

## SECTION 9

### DRIVE SHAFT

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## A. Description

The front drive shaft assembly consists of an axle shaft and a drive shaft jointed with two universal joints. A constant velocity ball joint is employed for the inner universal joint of all models and the outer joint of N400/N600 models. (Fig. 9A-2) while a double cross universal joint is employed for N360 outer joint (Fig. 9A-1). The constant velocity ball joints are factory-packed with special grease and they are enclosed in sealed rubber boots. The outer constant velocity ball joint employed for N400 and N600 cannot be disassembled except for removal of the rubber.

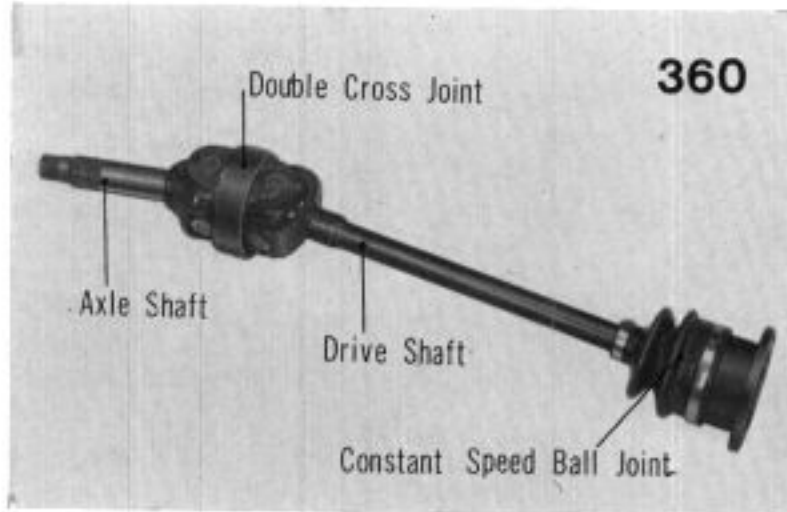


Fig. 9A-1

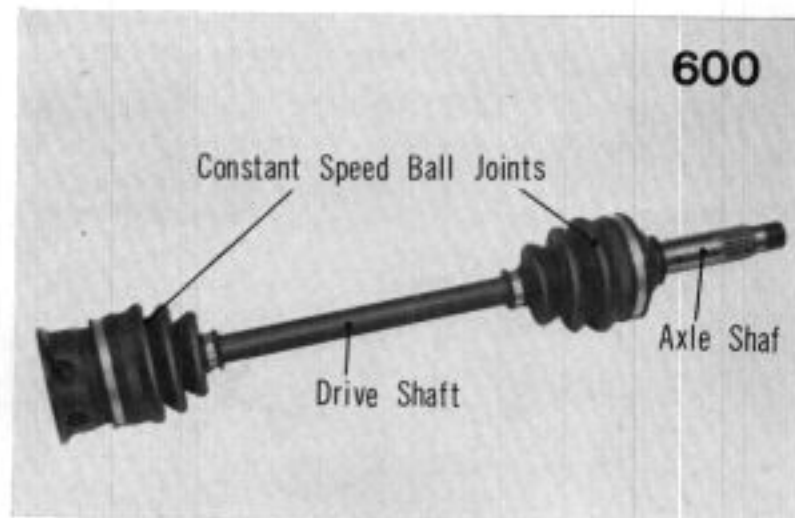


Fig. 9A-2

## B. Maintenance

### a. Inspection of the drive shaft

1. Clean and check the bellows for damage or deterioration. Replace if necessary
2. Raise front wheels off ground and check the drive shaft for excessive play in both rotational and axial directions. If excessive play is found, check the outboard joint for excessive wear. Worn joint may cause rattling noise.

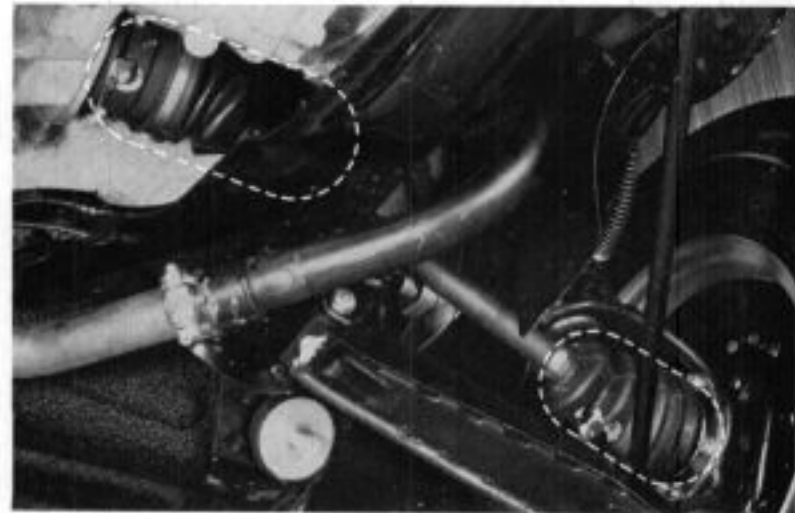


Fig. 9B-1



Fig. 9B-2

## 9-2 DRIVE SHAFT



Fig. 9B-3a

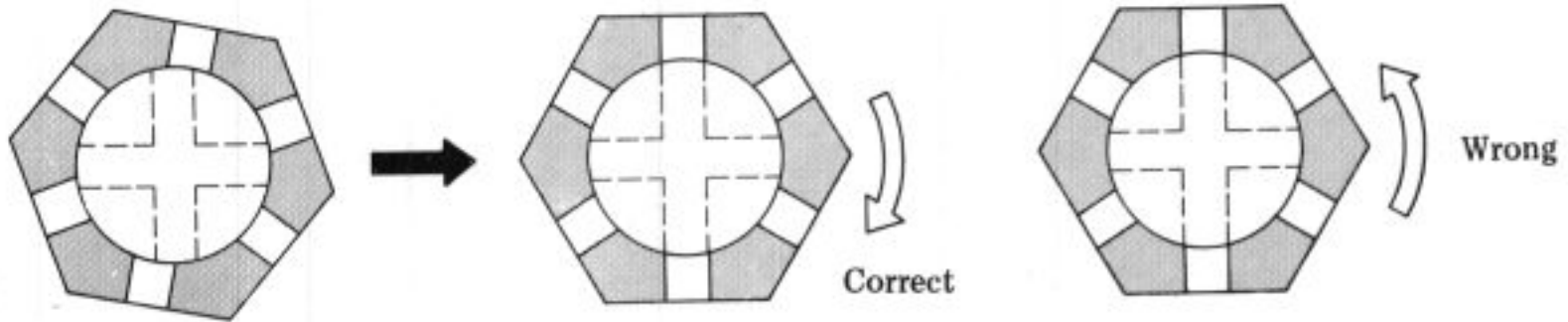
- The front wheel hub nuts should be inspected and tightened to specification periodically. A loose wheel hub nut may cause shimmy and vibration. There are two different hub nuts employed. They should be secured with same torque as follows.

Size of thread (mm Dia.)	Torque Kg-m (lb-ft)
20	14~20 (101~145)
22	14~20 (101~145)

(Note)

To align the hub nut slot with cotter pin hole in the spindle, always turn the nut in the direction of increased torque as shown below.

In order to avoid tightening the nut excessively, it is advisable to torque the nut first to 14 kg-m by means of torque wrench prior to aligning the slot with the hole. If the slot happens to be aligned with the hole, turn the nut another 30 degrees and align the next slot.



(Aligning the pin hole)

Fig. 9B-3b

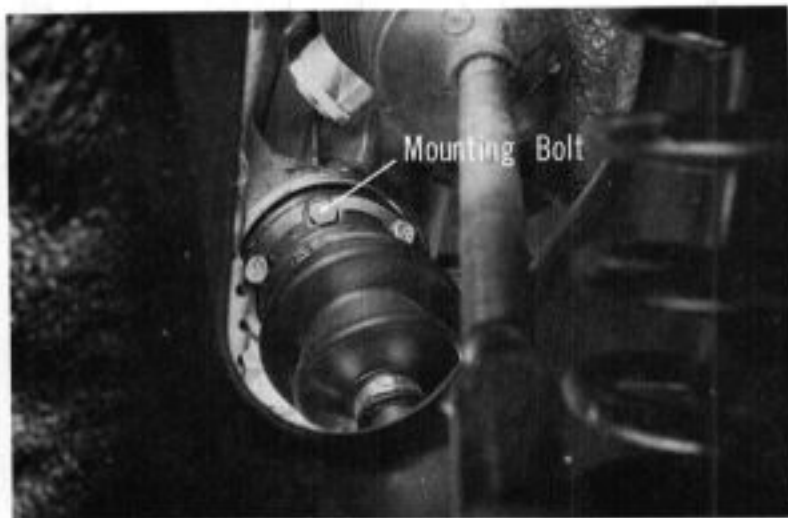


Fig. 9B-4a

- Check the drive shaft mounting bolts for looseness.

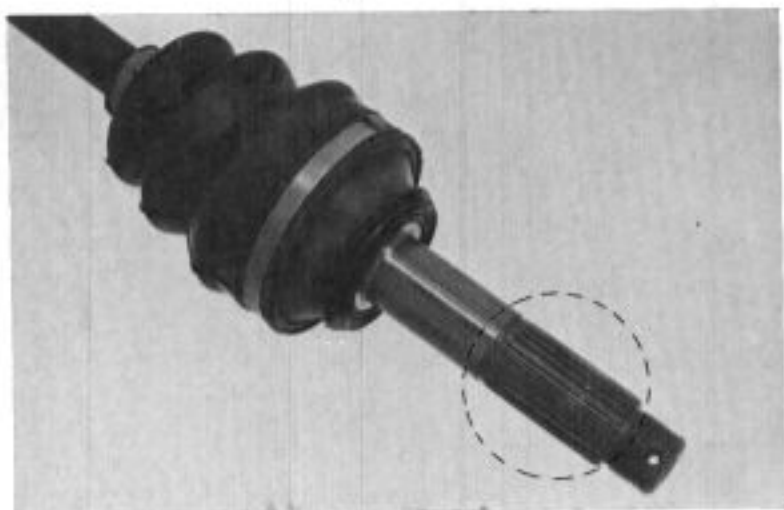


Fig. 9B-4b

- Check the splines for excessive wear.

**b. Removal of the drive shaft**

1. Jack the vehicle up and remove the front wheels and brake drums (or disk brake hubs).
2. Remove the backing plate from the knuckle, or the dust seal cover for the disk brake equipped vehicles.

**Note:**

Removal of the brake line necessitates bleeding air from the brake line; therefore, it should not be removed.

3. Disconnect the drive shaft from the differential joint flange. This is done by removing the six bolts (for 600 series vehicle, three for 360 and 400 series vehicles) after straightening the lock plate. The bolts on 360 and 400 series vehicles are easily loosened with a 12mm socket wrench (special tool).

4. Mount the special tool-Drive Shaft Replacer (Flange) on to the knuckle.

5. Attach the special tool-Drive Shaft Replacer Main (shaft and the center bolt) on to the flange as shown in the picture.

Then, thread the retainer on to the drive shaft ensuring that they are in the same axis.

Apply oil on the threads of the center bolt.

**Note:**

Shafts should be fully threaded into the flange and lock nuts securely tightened.

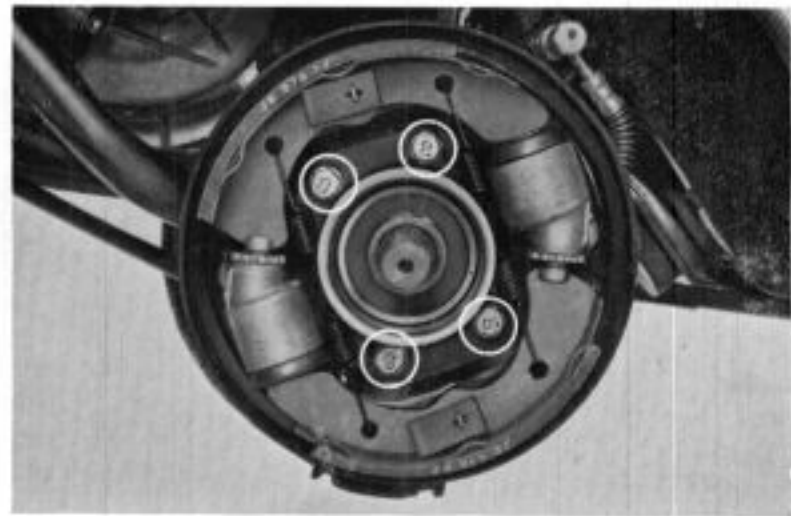


Fig. 9B-5a

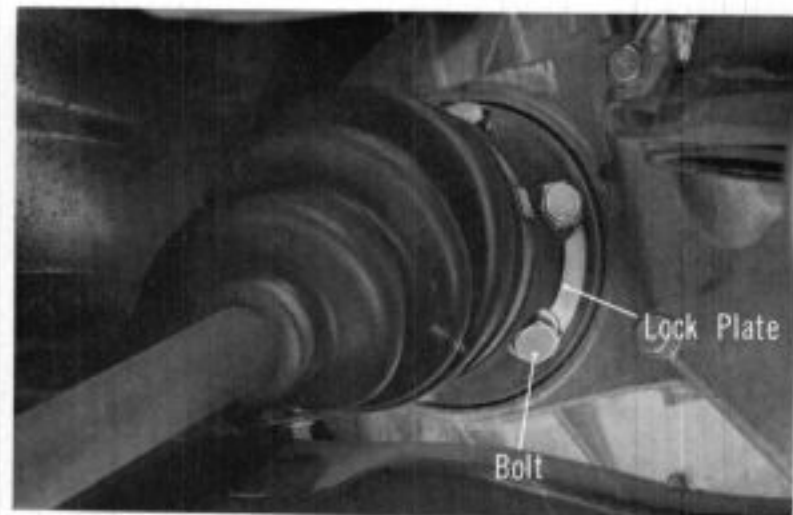


Fig. 9B-5b

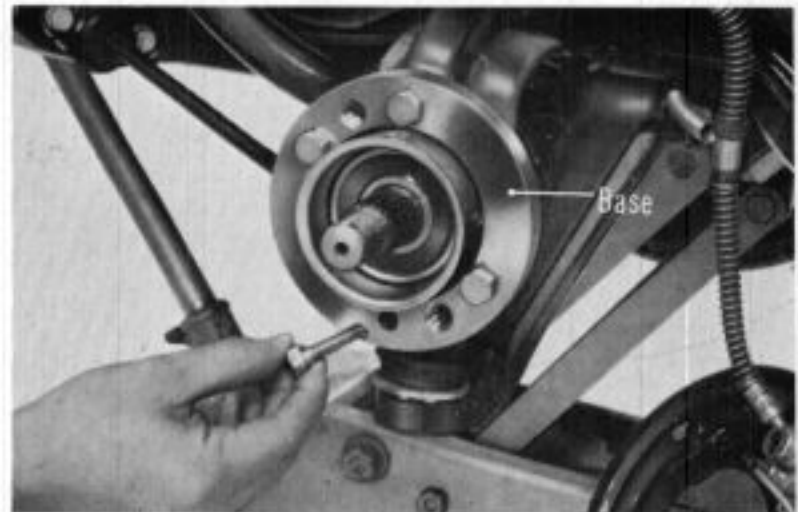


Fig. 9B-5c

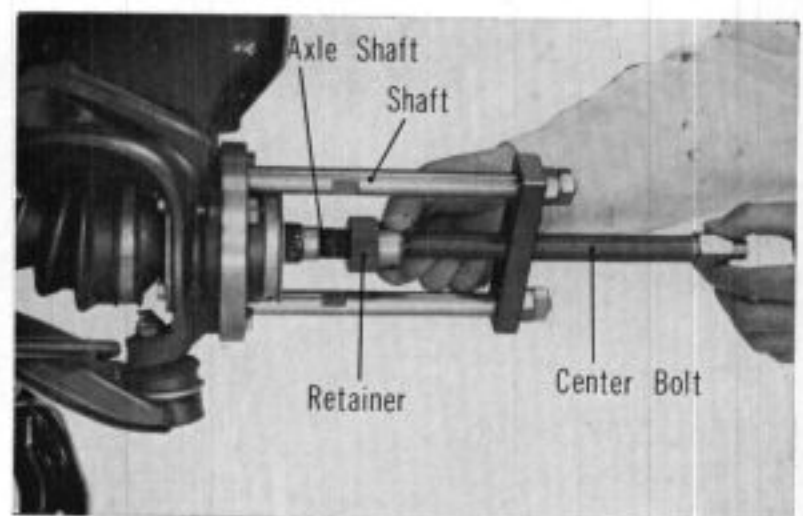


Fig. 9B-6a

## 9-3-1 DRIVE SHAFT



Fig. 9B-6b

Install the special tool-Drive Shaft Replacer Attachment when servicing 22mm thread dia. drive shaft.

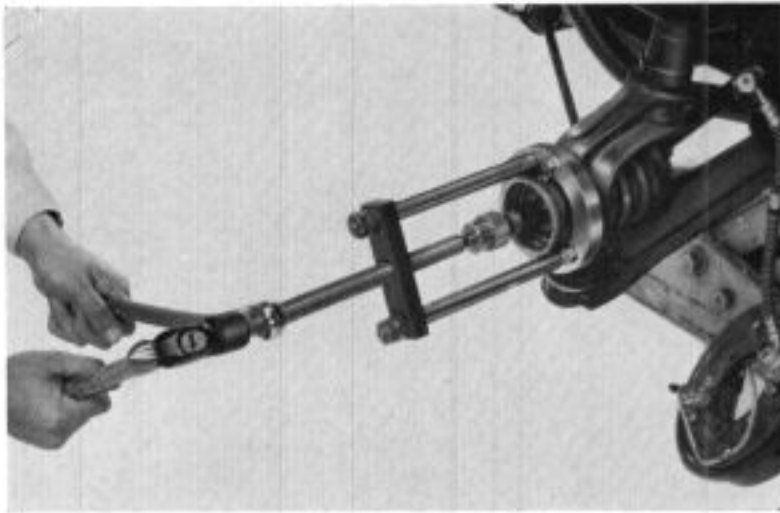


Fig. 9B-7a

6. Tighten the center bolt with the socket wrench while tapping with a hammer.

**Note:**

Take care to prevent interference between the drive shaft inboard joint and the engine.

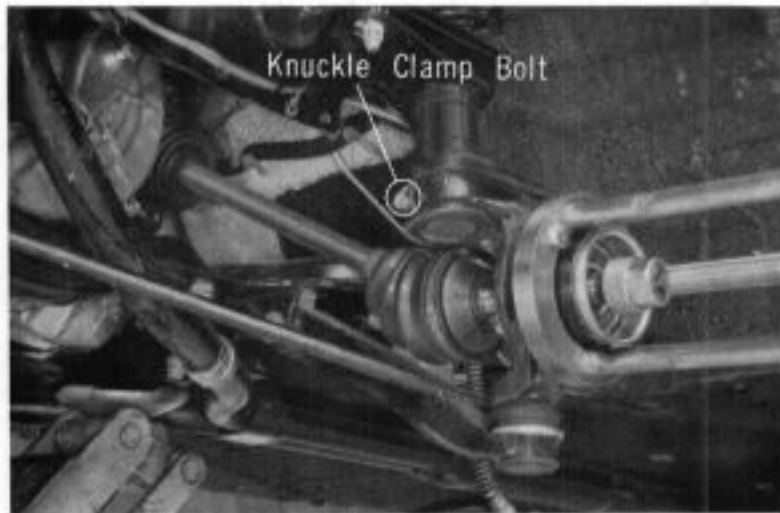


Fig. 9B-7b

7. When the axle shaft has been pushed out about two-thirds of its length, remove the knuckle from the front damper by tapping the knuckle downward with a copper hammer after the knuckle clamp bolt has been removed.

**(Knuckle Clamp Bolt Tightening Torque)**

8mm	2.8 to 3.4 kg-m (20 to 25 lb-ft).
10mm	4.5 to 5.0 kg-m (33 to 37 lb-ft).

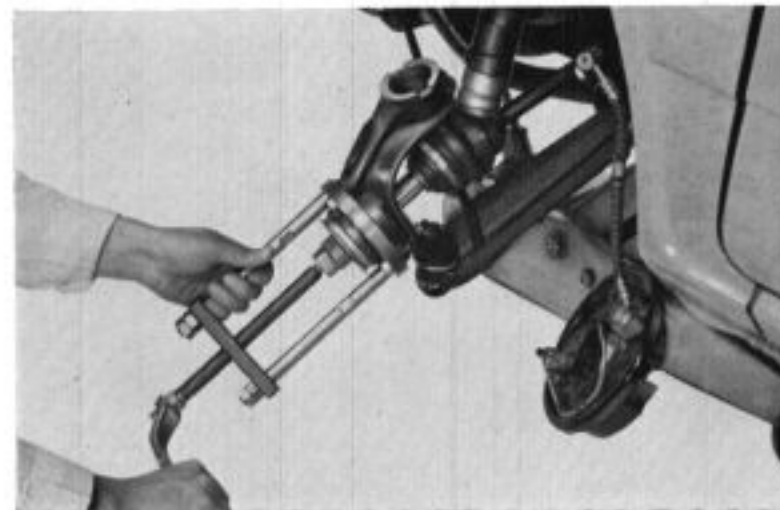


Fig. 9B-7c

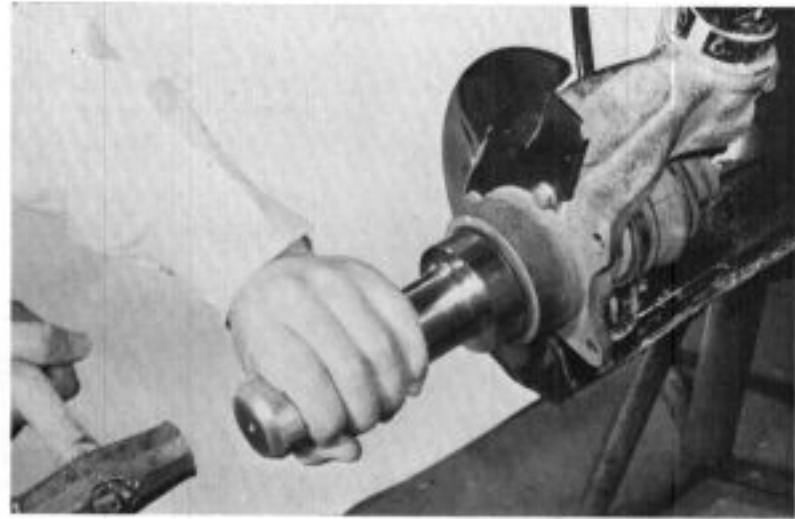
8. Screw the center bolt further and separate the drive shaft from the knuckle.

**C. Installation of the drive shaft****1. Assembly of the front bearings**

Use the special tool—Front wheel Bearing Driver A to install the inner and the outer bearings.

**2. Installation of the drive shaft**

The outer wheel bearing may be loose upon completion of assembly; correct by using the Bearing Driver A (Fig. 8B-8a)

**3. Dust seal is installed by means of the special tool front wheel bearing Driver B.****Fig. 9B-8a****Fig. 9B-8b**

## 9-4 DRIVE SHAFT

### b. Constant speed ball joint

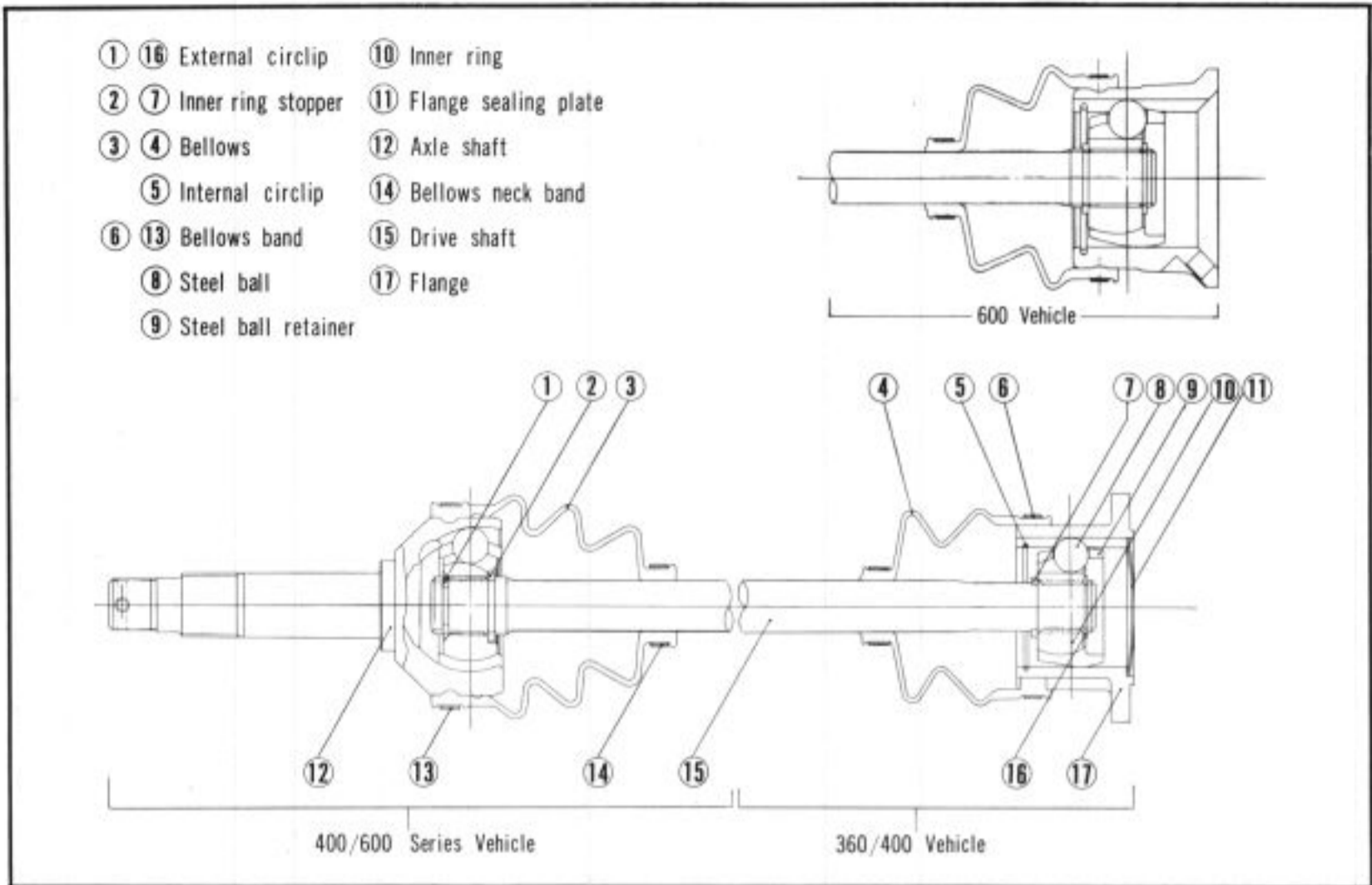


Fig. 9B-9

The drive shaft of 400 and 600 series vehicles employs constant speed ball joints on both inboard and outboard side; in 360 series vehicles a ball joint is used on the inboard side and a double cross universal joint on the outboard side.

The constant speed ball joint has the advantages of having outstanding constant-speed characteristics, a wider operating angle, higher resistance against overload and shock, and a longer service life with less maintenance. Replacement of damaged bellows and grease should be conducted as follows.



Fig. 9B-10

#### 1. Removing the bellows band.

After peeling off the end with a pliers remove the band by tapping a screwdriver (held as shown in Fig. 9B-10) with a hammer. Do this carefully to prevent damaging the bellows.

2. Move the bellows, and remove the circlip in the flange with a screwdriver. Separate the flange and the drive shaft. (Fig. 9B-11)

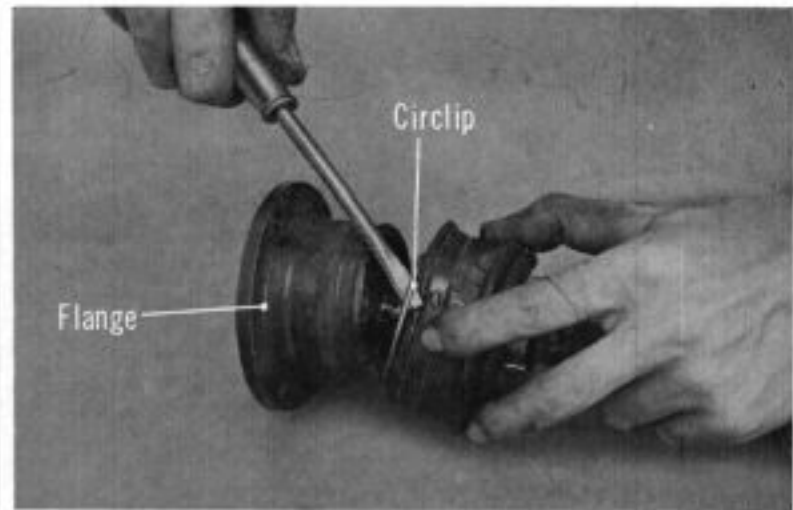


Fig. 9B-11

3. Remove the inner ring set circlip, and withdraw the steel ball and retainer from the drive shaft. Clean both after removal. (Fig. 9B-12)

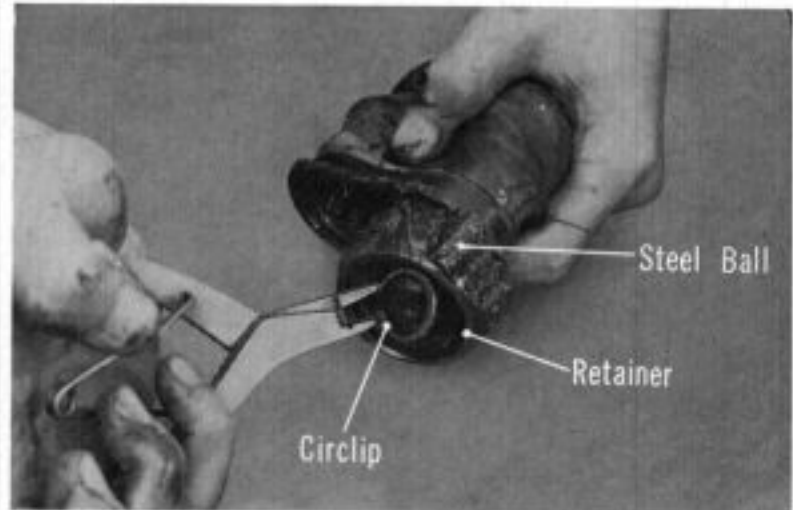


Fig. 9B-12

c. Assembly

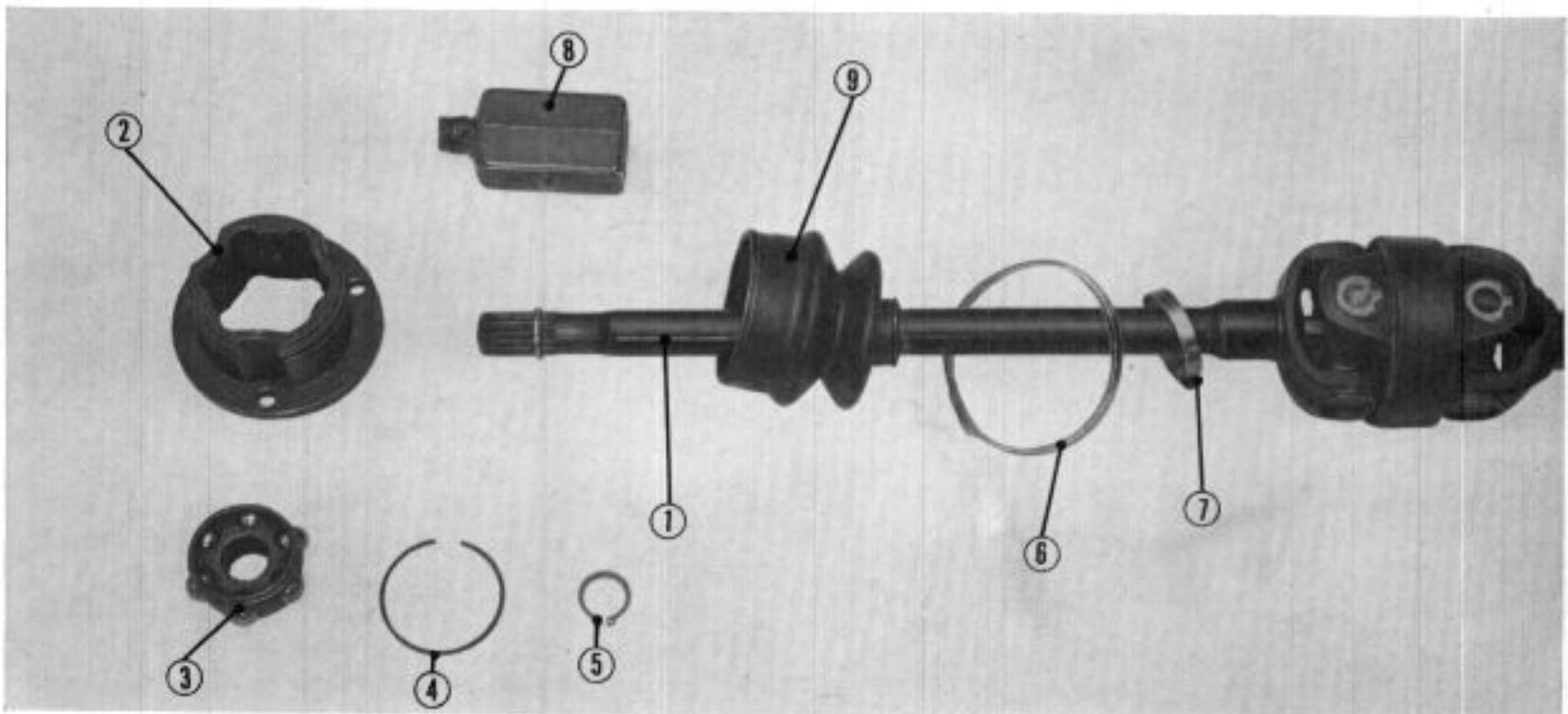


Fig. 9B-13

- |                                    |                    |                     |
|------------------------------------|--------------------|---------------------|
| 1 Drive shaft                      | 4 Internal circlip | 7 Bellows neck band |
| 2 Flange                           | 5 External circlip | 8 Grease (50g)      |
| 3 Inner ring, Retainer, Steel ball | 6 Bellows band     | 9 Bellows           |



## 9-6 DRIVE SHAFT

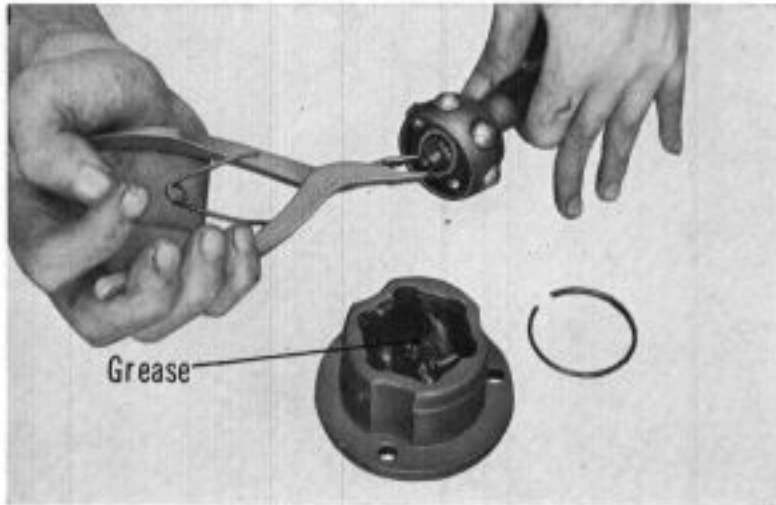


Fig. 9B-14

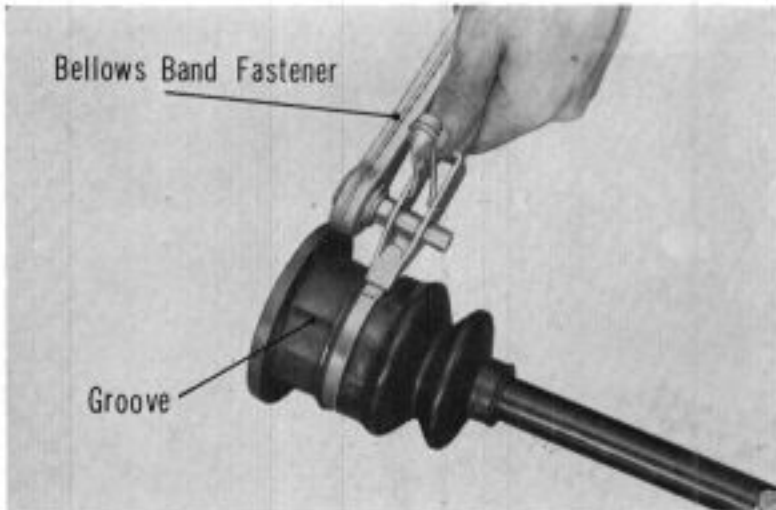


Fig. 9B-15



Fig. 9B-16

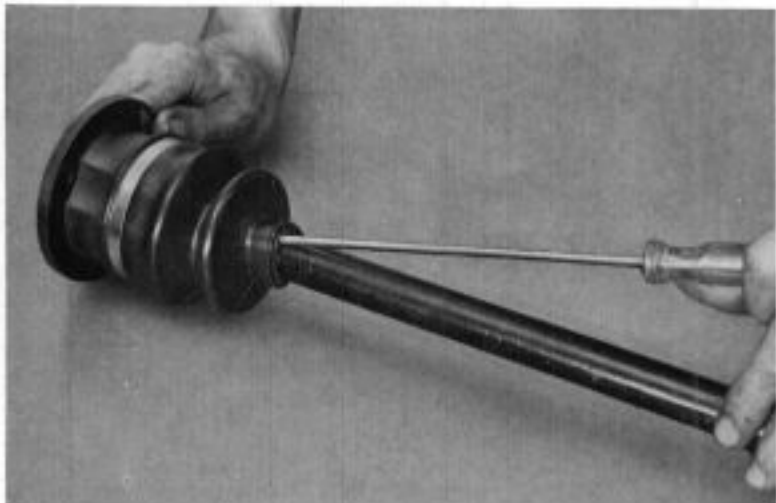


Fig. 9B-17

4. Insert the bellows neck band, bellows band, and bellows in this sequence into the drive shaft as shown in Fig. 9B-13.
5. Fill the flange with grease (approximately 30g or 2/3 the capacity).
6. Set the steel ball in the inner ring and retainer by hitting with a copper hammer.
7. Insert the retainer into the drive shaft in the direction as shown in Fig. 9B-14, and secure with circlip.
8. Raise the drive shaft with the flange side down, and insert the drive shaft into the flange until a small portion of the grease comes out. (360)
9. Pour the remaining grease (1/3) into the flange; do not pour it into the bellows.
10. Mount the bellows on the flange by aligning it with the flange's peripheral groove. Tighten the bellows band with the bellows band fastener, special tool.
11. Tightening should be effected between the grooves on the periphery of the flange bolt hole position. (Fig. 9B-15)
12. Lock the bellows band end with a punch. (Fig. 9B-16)
13. After locking, remove the fastener, and cut the band end at a position so that approximately 10mm (0.4 in) of it is left. Bend the left end.
14. Positioning the bellows neck band.  
If the bellows neck band position is not correct, bellows projecting piece may be worn out due to changes in drive shaft slide and operating angle caused. Therefore, the bellows neck band position should be determined by adjusting the air volume in the bellows to a normal value. Insert a thin screwdriver into the bellows as shown in Fig. 9B-17. After confirming that the bellows are shaped normally, remove the screwdriver, and tighten the band in this position. If the bellows projecting piece makes contact with the drive shaft when the shaft is bent to full operating angle, it represents that the band is positioned too near the flange. Or, if there is a hollow in the bellows when it is extended fully it represents that the air volume in the bellows is too low. Even after tightening the band, it is possible to slightly move the band. So, the band position should be set properly without fail.

15. (360/400)  
 Inspection and correction of flange sealing plate.  
 When reinstalling the used flange do not forget to check the sealing plate. To check push the drive shaft in completely, and make sure that there is no grease leakage from the periphery of the sealing plate. If grease is found coming out, fix the plate periphery with a screwdriver, and further caulk in 6 position. Caulk should be approximately 2mm (0.008 in) from the edge as shown in Fig. 9B-18.

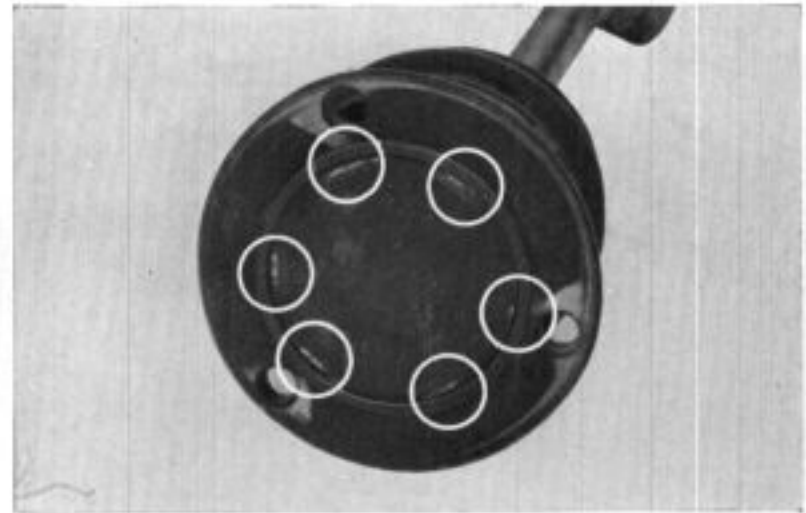


Fig. 9B-18

**C. Double cross universal joint  
 (for 360 vehicle)**

**Checking the drive shaft**

1. Place the vehicle in slow forward movement (in low or 2nd transmission gear shift lever position) and, while turning the steering to either the left or right, determine if abnormal sounds originate from the drive shaft.
2. If so, jack up the vehicle and make a thorough check of drive shaft parts.
  - (1) Insert a long screwdriver into the axle shaft yoke and lock the axle shaft. With a firm hand hold on the drive shaft, move it all directions up and down, right and left, and forward and backwards, and determine if there is any play.
  - (2) Position the dust seal on the double cross joint.
  - (3) Properly position the circlip on the bearing case.
  - (4) Make sure there is no water in the grease.
3. If any defects are found as a result of these four check items, disassemble and make necessary repairs. Examine both drive shafts carefully (left and right) if either is found defective. Disassembly and repair of both is recommended.

**Tools necessary for disassembly and assembly**

**Drive shaft service jig set:**

- 1 Base
- 2 Bearing case support
- 3 Cross shaft driver A
- 4 Cross shaft driver B
- 5 Center yoke fitting
- 6 Spacer
- 7 Center shaft press-in adaptor
- 8 Center shaft height gauge
- 9 Center shaft press-out adaptor
- 10 Center shaft holder
- 11 Center shaft clamber



Fig. 9B-19

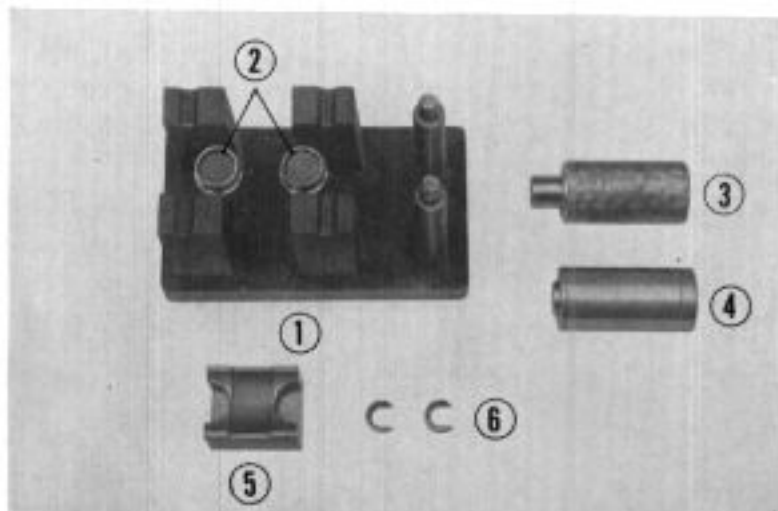


Fig. 9B-20

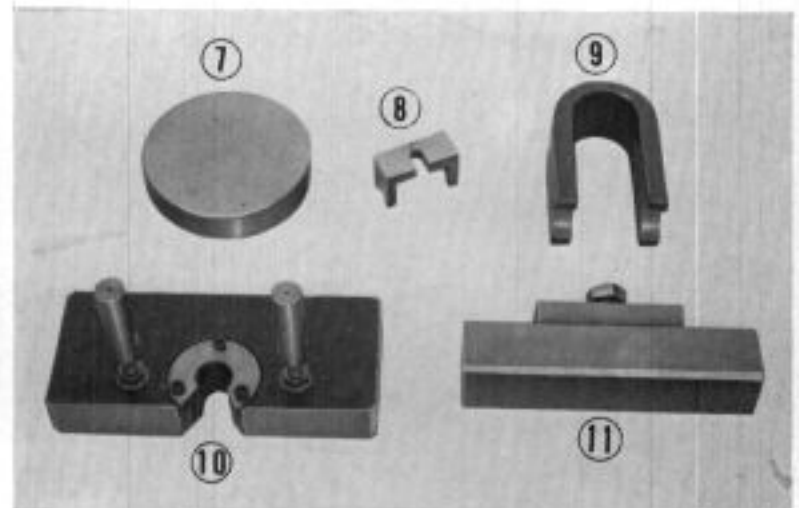


Fig. 9B-21

## 9-8 DRIVE SHAFT

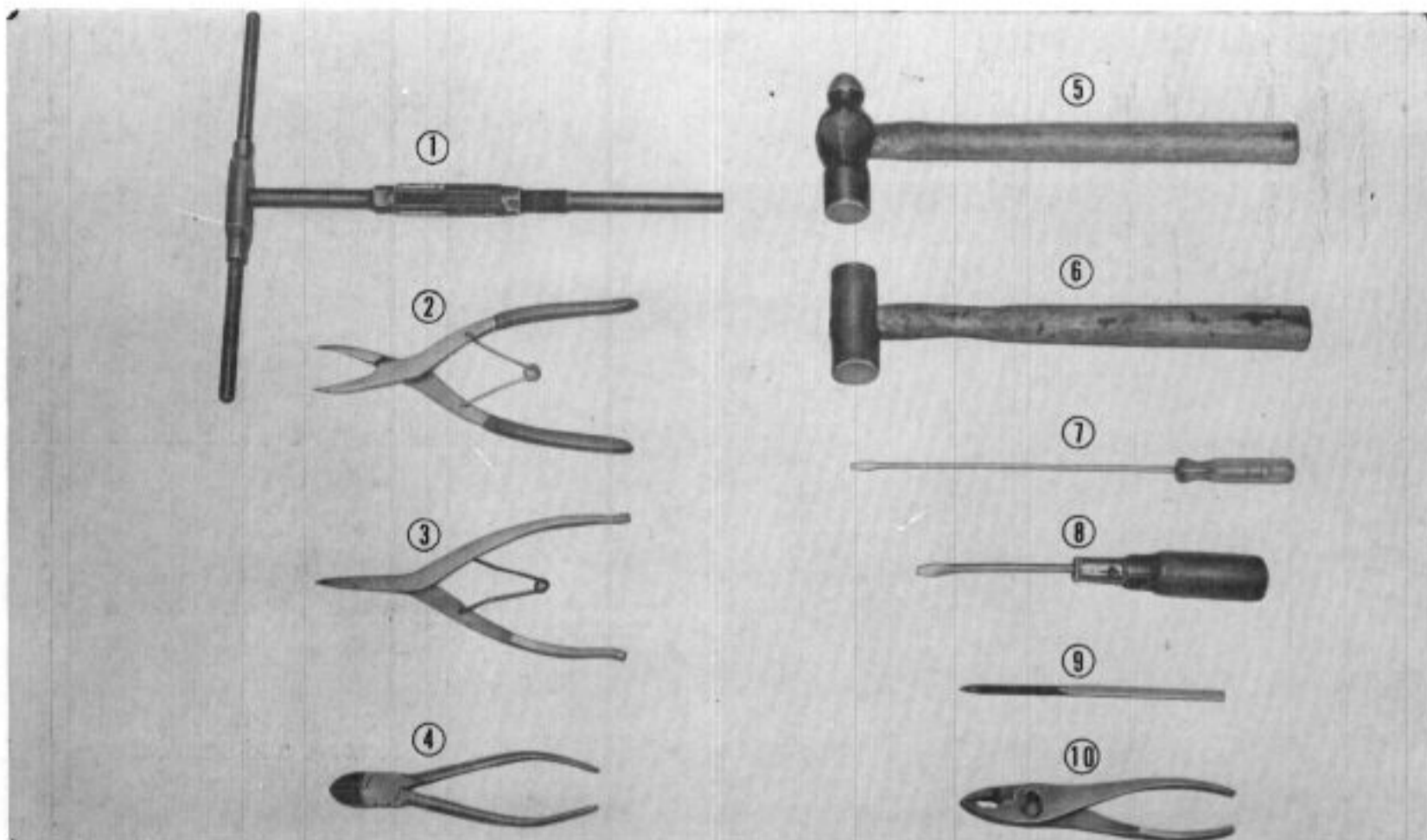


Fig. 9B-21-2

- 1 Reamer, 22mm
- 2 Snap ring pliers (open end)
- 3 Snap ring pliers (closed end)

- 4 Wire cutter
- 5 Hammer
- 6 Copper mallet

- 7 Screwdriver
- 8 Screwdriver
- 9 Punch or chisel
- 10 Combination pliers
- 11~1 Press (capacity: five tons or more)
- ~2 Bellows band fastener (special tool)

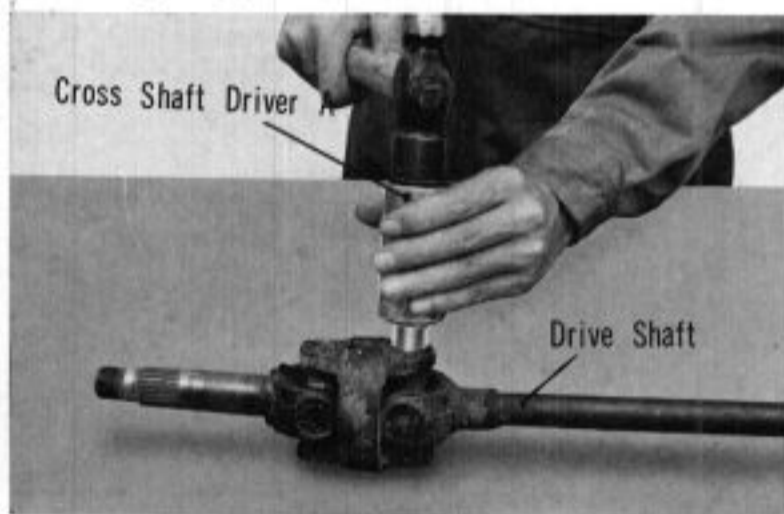


Fig. 9B-22

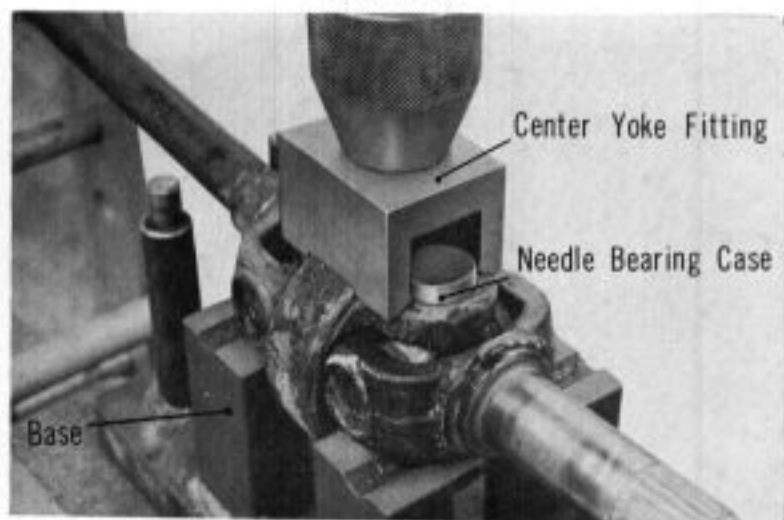


Fig. 9B-23

### Disassembly, Inspection and Assembly.

#### 1. Remove the double cross joint circlips

Tap the circlips (eight), through cross shaft driver A with a hammer, and remove them with the snap ring pliers. Tapping should be limited to loosening the circlips; they should not be tapped completely free.

#### 2. When the eight circlips have been removed, set the base of the jig on the press and the drive shaft assembly on the base of the jig in the direction shown in Fig. 9B-23.

#### 3. Mount the center yoke jig fitting, and operate the press. When pressure equivalent to two tons is obtained, the needle bearing case will protrude approximately 7mm (0.28 in).

4. Release the oil pressure, and insert the two jig spacer into the clearance between the cross shaft and bearing case. Mount each spacer so that the stepped side faces the cross shaft, as shown in Fig. 9B-24.

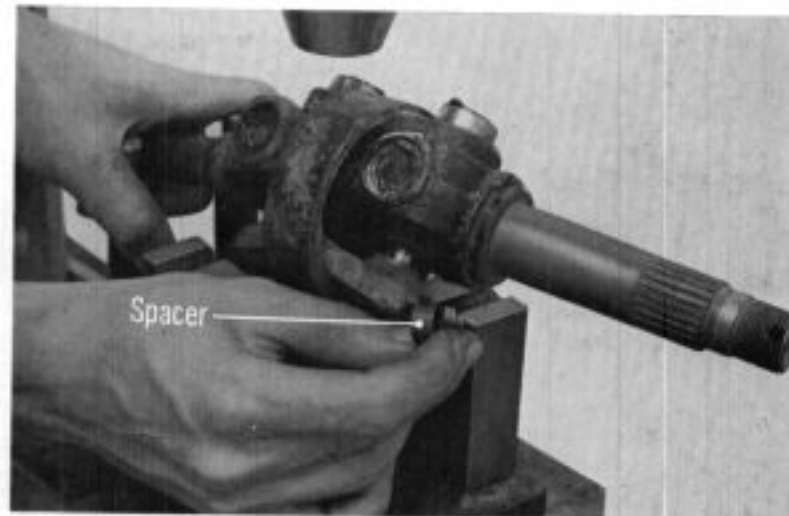


Fig. 9B-24

5. Reverse the drive shaft assembly and again operate the press through the center yoke fitting until the bearing case is drawn out. Re-check spacer mounting if the bearing case is too tight.

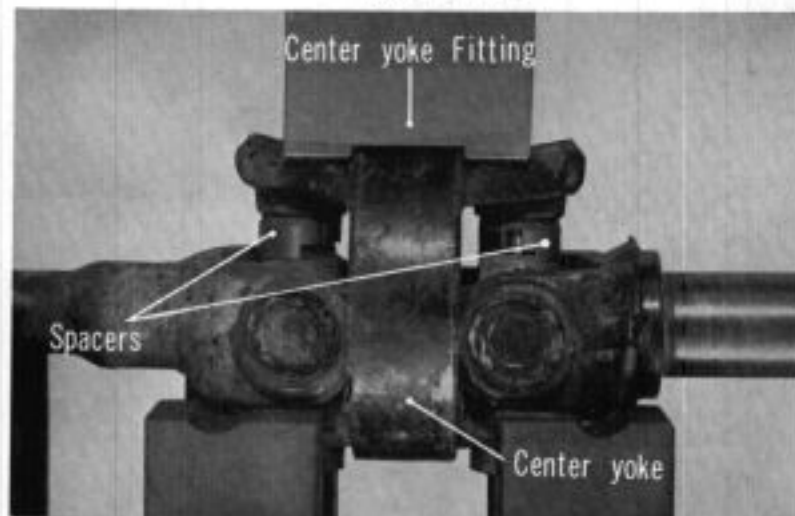


Fig. 9B-25

6. Disconnect the axle shaft and drive shaft from the center yoke, and, holding the axle shaft and drive shaft by hand, remove the cross shaft from the center yoke by pushing the former downward. (Fig. 9B-26)

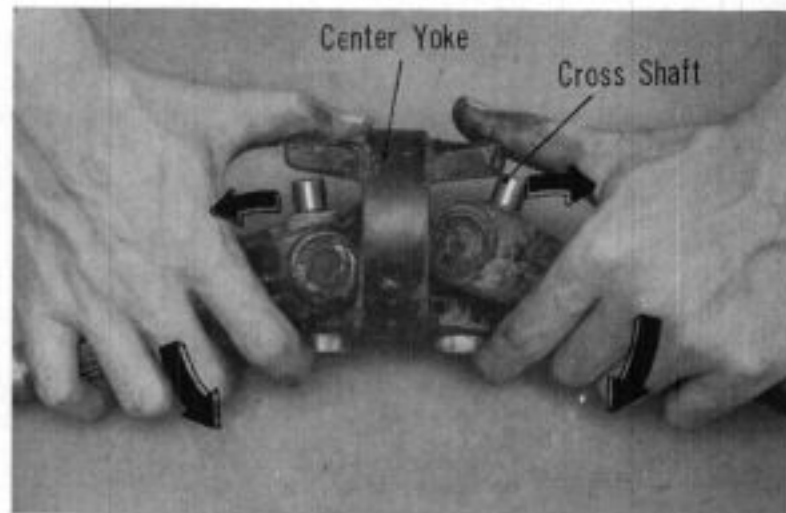


Fig. 9B-26

7. Remove the bearing case from the center yoke. Mount the yoke on the base, and remove the bearing case together with the center yoke fitting. (Fig. 9B-27)

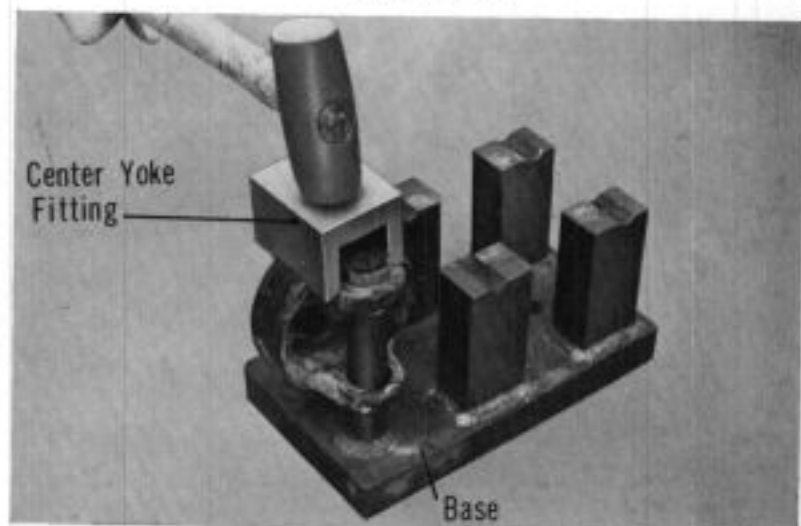


Fig. 9B-27

## 9-10 DRIVE SHAFT

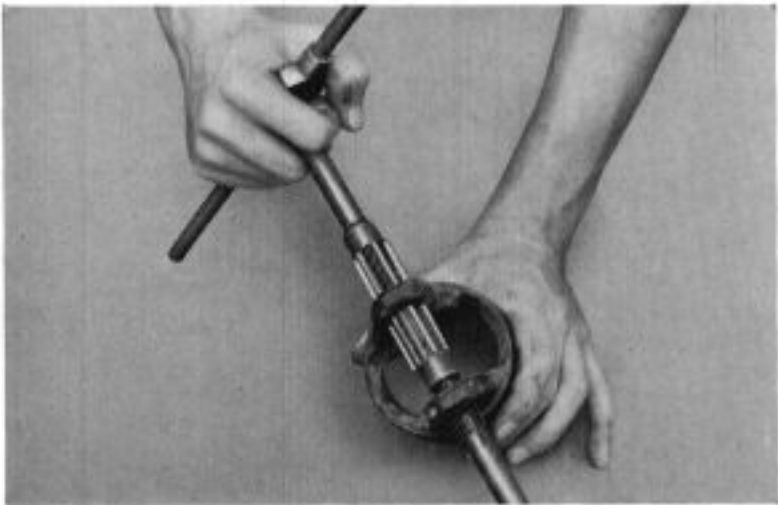


Fig. 9B-28

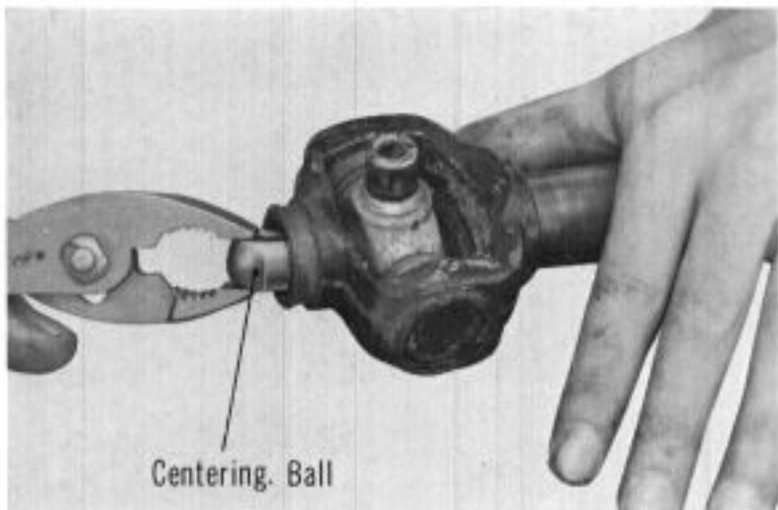


Fig. 9B-29

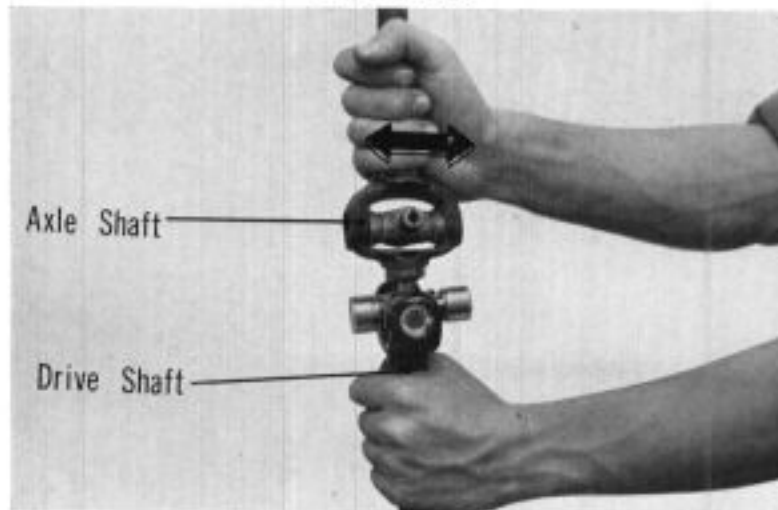


Fig 9B-30

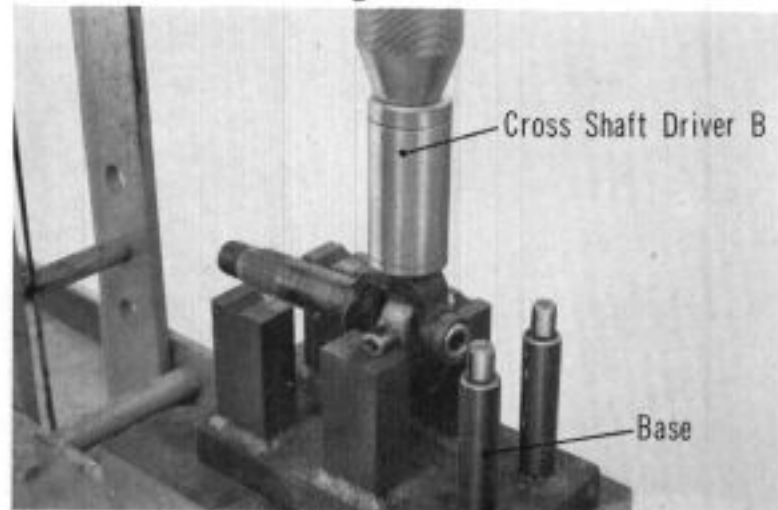


Fig. 9B-31

8. Check the center yoke and make any correction necessary.

- (1) Ream the center yoke to remove surface defects.
- (2) Check the circlip groove, and correct surface damage, if any, with a punch or file.

9. Inspect the axle shaft.

- (1) Removing the centering ball.  
The centering ball can be easily removed when placed as shown in Fig. 9B-29.
- (2) Clean the centering ball and axle shaft ball receptacle, and check for scars and cracks. Replace the part if defective.
- (3) Check the bearing section and threaded portion of the axle shaft. Replace defective parts.

- (4) Check the centering ball for wear.  
Reassemble the centering ball in the axle shaft, and insert a new drive shaft. As shown in Fig. 9B-30, check for axle shaft play by moving the axle shaft to the left and right. Replace the axle shaft if play exists.

Standard value:

0.05 to 0.06mm (0.0020 to 0.0024 in)

Serviceable limit:

0.2mm (0.008 in)

10. If no axle shaft defects are found as a result of checking, remove the cross shaft and replace the bearings.

- (1) Set the axle shaft on the base, and press it with cross shaft driver B.

- (2) After pressing approximately 7mm (0.28 in), mount the spacer.  
Repress the axle shaft after reversing it, and then remove the cross shaft from the axle shaft. (Fig. 9B-32)

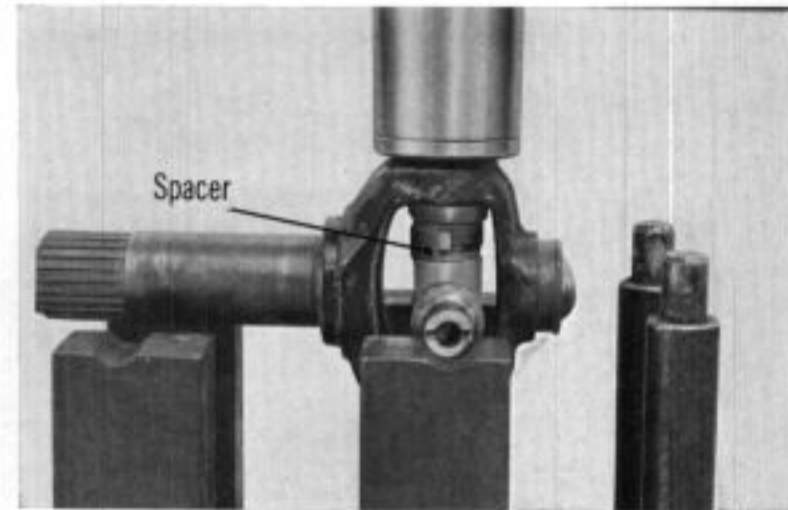


Fig. 9B-32

#### Replacement of the Center shaft (Item No. 11 to 17)

11. To press the center shaft out from the drive shaft, first supply a few oil to the chuck of the clammer and insert the center shaft among them, and torque the bolt from 5 to 7kg-m (36 to 50 lb-ft). (Fig. 9B-33)

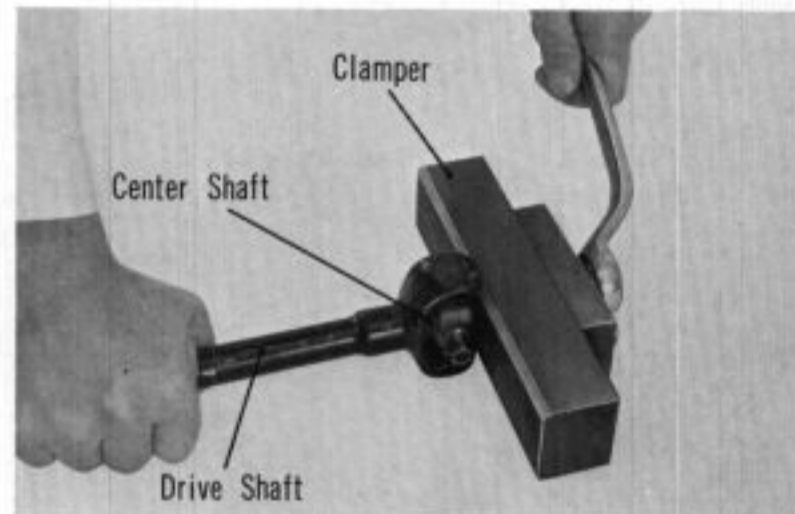


Fig. 9B-33

12. Set the center shaft clammer with the drive shaft, the center shaft adaptor and the center yoke fitting on the press, as shown in Fig. 9B-34.

Operate the press until the center shaft is drawn out.

13. Replace the cross shaft assembly with new one as the same manner described in No. 10, page 9-10.

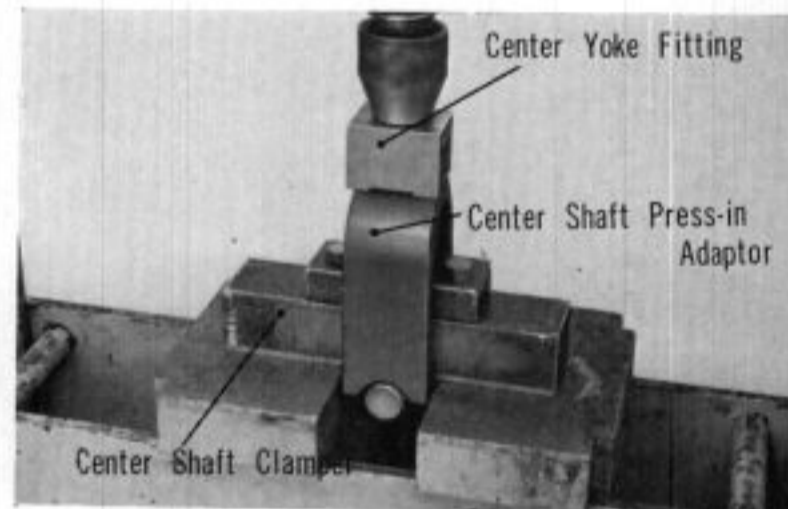


Fig. 9B-34

14. The center shaft should be pressed-in a oversized one which marked with yellow paint. After assembling new cross shaft (refert to 22~29 page 9-14~9-16), apply a few grease around the shaft and tap the center shaft with a copper mallet until it is driven in about 2 or 3mm (0.79 or 0.118 in). (Fig. 9B-35)

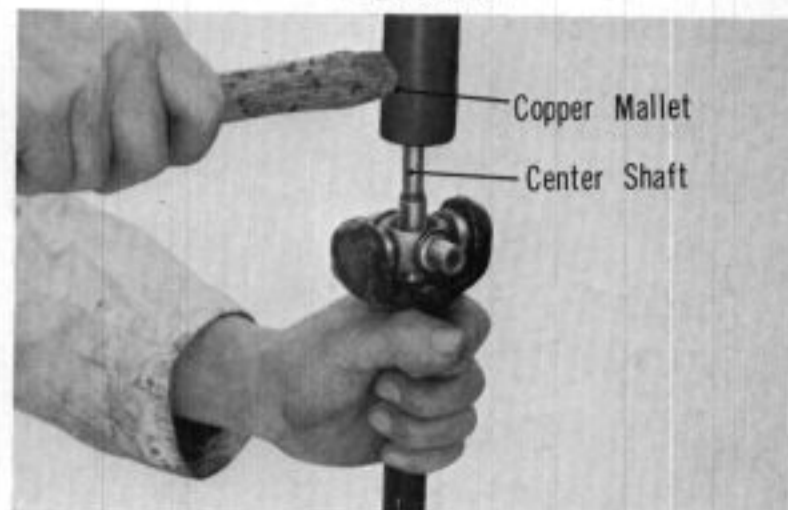


Fig. 9B-35

## 9-12 DRIVE SHAFT

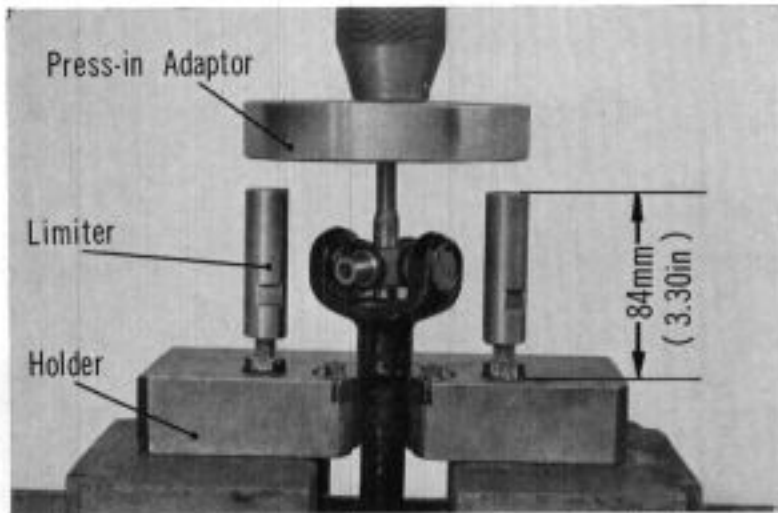


Fig. 9B-36



Fig. 9B-37

15. Assemble the two limiters in the center shaft holder.  
Height of limiter should be 82.5 to 84mm (3.25 to 3.30 in).

16. Set the drive shaft with the center shaft on a press and operate the press through the center shaft press-in adaptor until the adaptor touches on the limiter.  
The press load should be 2 tons or more, if less than 2 tons, replace the drive shaft with new one. (Fig. 9B-36)

17. Inspect the height of center shaft with the center shaft height gauge as shown in Fig. 9B-37.  
The height should be in the step of the gauge.

Assembling the drive shaft

The following components parts are available. (Fig. 9B-38)

- ① Ball joint kit A (Flange, Retainer, Steel balls and Sealing plate)
- ② Ball joint kit B (Bellows, Grease 50g, Bellows band)
- ③ Ball joint kit C (Kit A and Kit B)
- ④ Drive shaft set (Center shaft, Cross shaft set and Drive shaft)
- ⑤ Cross shaft set (Cross shaft, Bearing case with needle bearing, Oil seals and Dust seals)
- ⑥ Axle shaft (w/centering ball)
- ⑦ Dust seal clip (for centering ball), 20mm
- ⑧ Dust seal, centering ball, 20mm
- ⑨ Dust seal clip (for centering ball), 20mm
- ⑩ Dust seal, centering ball, 22mm
- ⑪ Bellows band
- ⑫ Bellows neck band
- ⑬ Bellows
- ⑭ Sealing plate, flange
- ⑮ Center shaft, over size
- ⑯ Oil seal, cross shaft
- ⑰ Dust seal, cross shaft
- ⑱ Grease, BJ68, 30g
- ⑲ Grease, BJ68, 300g

Note:

The diameter of the centering ball for the former 360 series vehicle has been changed from 20mm to 22mm. When the axle shaft for models earlier than N360-1142414 (body serial number), is used use item ⑦ and ⑧ instead of ⑨ and ⑩.

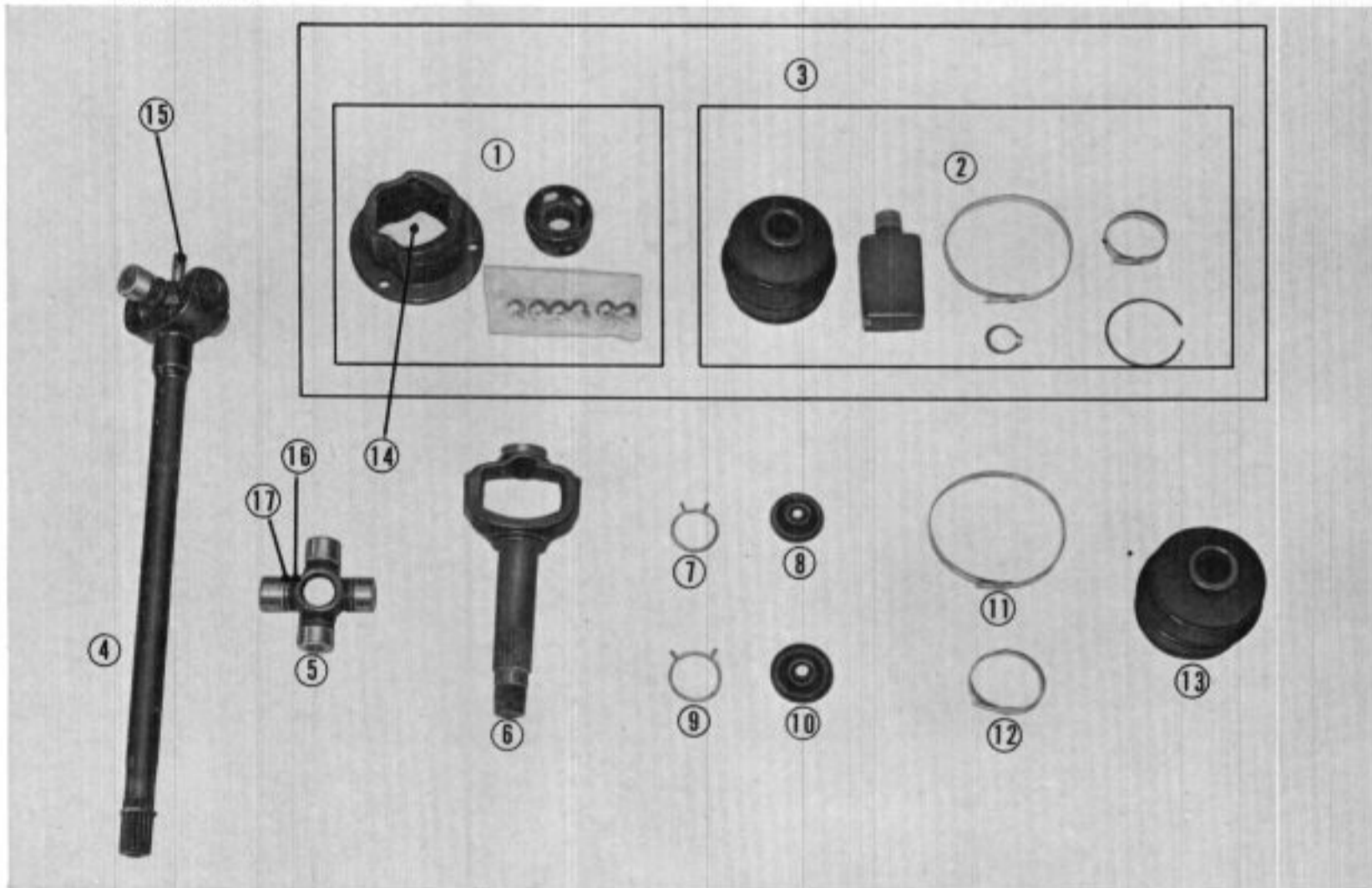


Fig. 9B-38

- 18. Insert the centering ball into the axle shaft, and fill with grease. Grease should be applied in such an amount that it effuses slightly from the periphery of the ball.



Fig. 9B-39



## 9-14 DRIVE SHAFT

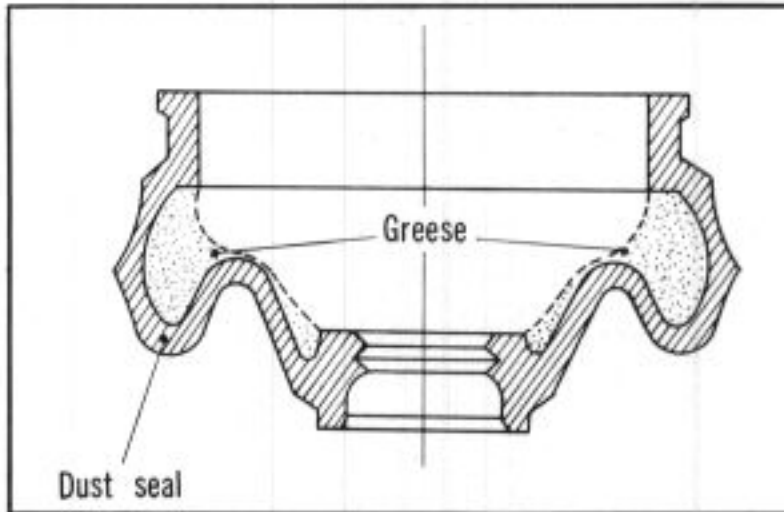


Fig. 9B-40



Fig. 9B-41



Fig. 9B-42

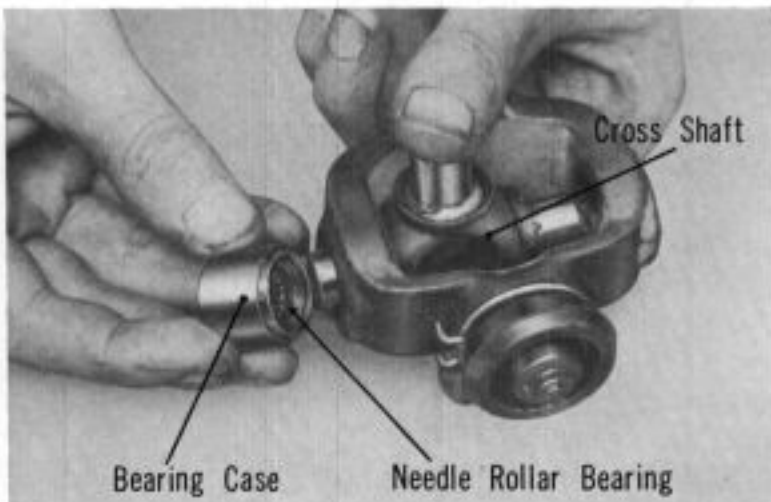


Fig. 9B-43

19. Apply grease to the dust seal.  
See Fig. 9B-40 for amount of grease.

20. Mount the dust seal on the axle shaft:  
Use a screwdriver and hold the end with the fingers to prevent the grease from coming out. (Fig. 9B-41)

21. Mount the dust seal clip on the dust seal.  
Carefully mount the clip in the direction shown in Fig. 9B-42.

22. Remove the bearing case from the cross shaft, set and arrange the bearings evenly with the fingers.  
Mount the cross shaft on the axle shaft, and set the bearing case in position. (Fig. 9B-43)

23. Mount the two bearing case support on the base of the jig.
24. Set the base in a press, and mount the cross shaft onto the base while holding it so that it does not dislocate from the bearing case. (Fig. 9B-44)

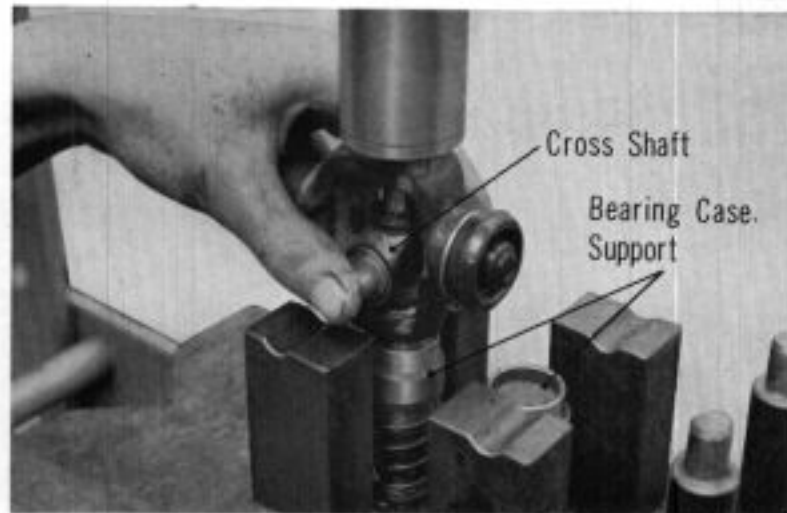


Fig. 9B-44

25. Set the cross shaft driver B, and effect oil pressure.  
Hold both ends of the cross shaft, and pushing it downward against the air compressed by the press between the bearing case and the shaft, swing the cross shaft to the right and left so that centering is not disordered.  
Continue the application of the press until the clearance between the dust seal and axle shaft inside (horizontal line in Fig. 9B-45) becomes zero.

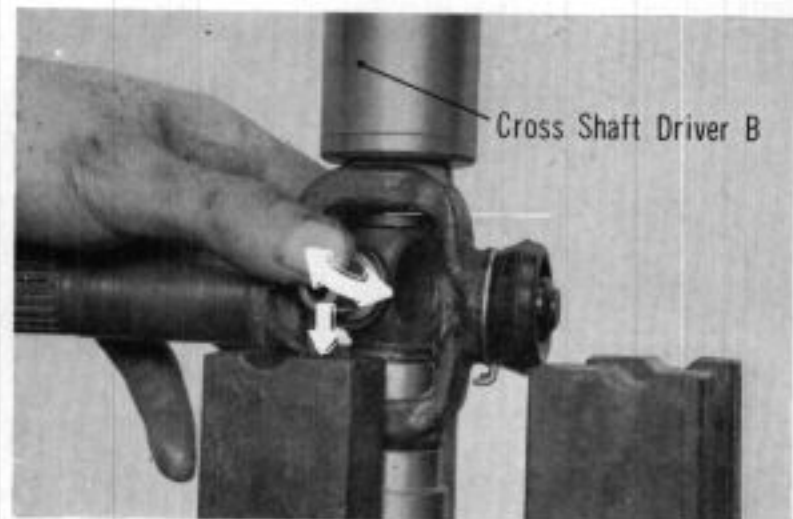


Fig. 9B-45

26. Mount a bearing case on the opposite side of shaft with the bearing case pressed in.
27. Insert circlip into the pressed-in bearing case while holding the bearing case by hand.

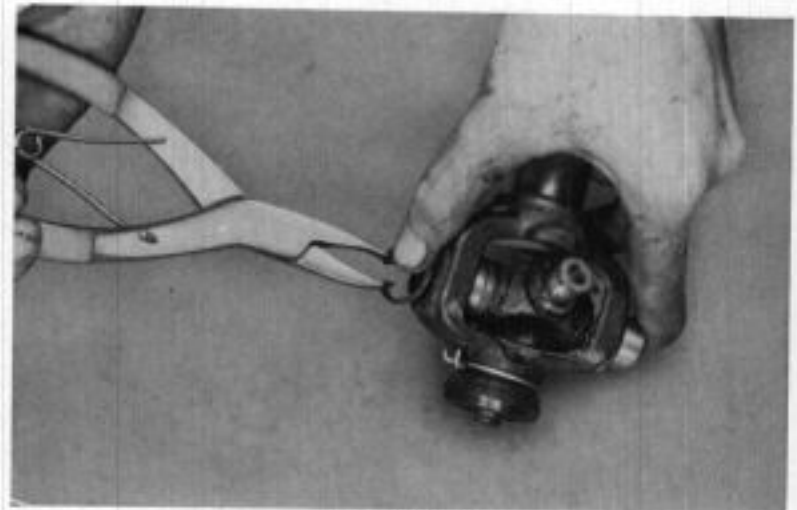


Fig. 9B-46

**Note:**  
The circlip is slanted along one section of its periphery.  
Carefully insert the circlip in the correct direction. See Fig. 9B-47.

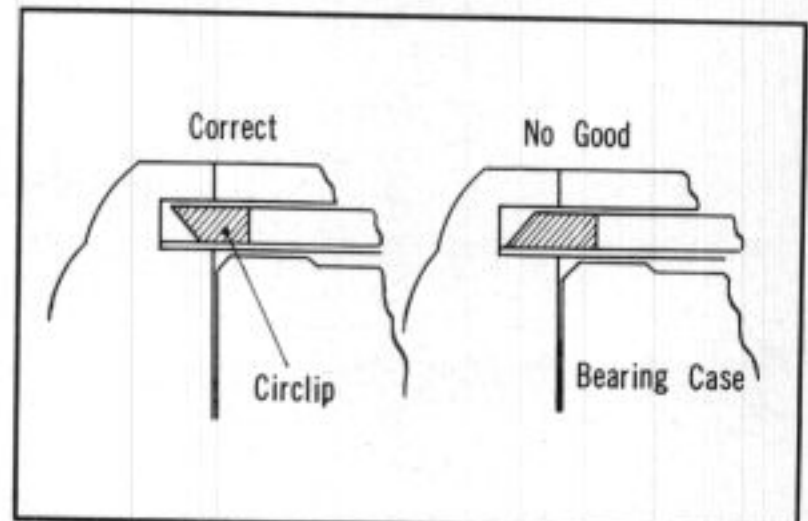


Fig. 9B-47

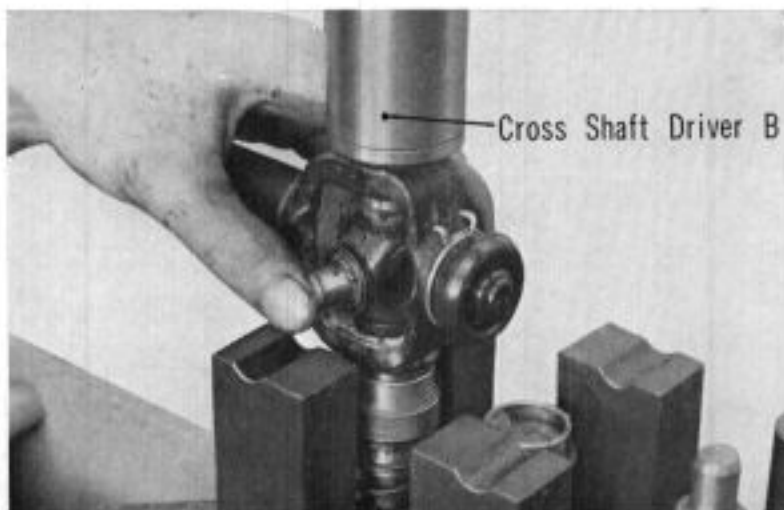


Fig. 9B-48



Fig. 9B-49

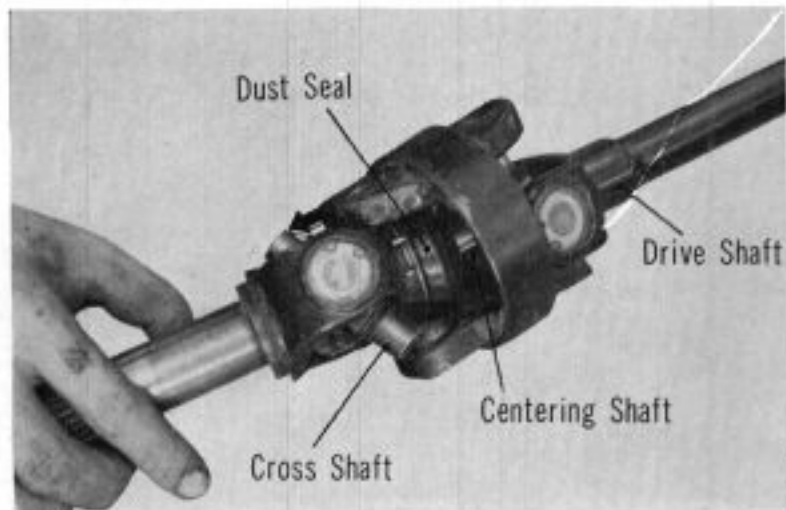


Fig. 9B-50



Fig. 9B-51

28. Mount the bearing case on the base with the circlip inserted side up (so that it contacts the cross shaft driver B), and effect the press within two tons.

Be sure in this case to rotate the cross shaft to the right and left so that centering is not disordered.

**Note:**

Do not apply two tons or more of oil pressure. If otherwise, the cross shaft will fail to move to the right and left.

29. Insert the circlip in the bearing pressed-in side. The circlip acts as an adjusting shim for the bearing clearance in the shaft direction. Therefore, choose the optional type of circlip out of the list below. If the circlip used is too loose, a thicker one should be used. If the thicker circlip is difficult to insert, tap the bearing case with a hammer through the cross shaft driver A. In this case, it is better to hit the other side of the bearing case with a hammer so that the circlip on the opposite side not bent out.

- Internal Circlip, 1.0mm thickness
- Internal Circlip, 1.1mm thickness
- Internal Circlip, 1.2mm thickness
- Internal Circlip, 1.3mm thickness

Connections of center yoke, axle shaft, and drive shaft. (Item No. 30 to 39)

30. Position the centering ball in the axle shaft. This is for the vacilitation of assembling.

- (1) Make the centering ball flat by holding the dust seal end by hand.
- (2) Erect the drive shaft vertically, and insert the ball into the centering shaft by the weight of the axle shaft while turning the axle shaft slowly to the left and right. (Fig. 9B-49) Then remove the axle shaft vertically. Thus, the ball has been rightly positioned with the grease enclosed therein.

31. Tilt the cross shaft assembled in the axle shaft fully to one side.

32. Assemble the cross shaft (inserted in the drive shaft) into the center yoke as shown in Fig. 9B-50. Then insert the drive shaft center shaft into the axle shaft dust seal. In this case, be careful not to allow the shaft to contact the centering ball.

33. Erect the axle shaft vertically as shown in Fig. 9B-51, and insert the centering ball slowly into the center shaft. Simultaneously, insert one side of the cross shaft into the center yoke. If it is difficult to insert the centering ball, the centering ball should be again positioned. (Refer to 30).

34. Move the center yoke fully to one side, and set the axle shaft cross shaft in the center yoke by hand. (Fig. 9B-52)

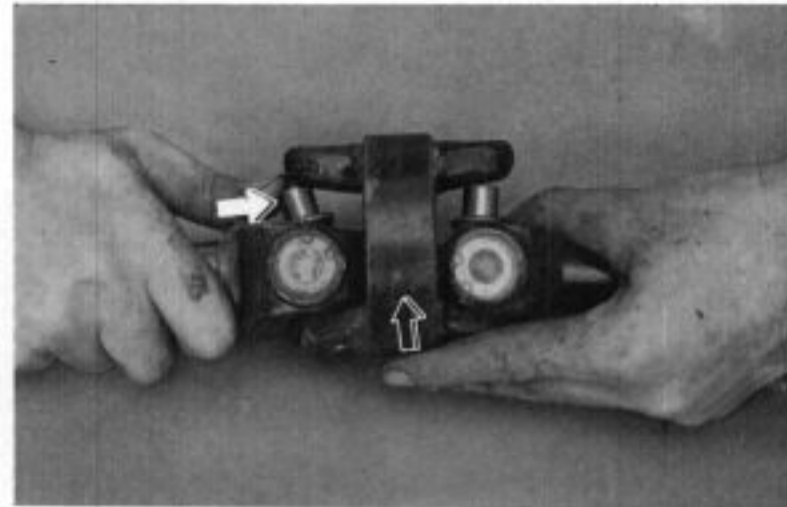


Fig. 9B-52

35. Check the needle bearings for tilt or uneven arrangement, and mount two bearings on the bearing case support. (Fig. 9B-53)

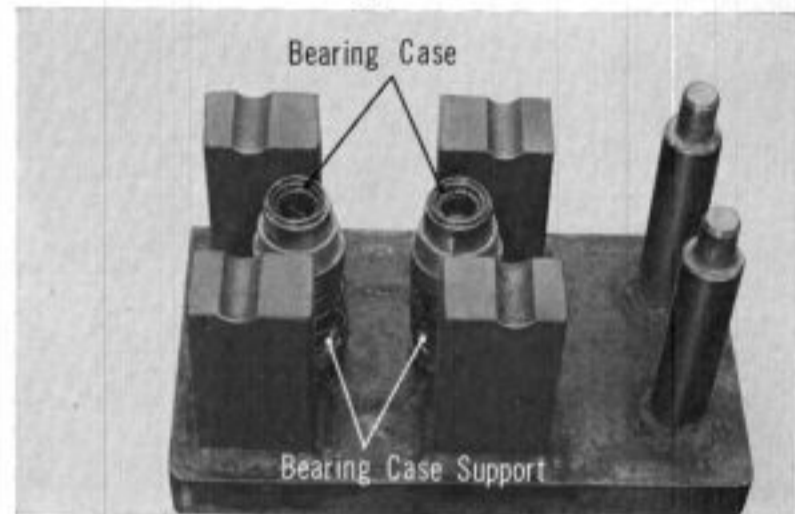


Fig. 9B-53

36. Press the center yoke through the center yoke fitting, and insert the bearings. (Fig. 9B-54)

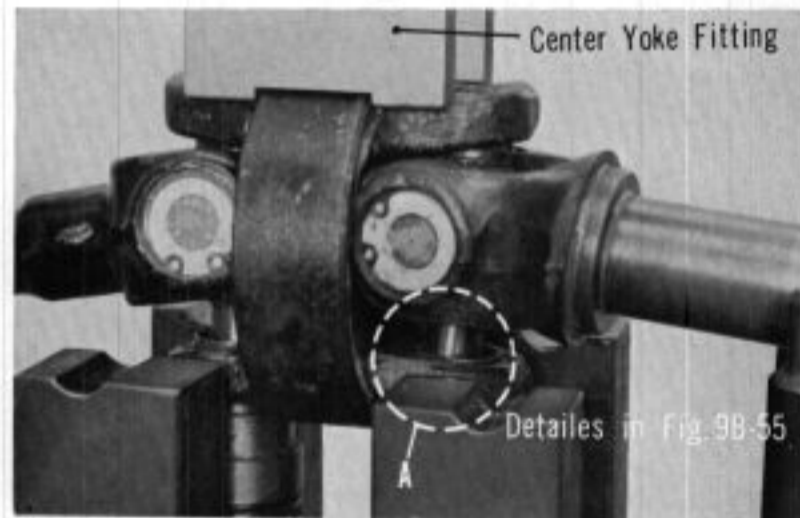


Fig. 9B-54

**Note:**

Press in the needle bearings as follows so that they do not tilt: Mount the cross shaft slantingly on the edge of the bearing case as shown in Fig. 9B-55.

Then insert the bearing case so that the bearing case contacts closely the inside of yoke.

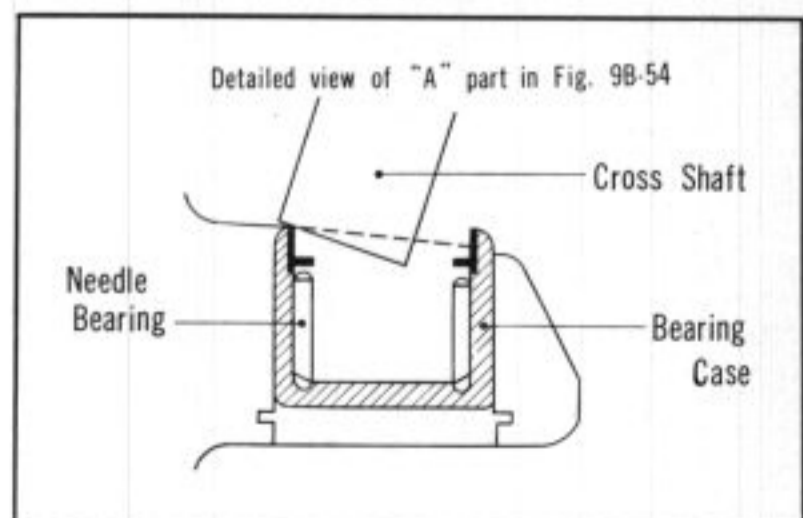


Fig. 9B-55

## 9-18 DRIVE SHAFT

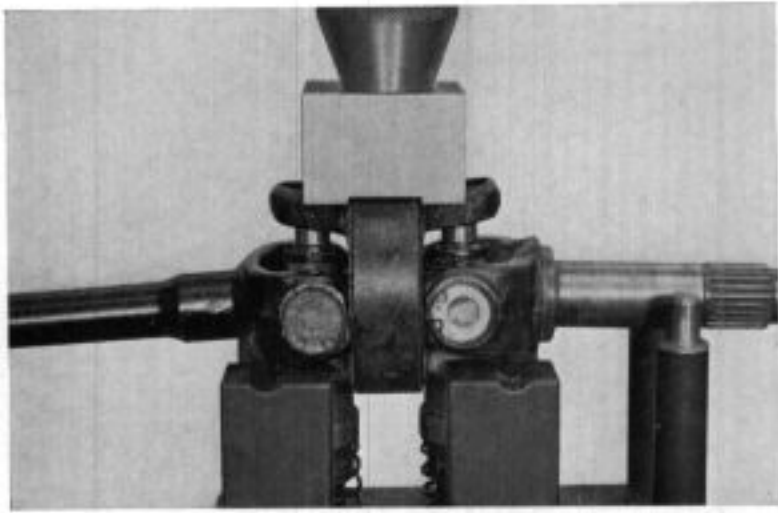


Fig. 9B-56

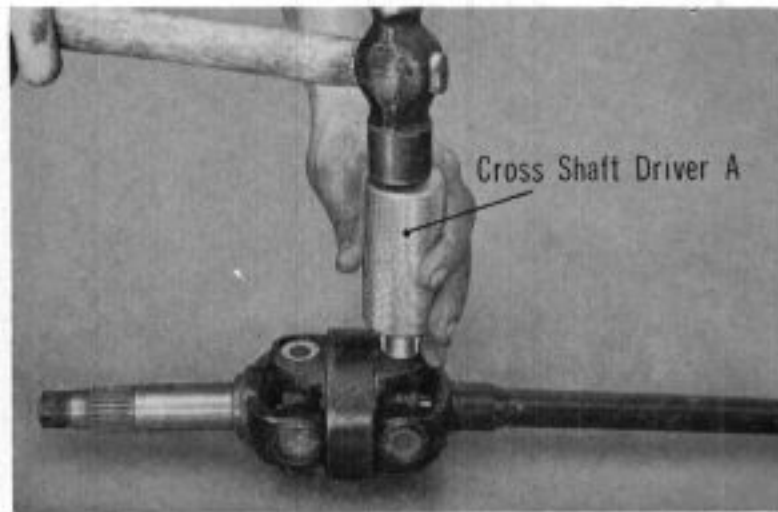
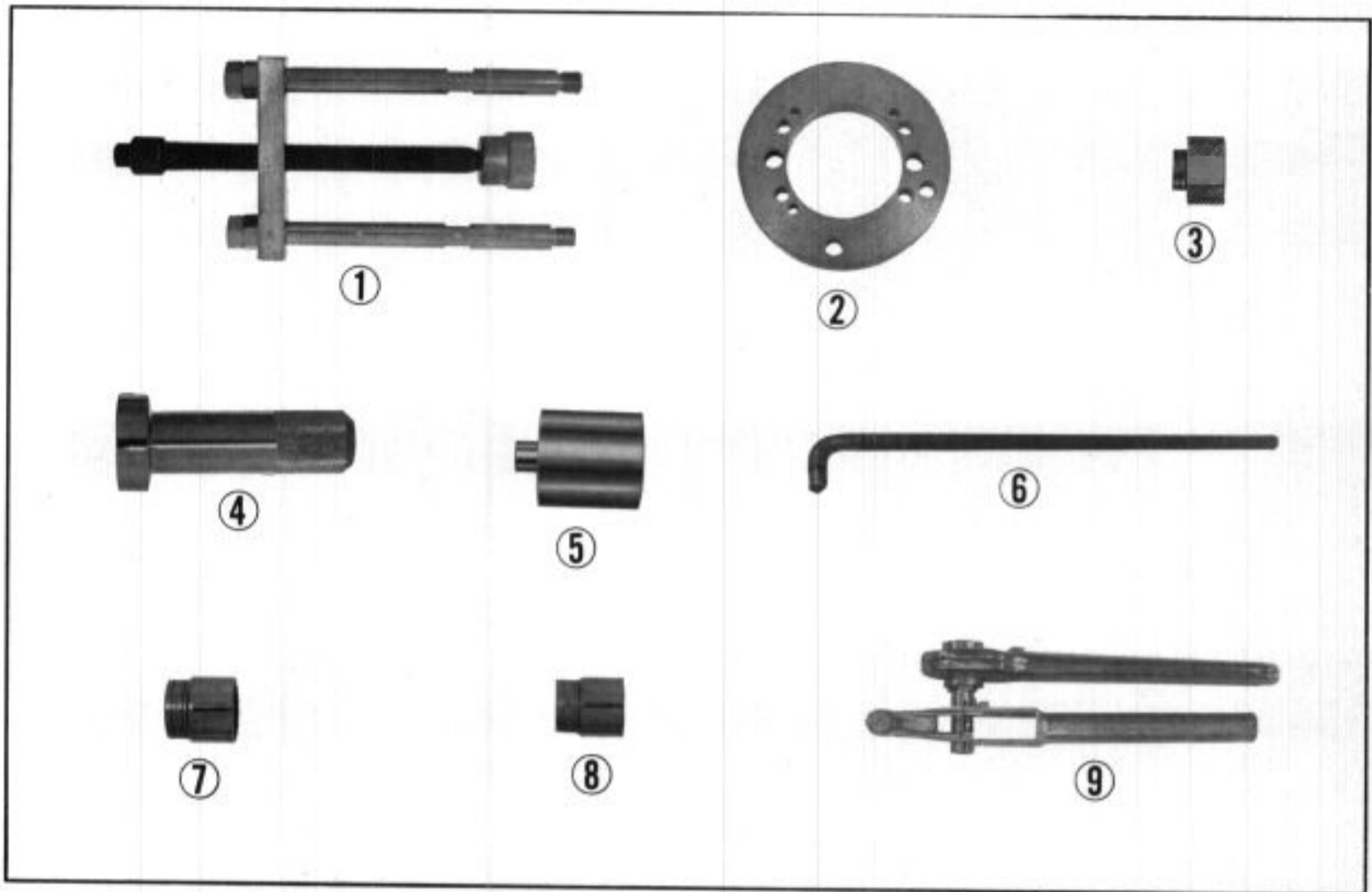


Fig. 9B-57

37. After pressing in the bearing case, insert the cross shaft. Insertion should be moderately concluded while swinging the shaft to the right and left so that the needle bearings do not tilt.
38. Insert circlip.
39. After reversing, press in the other side of the bearing case while swinging the cross shaft to the right and left while taking care not to tilt the bearings. 3.5 tons of oil pressure can be used for insertion.
40. Since the bearing case is filled with grease, insertion may sometimes be not completed even with 3.5 tons of oil pressure. If the circlip is difficult to insert, therefore, knock with cross shaft driver A. Use chosen circlip (refer to 29.). After inserting the circlip, make sure that the axle shaft is not lowered by its own weight while holding the drive shaft horizontal by hand. If the axle shaft is lowered, replace with a thicker circlip, and adjust.

C. Special Tool



Ref. No.	Description	360 400	600
1.	07045-56805 Drive shaft replacer main	<input type="checkbox"/>	<input type="checkbox"/>
2.	07045-56810 Drive shaft replacer flange	<input type="checkbox"/>	<input type="checkbox"/>
3.	07045-56810 Drive shaft replacer attachment	<input type="checkbox"/>	<input type="checkbox"/>
4.	07048-55110 Front wheel bearing driver A	<input type="checkbox"/>	<input type="checkbox"/>
5.	07048-55101 Front wheel bearing driver B	<input type="checkbox"/>	<input type="checkbox"/>
6.	07083-60106 Wrench handle	<input type="checkbox"/>	<input type="checkbox"/>
7.	07083-60110 Socket (32mm)	<input type="checkbox"/>	<input type="checkbox"/>
8.	07083-60115 Socket (27mm)	<input type="checkbox"/>	<input type="checkbox"/>
9.	07043-55101 Bellows band fastener	<input type="checkbox"/>	<input type="checkbox"/>

OPTIONAL

10.	07043-55110 Drive shaft overhaul jig set	<input type="checkbox"/>	<input type="checkbox"/>
11.	07043-55113 Drive shaft overhaul spacer	<input type="checkbox"/>	<input type="checkbox"/>
12.	07093-55113 Drive shaft replacing socket wrench	<input type="checkbox"/>	<input type="checkbox"/>

- Used as a set (Fig. 9B-20, 21)
- Used on drive shaft-to-differential mounting bolts

MEMO