering wheel either to the extreme right for greasing through the right hand side nipple or greasing adapter, or to the extreme left for greasing through the left hand side nipple or greasing adapter. Noise noted in the steering gear box during vehicle running after sufficiently greasing indicates improper adjustment of the rack adjusting bolts or the pinion adjusting bolts. Readjust them by referring to "Assembly".



Fig. 10D-19



Fig. 10D-20

Check the lock plate in the link between the rack end ball joint and the rack gear for looseness; then check the rack end ball joint for noise by means of the sound scope.

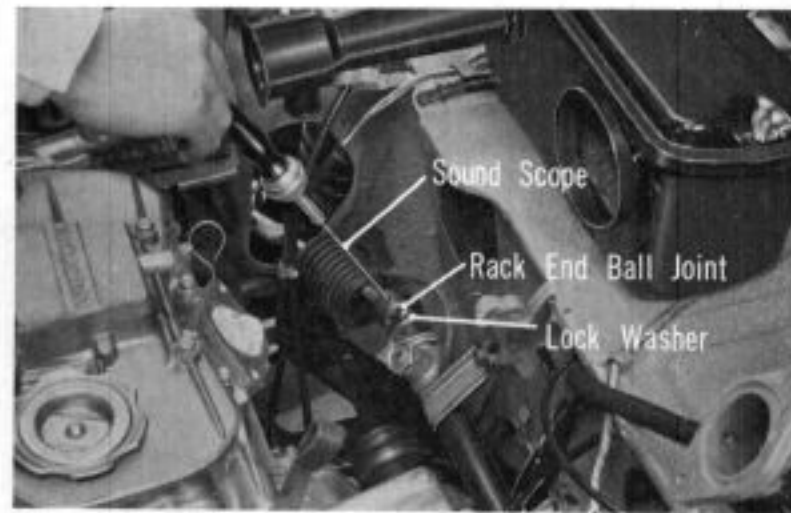


Fig. 10D-21

Assembly

1. Place the pinion in the gear box.
Grease (graphite grease) the pinion gear, U-thrust plate, and pinion gear mounting bolt. The U-thrust plate should be installed with the round-edge-face in ward.

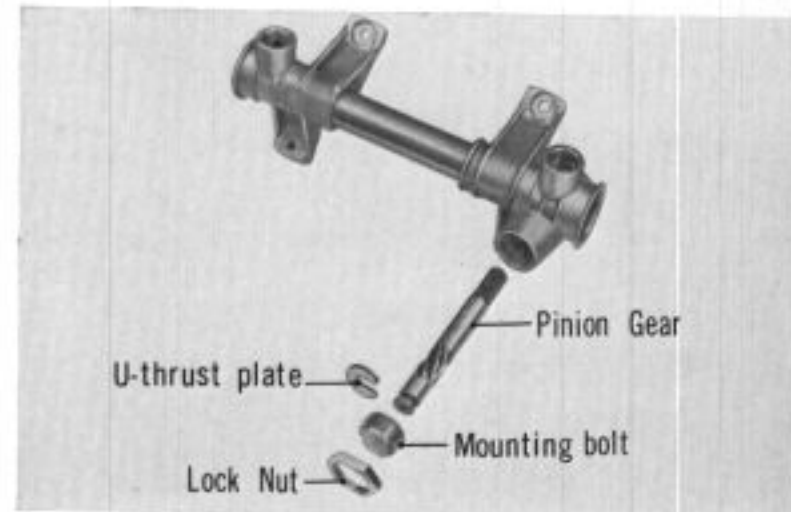


Fig. 10D-22

Tighten the pinion gear mounting bolt and secure with the lock nut.

Note: Do not tighten the lock nut too hard to prevent the damage to the threads of steering gear box.

(Tightening torque) 2.0~2.5kgm (14.5~18.1 lb-ft)



Fig. 10D-23

2. Grease the steering rack and insert it into the gear box.



Fig. 10D-24

10-16 STEERING

3. When rack end is threaded in tightly to the rack, secure with the lock washer. Lock washer should be replaced with a new part when reassembling.

Note:

The tongue of the tie-rod lock washer fits to the groove of the rack gear.

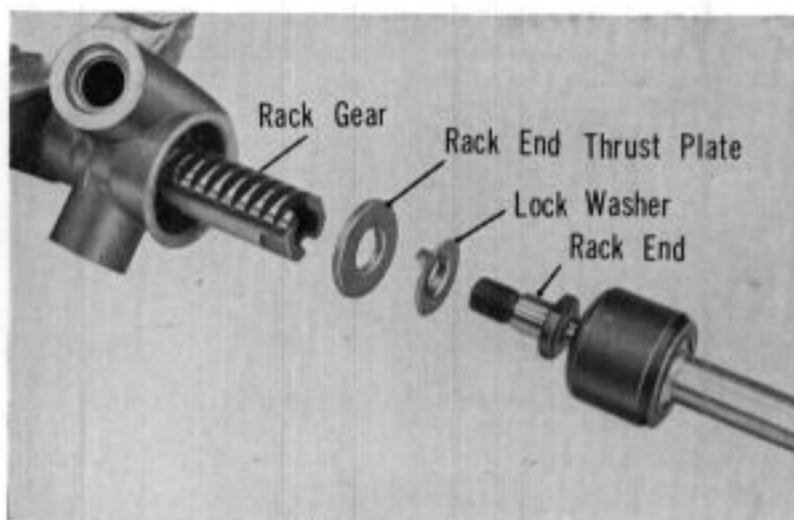


Fig. 10D-25

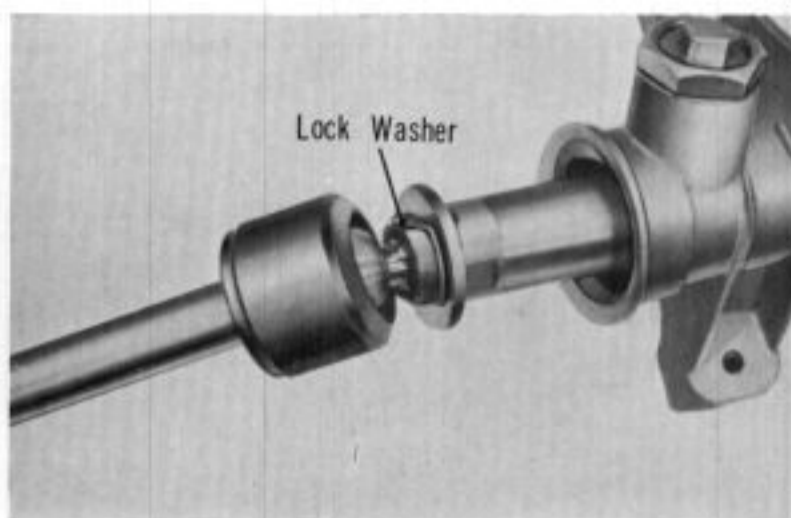


Fig. 10D-26

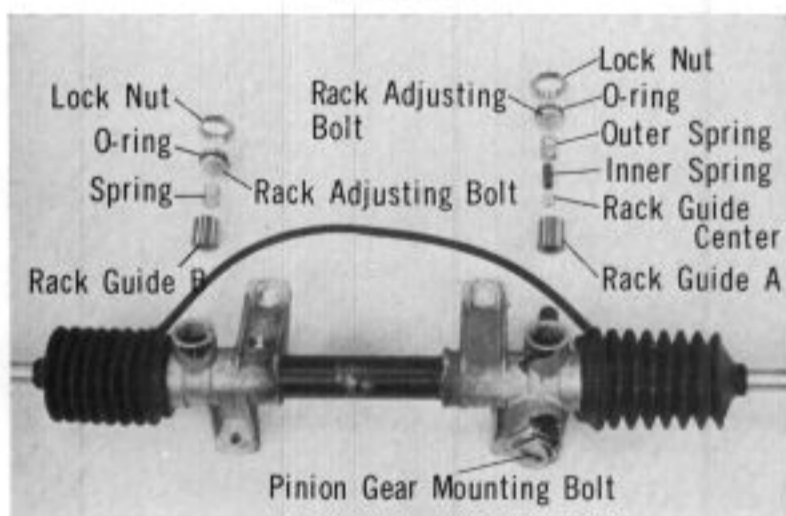


Fig. 10D-27

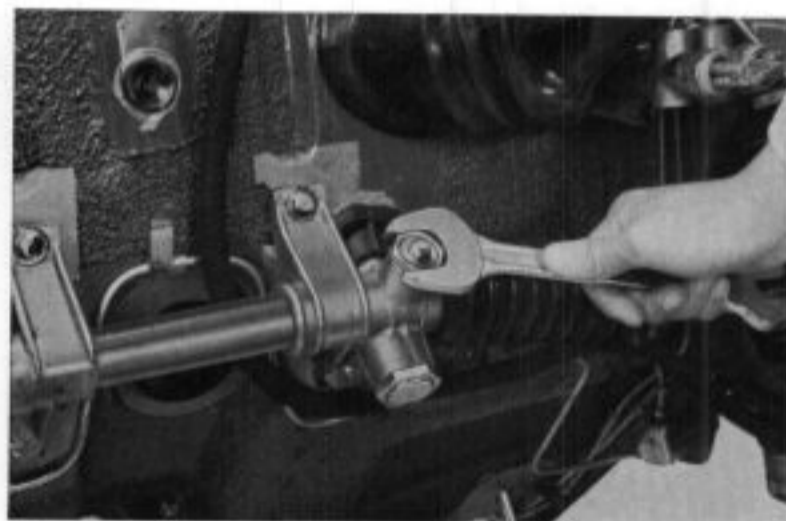


Fig. 10D-28

4. Grease the rack guides A and B and install them into the specified positions with claws toward front.

Do not interchange the rack guides. Check the O-rings fitted to the rack adjusting bolts for any damage and deterioration.

5. Prior to adjusting rack guide A near the pinion gear, adjust the rack guide B. Tighten the adjusting bolt until it does not rotate and back off the bolt about 20 degrees. This is the correct position. Secure with the lock nut. Then, adjust the rack guide A in the same manner.

Note: Do not tighten the lock nuts too hard to prevent damage to the threads of the steering gear box.

Tightening torque: 2.0~2.5kg-m
(14.5~18.1 lb-ft)

E. Checking and Adjusting Front Wheel Toe-in

When checking wheel alignment, place the unloaded car on a level surface. It is imperative that all checks of steering linkage for bends, wear, and other damage (spring damage, bent frame wheel distortion, deformed tires, tire pressure, worn wheel bearings, steering gear backlash) be made and faults corrected before performing this test. If these checks are not made in advance, no accurate test of the wheel alignment can be made.

1. Checking Toe-In

Set the front wheels in the straight ahead position. Chalk a mark line at the center of each front tire and measure distance between the chalked lines. Turn wheels 180 degrees and measure the distance at the rear. Toe-in equal (rear measured value) - (Front measured value)

The standard value of the toe-in is -2mm (-0.08 in) OUT.

2. Adjustment

Toe-in can be adjusted by loosening the lock nuts at each of the tie rods. To increase toe-in, turn the right tie-rod in the direction of wheel rotation when the car moves forward; turn the left tie-rod in the opposite direction. Turn both tie-rods an equal amount until toe-in becomes -2mm .



Fig. 10E-1

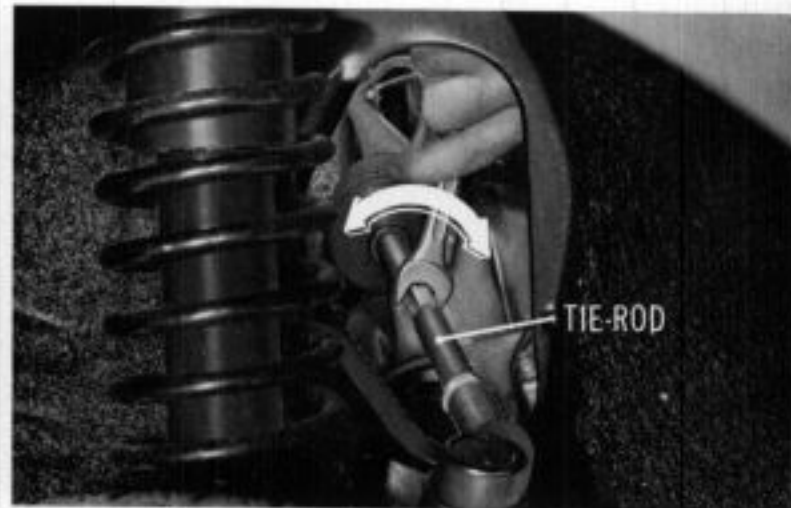
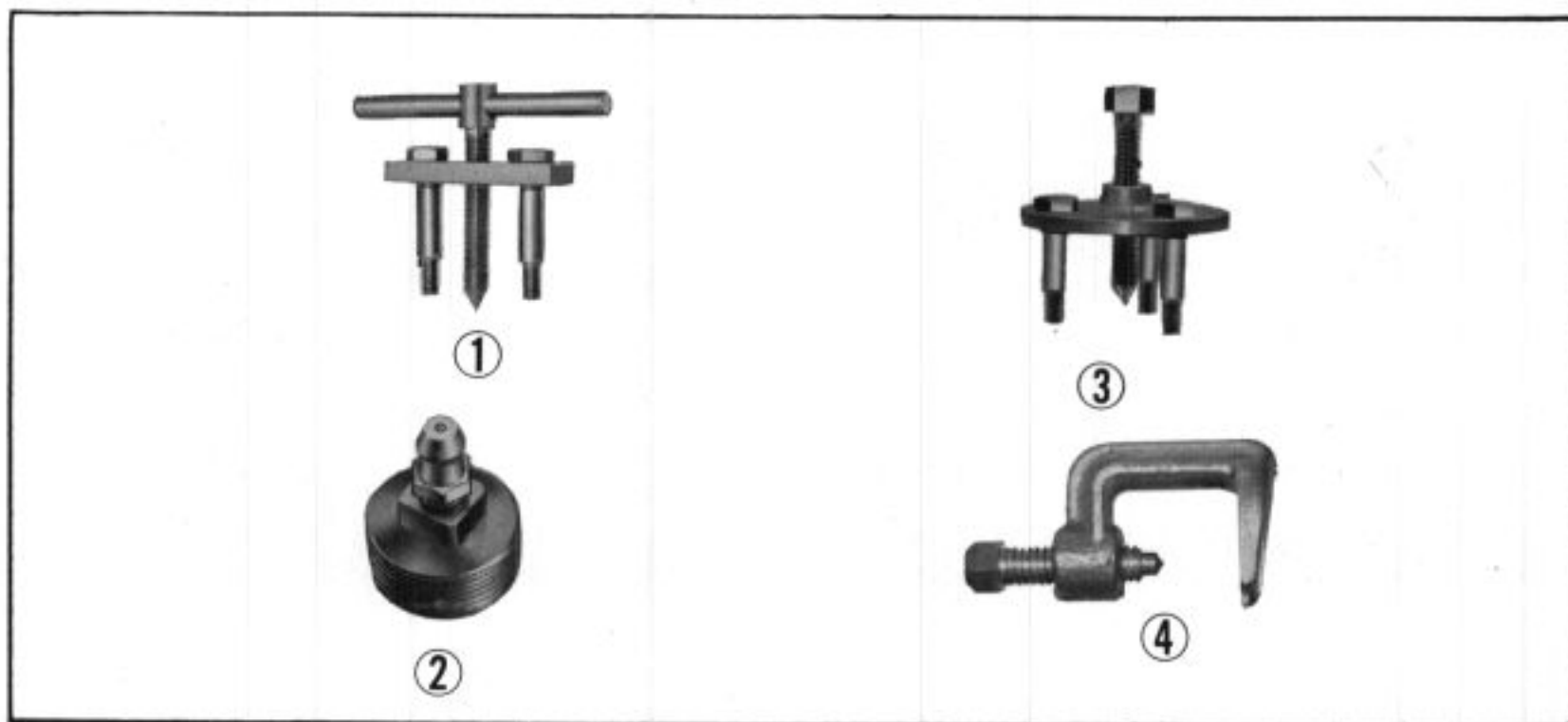


Fig. 10E-2

F. Special Tool



Ref. No.	Tool No.	Description
1	07010-51201	Steering wheel puller A
2	07019-51201	Steering wheel puller B
3	07099-56801	Greasing adapter (Optional)
4	07092-55103	Tie-rod end puller

G. Trouble Diagnosis

(a) Hard steering and poor return steering

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Insufficient tire pressure	Correct front tire pressure to 1.7kg/cm ² (24 psi) for standard tire and 1.8kg/cm ² (26 psi) for radial tire
2. Incorrect front wheel alignment	Correct front wheel alignment. Toe-in: -2mm (-0.08in) (Toe "OUT" 2mm) Camber: 0.5° Caster: 1.0°
3. Incorrect adjustment of the rack adjusting bolts	Readjust
4. Improper steering column housing position.	Reposition the column housing so that there is 0~0.2mm (0.008in) play in the axial direction between the steering column and the column housing.
5. Tight rack end ball joints and/or tie-rod end ball joints.	These ball joints will be somewhat tight when new, but will become smooth after mileage of about 3000km (1800 miles).
6. Worn pinion gear bushing damper rubber.	Replace the pinion gear bushing.

(b) Steering gear box chuckles or rattles

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Insufficient amount of grease inside gear box.	Add grease. Refer to section "steering gear box" for detail.
2. Improper adjustment of rack adjusting bolts and pinion gear adjusting bolt.	Readjust.
3. Loose linkage between rack gear and rack end ball joint.	Tighten and secure with new lock washer.
4. Worn rack end ball joint.	Replace with new ball joint. Make sure the front wheel alignment is correct.

10-20 STEERING

(c) Excessive wheel return or loose steering

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Lash in steering shaft universal joints.	Select-assemble the lock plates of the trunnion caps, or install wave springs inside the trunnion caps.
2. Incorrect front wheel alignment.	Adjust to specified value.
3. Loose wheel bearings.	Replace with new parts.
4. Worn rack end ball joints and/or tie-rod end ball joint.	Replace with new parts.
5. Loose rack end and rack linkage.	Tighten and secure with new lock washer.

(d) Steering column vibrates

POSSIBLE CAUSE	CORRECTIVE ACTION
1. Excessive play between steering column and column bushings.	Replace with new part.
2. Loose steering column mount.	Mount securely with four bolts.
3. Loose steering wheel mount.	Tighten the nut to a torque of 3 to 3.5kg-m (21.7~25.3 ft-lbs)
4. Excessive lash in the steering shaft universal joints.	Select-assemble the lock plates of the trunnion caps, or install waves springs inside the trunnion caps.

(e) Car leads to one side

POSSIBLE CAUSE	CORRECTIVE ACTION
Incorrect wheel alignment	Adjust