Pivot with hub

Center-point steering, in which the kingpin axis is centered on the tire's contact patch, is part of the DS's front suspension geometry. This design
feature minimises steering inputs as a result of torque being applied to the wheel, this torque being from power application, braking, or irregularities in rolling resistance such as those caused by changing road
surface of tire failure.

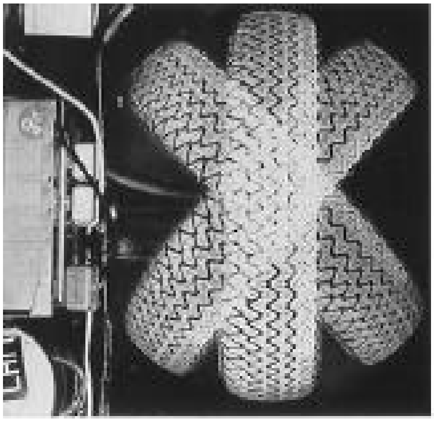


Fig. 1 : Center-point steering

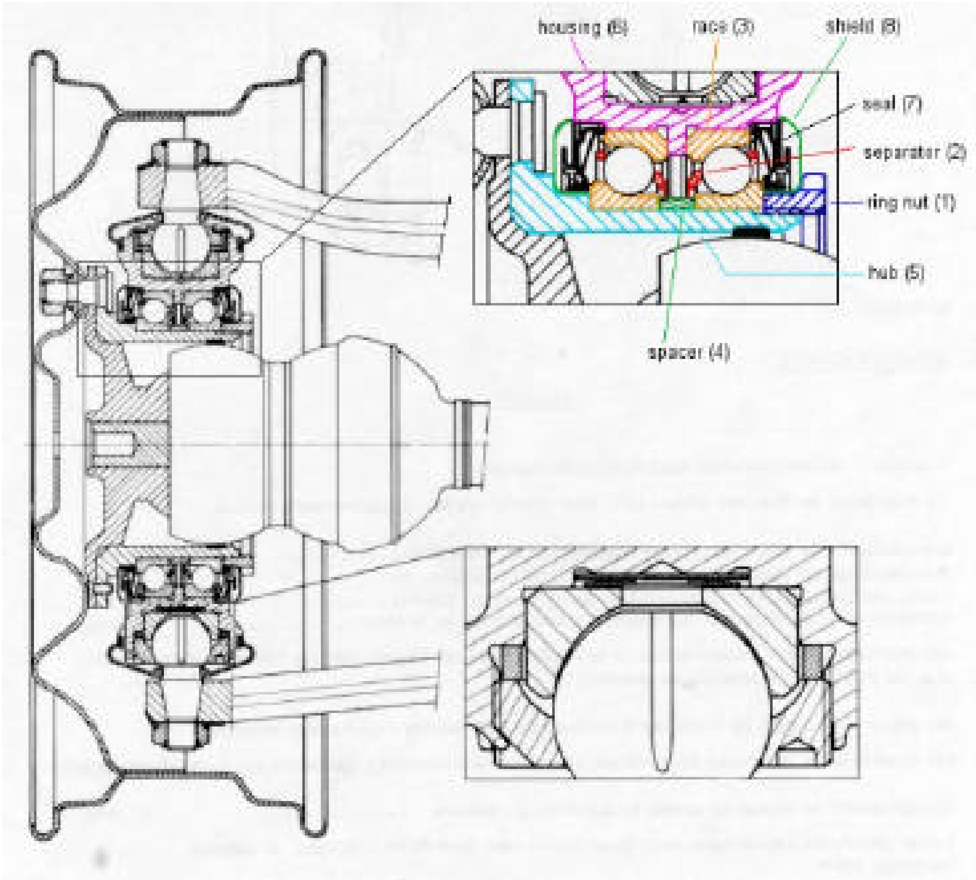


Fig. 2 : Drawing of the pivot with driveshaft and rim

The outboard driveshaft universal joint also has a "bearing" on the wheel hub design :
A tough engineering problem for the early front-wheel-drive engineers was the design of driveshaft universal joints. Citroën had terrible results with the Tracta outboard joints first used on the Traction Avant, and soon substituted a double Hookes joint similar to that on our cars. A problem with the double Hookes joint is that due to its length, stresses on the joint rise dramatically when operated at high angles as the joint is moved inward from the kingpin. In a car such as a Traction or a Panhard, the joint can be seen to move forward and back as the steering is turned. The joint works best if its center (that is, the guide ball between the two cross-arms) is quite near the kingpin line. I believe this is the problem Citroën solved by placing the outboard joint within the wheel bearing.

The idea of mounting a universal joint within a wheel bearing was not unique to Citroën. Vittorio Jano's Lancia Aurelia, a contemporary of the DS19, used a similar design. But the Lancia used it at the rear; Citroën's front-drive design was far more ambitious.

Modern Rzeppa joints, now almost "universal" on modern front-drive cars, are much more compact and can be mounted inboard of the wheel bearing without problem.

The pictures below show a pivot assembly being disassembled step by step.

Fig. 3 : complete pivot with hub

Fig. 4 : Detail of ring nut with notch and shield

Fig. 3 shows the (damaged by rust) pivot unit on the bench waiting for disassembly. One can see the notch in the ring nut (1) which accepts the special tool which Citroën does not sell. Rotating with the hub (5) and ring nut (1) is the pressed steel shield (8).
Fig. 4 shows the small clearance between the shield and the housing, which is part of a labrynth seal (7) for the bearing.

A note on greasing the hub bearing :
Since there is no grease nipple for the hub bearing and since the shield is not easily removable it is not possible to apply new grease to the bearing in an easy way. Obviously Citroën designed this bearing to last for the life of the car !

On the DS/ID models with the single-bolt-wheels a similar shield is more easy to remove. On those cars one could try to grease the bearing by injecting grease through the seal with a sharp hollow needle. However this is not recommended !

When Citroën designed the bearing to last for the life of the car they were most probably not thinking about 25 or even 40 years ! Click here for a suggestion on how and where to mount a grease nipple can be found here.

Fig. 5 : Ring nut removed

Fig. 6,7 : Underside of the ring nut, detail of grease seal

Fig. 5 shows the assembly after removal of the ring nut. The nut was extremely tight; it was damaged beyond further use by using a pneumatic hammer to turn it. If one wished to repair an unit a proper tool would need to be made.

With the nut and steel shield removed the seal becomes visible. This seal is quite complicated and interesting. The outside of the seal is a light press in the housing. There is a small lip on the seal which lightly contacts the underside of the shield creating the other part of the labrynth. Click here for more detailed pictures of the seal.

Fig. 6 shows the underside of the ring nut with pressed-on shield. The actual grease seal is axial rather than radial. There is a lip visible at the top in fig. 7 which contacts the face of the inner race (3) of the bearing.

Fig. 8 : Grease seal removed

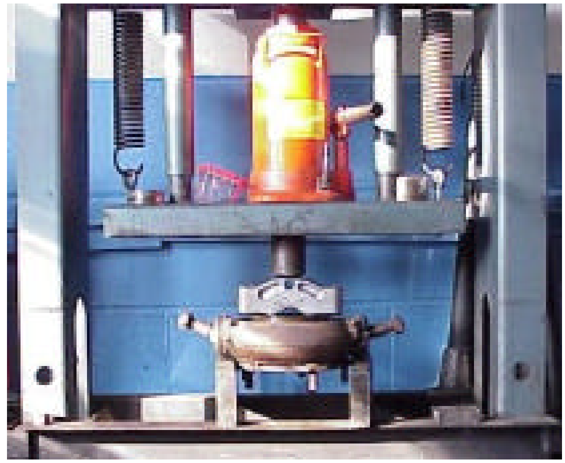


Fig.9 : Pressing the hub out of the housing

Fig. 8 shows the unit after removing the seal. The rust damage to bearing can be seen between "10:00 and 12:00" on the housing (6).

Fig. 9 shows how the unit was setup in the press to remove the hub (5) from the bearings. It was a surprisingly light press fit.

Fig. 10 : The hub

Fig. 11 : The housing

Fig. 10 shows the hub with the outer seal and the inner race of the outer bearing still in place. In the background is, left to right, the inner race of the inner bearing, the selective spacer between the inner races which adjusts preload of the bearings, and the bearing separator with a bunch of balls.

Fig. 11 shows the housing with outer races in place. If one were to install a grease fitting, I believe grease should be injected in the space between the inner and outer bearings. A relief orifice could be drilled diametrically opposite the grease fitting to relieve pressure.

Fig.12 From left to right : a bearing separator, a race, the spacer and the other separator together with some balls.

Fig. 13 All parts together

Fig. 13 is a general view of all the parts. At the lower right is a wheel bearing for a 1991 Audi 100, a car similar in size and mission to the DS. It is included to provide a perspective on the design of our cars.

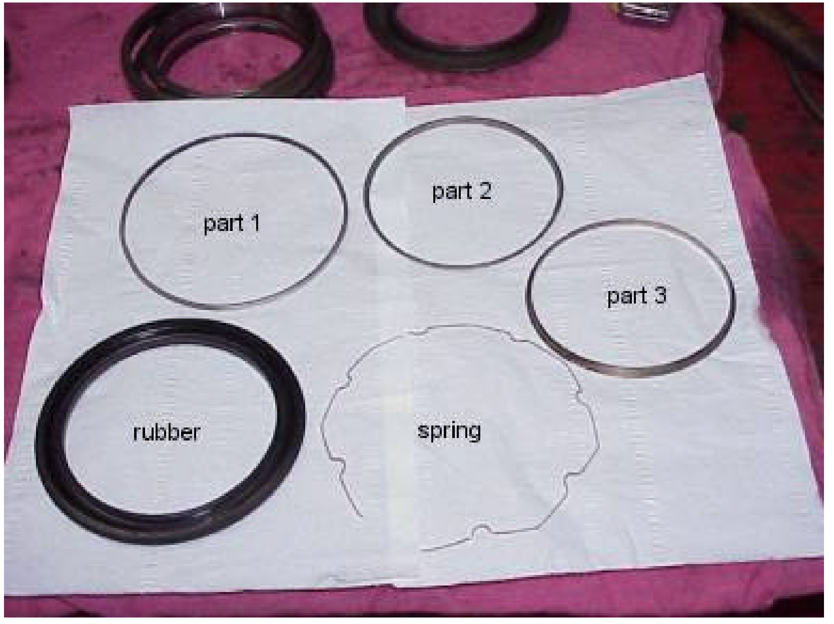
Pictures and text by Carter Willey

Last updated on : 27.03.2000, by Jint Nijman

Hub bearing seal

In fig. 2 all five parts are arrayed. At lower left is the rubber part. Then clockwise are three steel rings I've numbered part 1, part 2, and part 3. The following photos show these parts separately, some with some closeups. At the lower right is the spring.
The metal parts 1 and 2 fit together with the spring to make the framework shown in fig. 7. The framework is installed on the inside of the rubber part. Then part 3 presses in from the outside capturing the rubber between its inside diameter and the inside diameter of part 2, so locking the framework to the rubber. This is shown from the inside in fig. 11 and from the outside in fig. 12.
Fig.12 shows the inner surface of the rubber with the framework removed. Fig.13 shows the lip on the outside of the rubber which can be seen in the cross-section drawing.

Fig.1 : Complete seal seen from the inside (of the bearing)



Pig.2 : All the parts that form the seal

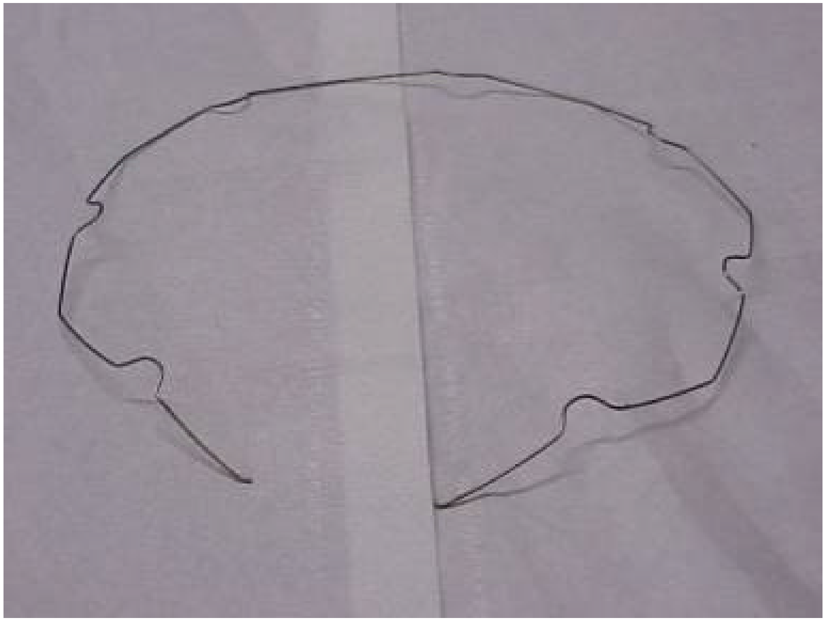


Fig.3 : Spring


Fig.4 : Part 1


Fig.5 : Part 2


Fig.6 : Close up of part 2

The metal parts 1 and 2 fit together with the spring to make the framework shown in fig. 6.

Fig.7 : Framework (metal parts 1 and 2 + spring)

Fig.8 : Part 3

Fig. 9 : Close up of part 3

Then part 3 presses in from the outside capturing the rubber between its inside diameter and the inside diameter of part 2, so locking the framework to the rubber. This is shown from the inside in fig. 10 and from the outside in fig. 11.

Fig.10 : Complete seal (inside view)

Fig.11 : Complete seal (outside view)

Fig. 12 shows the inner surface of the rubber with the framework removed. Fig. 13 shows the lip on the outside of the rubber which can be seen in the cross-section drawing.

Fig.12 : Inner surface of rubber

Fig.13 :Lip on outside of the rubber

All pictures by Carter Willey, text by Carter Willey

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Suggestions for a grease nipple for a front wheel bearing

All around the perimeter of the housing (except for where the ball joints and the boss for the steering arm are located) is a roughly flat area about 9mm wide.
The grease fitting should be in this area, as close as possible to exactly centered across the housing. The hole will penetrate the housing about 26mm (I measured thicknesses of just over 26mm to just under 27mm) before entering the space between the bearings; the space is 8mm wide, so it will be necessary to mount the unit in a drill press for accuracy.
It's important that the final bits of swarf from the drilling be extracted from the hole. Even a small bit of loose steel will be very bad for the bearings.

The fitting should be installed at 3:00 on the housing with a relief hole at 9:00. Grease should be injected slowly while turning the hub. There will be a tendency for the new grease to simply flow around the cavity between the bearings; turning the hub should encourage the new grease to enter the bearings.

"A" is the 8mm-wide space where the hole must enter the bearing area.
"B" is the 9mm-wide band around the housing where the hole is started and where grease will be injected.

Picture and text by Carter Willey

Last updated on : 17.03.2000, by Jint Nijman

Hub bearing seal

In fig. 2 all five parts are arrayed. At lower left is the rubber part. Then clockwise are three steel rings I've numbered part 1, part 2, and part 3. The following photos show these parts separately, some with some closeups. At the lower right is the spring.
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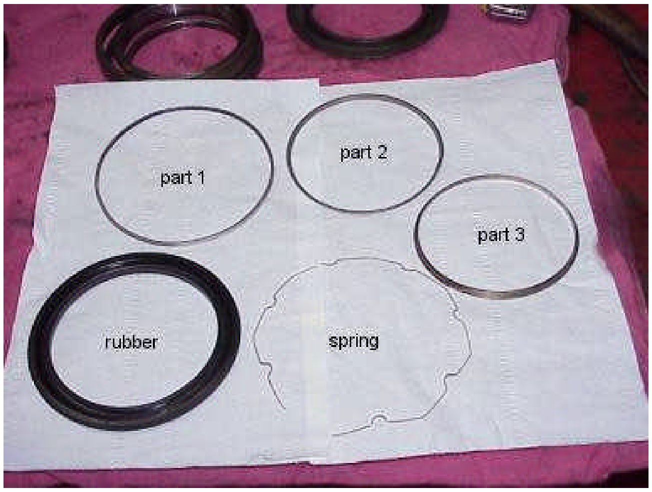
Fig.1 : Complete seal seen from the inside (of the bearing)



Pig.2 : All the parts that form the seal

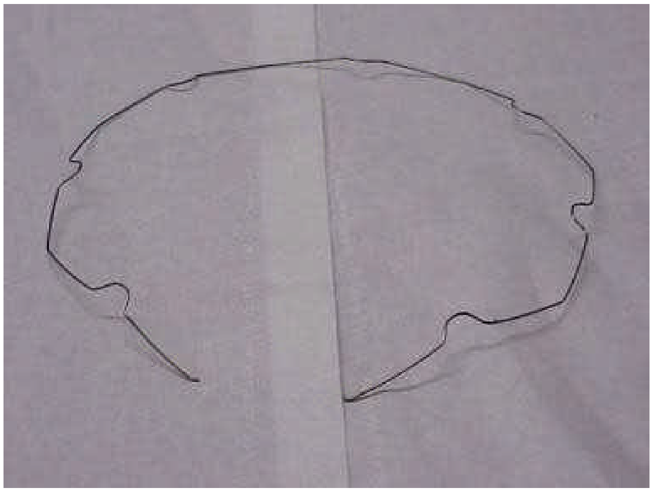


Fig.3 : Spring

Fig.4 : Part 1

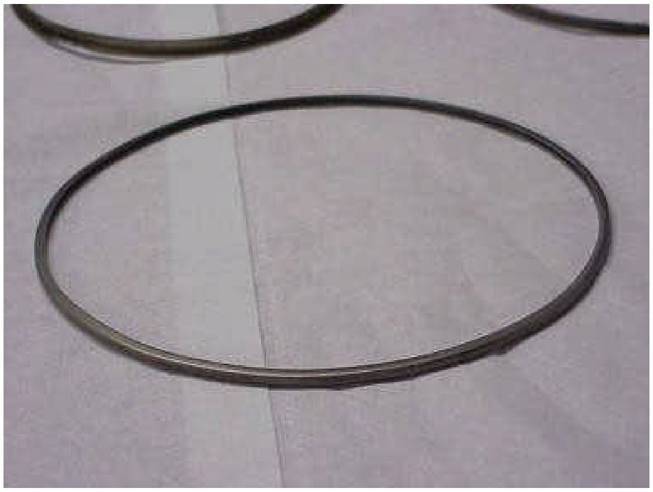


Fig.5 : Part 2

Fig.6 : Close up of part 2

The metal parts 1 and 2 fit together with the spring to make the framework shown in fig. 6.

Fig.7 : Framework (metal parts 1 and 2 + spring)

Fig.8 : Part 3

Fig. 9 : Close up of part 3

Then part 3 presses in from the outside capturing the rubber between its inside diameter and the inside diameter of part 2, so locking the framework to the rubber. This is shown from the inside in fig. 10 and from the outside in fig. 11.

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