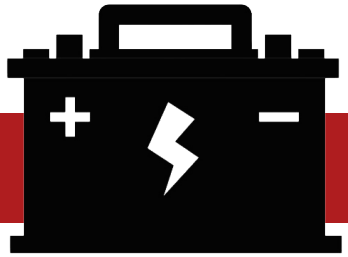
Paruzzi Magazine

Technical Publication for the classic Volkswagen

23

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#67 Electrical

Introduction

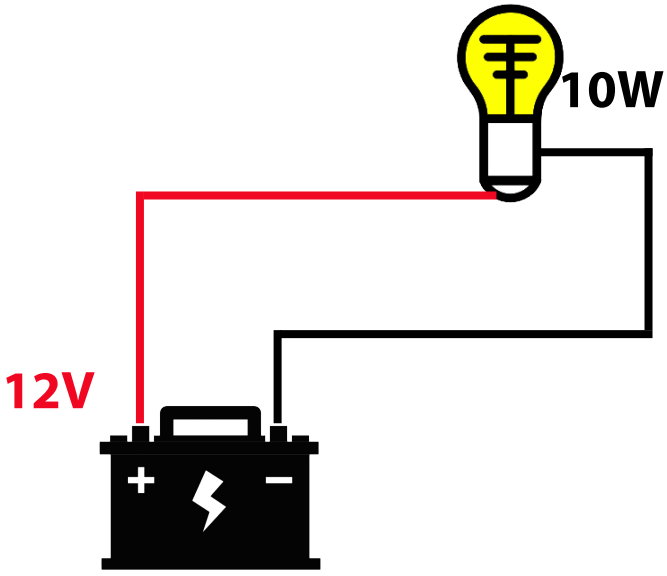
The electric consumers of your classic Volkswagen expect the full 6 volts or 12 volts (or more) to function properly, which is unfortunately not always the case. Especially the 6 volt version sometimes complains about slow running windscreen wipers, weak headlights and direction indicators that flash too slowly. When the ignition in turn gets a too low voltage, then it is over and out, the engine runs badly, misfires, or does not start at all.

If the battery is healthy (see edition 01 for battery diagnosis), there may be excessive voltage drops in the electrical circuit. It is time to intervene. But first we will try to understand the theory behind voltage drops, this will help you to better understand how it works to make a correct diagnosis later on.

This article only deals with **DC and DC voltage circuits**. We have explained in edition 17 what is direct current (DC) and what is alternating current (AC). Our classic Volkswagen is powered by direct current coming from the generator (DC dynamo or AC or alternator). You will only find alternating current inside the generator. Alternating voltage principles belong to a completely different chapter of electricity.

Resistors

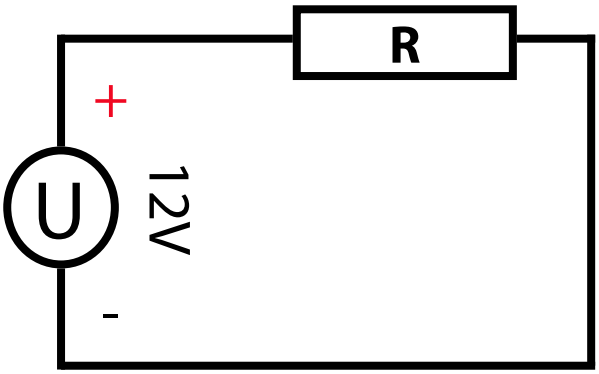
To illustrate the theory about voltage and resistance, we will start with a simple electrical circuit, namely a battery (12 V) and a 10 W light bulb.



Each electrical circuit can be traced back to a basic scheme represented by symbols. A power source (a battery or power supply) is represented by the symbol U (or V).

Each electrical consumer can be replaced by its resistor, and is represented by the following symbol:

We can now replace the drawing on the left with the following symbols:

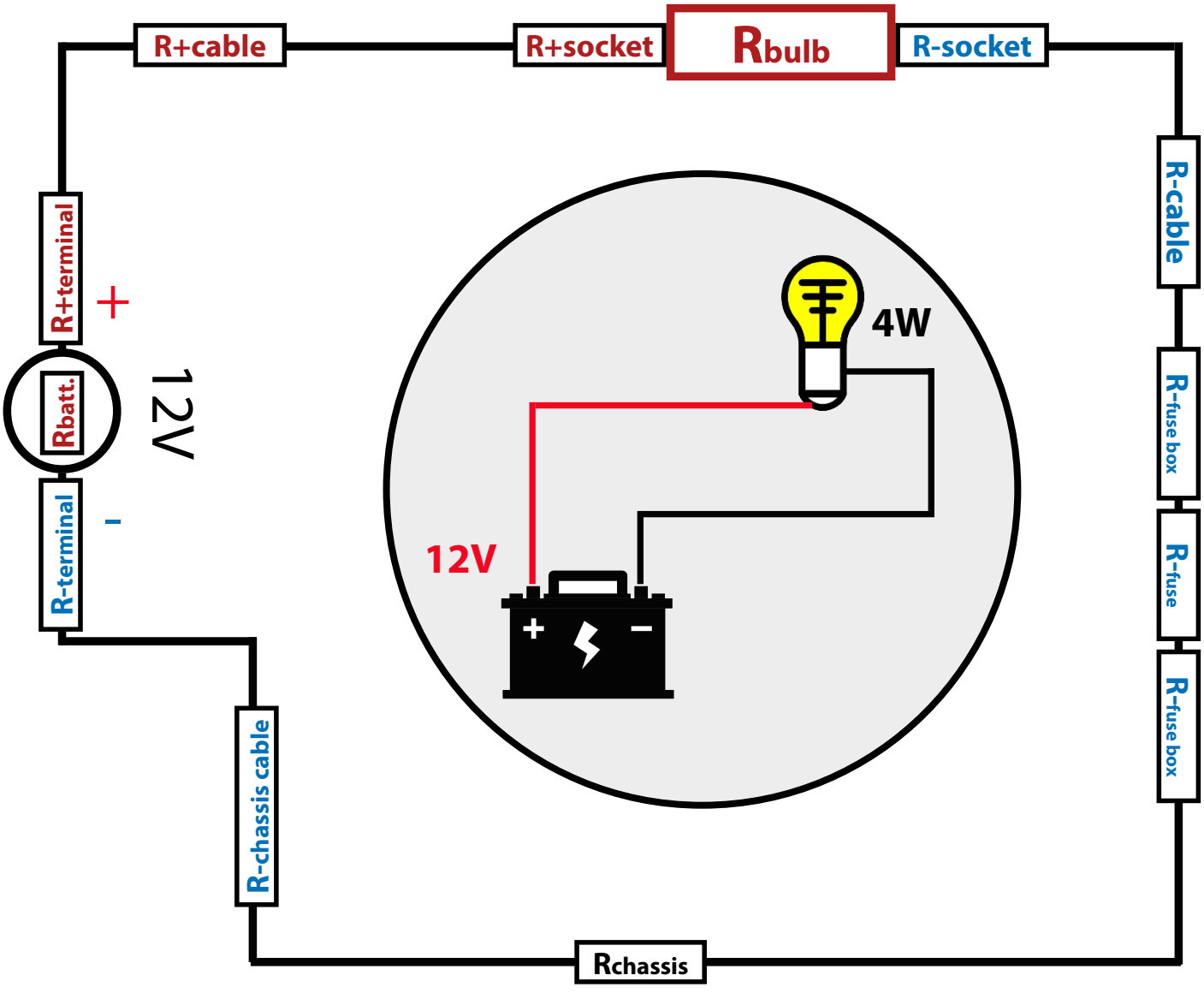


How many electrical consumers are there in the circuit of the light bulb? I did the test with several car enthusiasts, the answer was always: "*1 consumer of course, the light bulb*".

Well, that's not quite correct.

#67 Electrical

The electrical cables to which everything is connected are also electrical consumers and in practice exhibit electrical resistance. The connections (e.g. crimp terminals) with which the cables are connected are also consumers. If we now draw the actual circuit, with all electrical consumers, it looks like this (in the middle we show again the simplified representation with battery and light bulb). We have given each resistor a name that explains where the resistor comes from, on the next page we explain this in more detail in the boxes.



voltage drops

Rbatt.: is the internal resistance of the battery, ideal is that zero
R+terminal: the connection to the battery terminal
R+cable: the plus connection of the battery to the bulb
R+socket: the socket of the light bulb
Rbulb: the light bulb

R+socket: the socket of the light bulb
R-cable: the minus terminal of the battery with the bulb
R-fuse box: the terminals of the fuse box
R-fuse: the fuse
R-chassis en R-chassis cable: the chassis is used with most cars as a common negative (ground) terminal
R-terminal: the connection to the battery terminal

All components placed in an electrical circuit will resist the electric current flowing through it. And yes, all parts, including the cables and even the terminals and all other connections through which current flows. Also the chassis of your Volkswagen forms an electrical consumer, which is used to connect all negative electrical connections (ground).

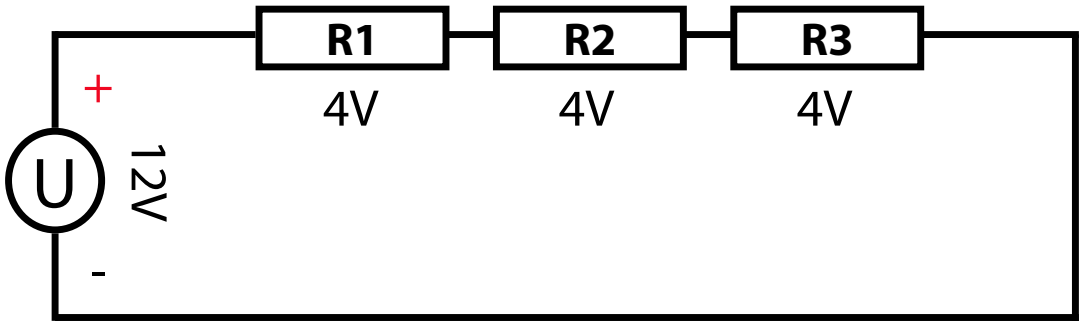
And let's not forget the battery, ideally a battery has an internal resistance of zero ohm (according to the theory of the ideal voltage source). If this is not the case, the battery will also consume energy and heat up, generating a voltage loss.
The next time you work on your Volkswagen, you shouldn't think about **a battery with a light bulb**, but about **all the potential consumers** and how you can make them consume as little as possible.

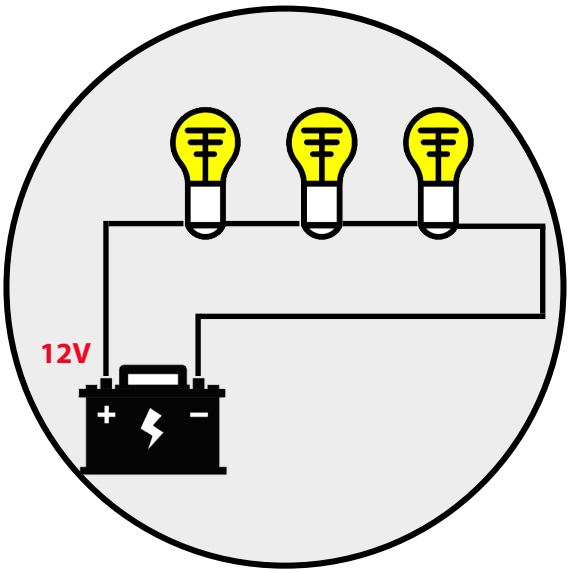
Voltage divider

Because of all these extra resistors, which in turn consume a small amount, the real consumer (the light bulb) will not get the full 12 V, part of the battery voltage will be lost over the other (loss) resistors. This is the principle of the voltage divider.

When electrical consumers are connected in series, you may add their respective resistance values. The total resistance of the circuit below is equal to the sum of the three resistors:

Rtotal= R1 + R2 + R3

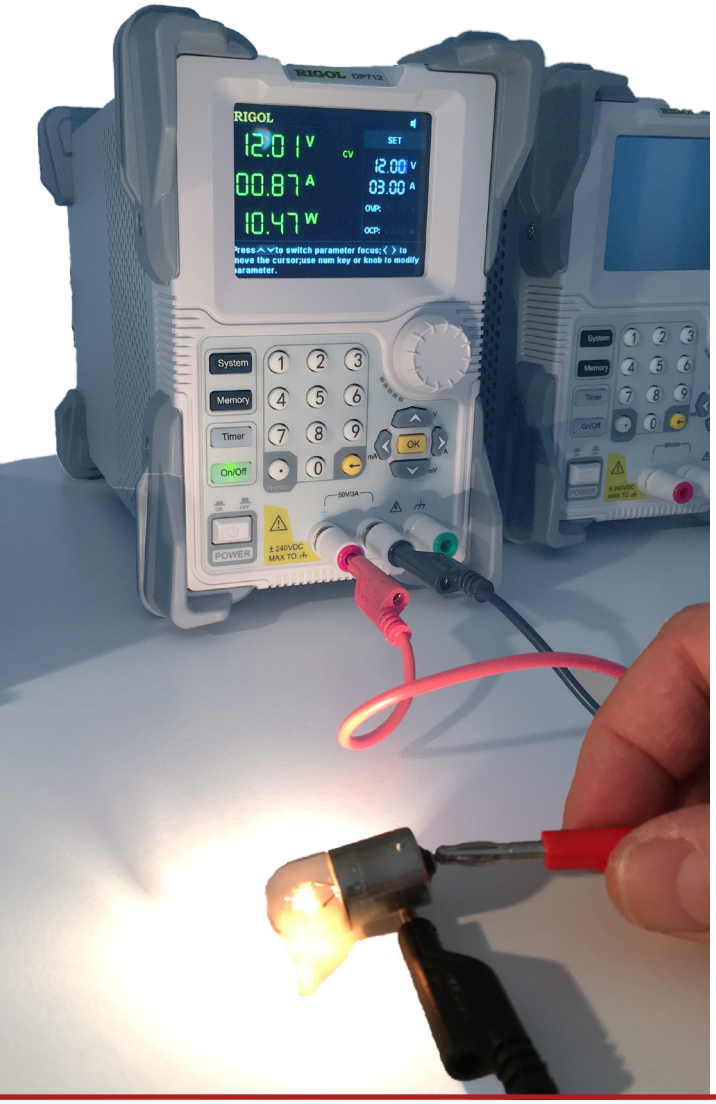




If the three resistors have an equal value, e.g. three light bulbs of 12 V/10 W, then the voltage across each bulb (in ideal conditions, i.e. all other parts of the circuit have a resistor zero) will be one third of the battery voltage, i.e. 4 volts.

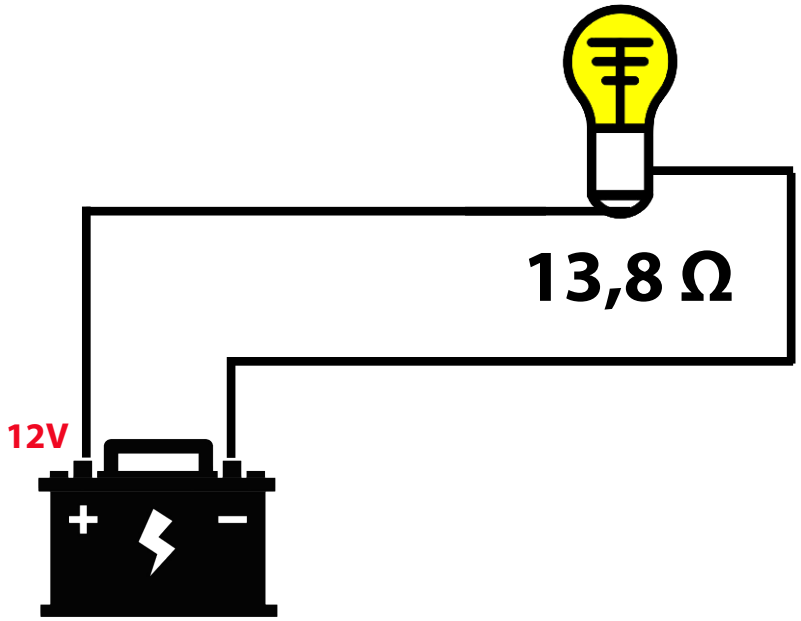
voltage drops

What is the resistance of such a 10W/12V light bulb? It doesn't make sense to measure the resistance with an ohmmeter, because the resistance of the light bulb will change once current passes through it. The filament will become very hot, and it will have a higher resistance value than cold.



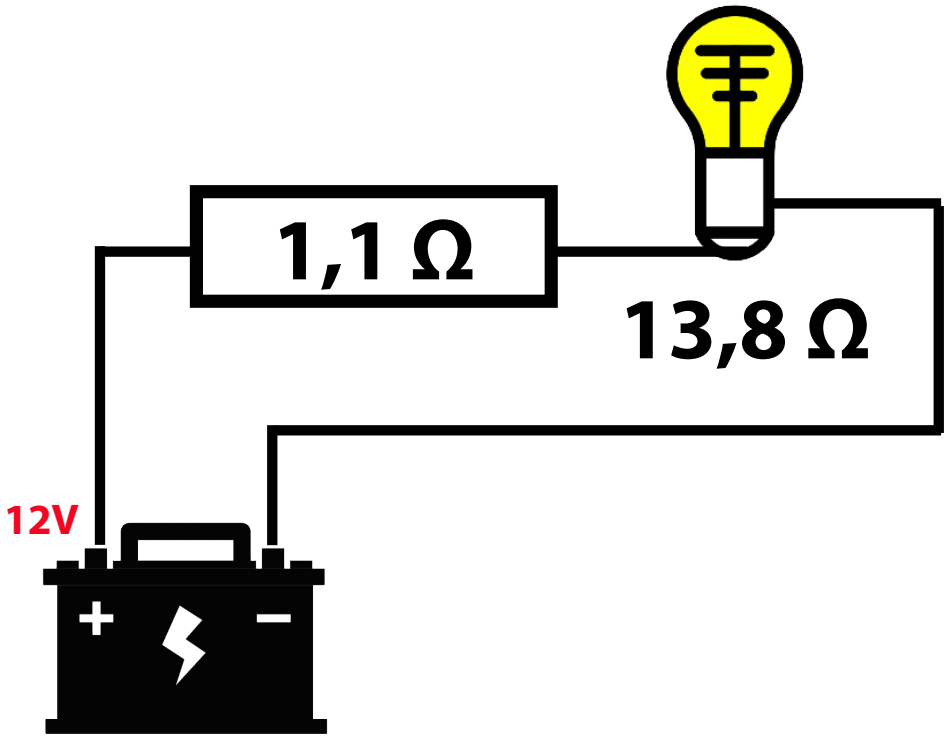
The resistance of an incandescent lamp can also not be determined with Ohm's law, because the resistance depends on the temperature of the filament and is therefore not linear. We have determined the resistance of the incandescent lamp in our lab by switching 12 V over the bulb with a stabilized power supply and see how much current flows through it. The current is 0.87 A. With Ohm's law we can determine the resistance of our incandescent lamp:

Rbulb= U/I = 12V/0,87A



Our 10 W bulb has a filament resistance of 13.8 Ω. If we look at the drawing on page 6, we see a series of series-connected resistors, eleven in total (without counting the battery and the bulb). As an exercise, let's assign a value of 0.1 Ω to each of those resistors (total is then 1.1 Ω), we assume for a moment that all couplings are oxidized, do not connect properly anymore or are damaged (or all three together). We show the replacement circuit below.

In this case, the bulb will no longer receive the full 12 volts, because other resistors (read electrical consumers) will take a part of the voltage, according to the principle of the voltage divider.



voltage drops

To know how much voltage is left for the "real" consumer, the light bulb, we can use the theory of **voltage divider**. When two resistors are connected in series, the voltage will be distributed over these two resistors, proportional to the value of the resistor. It is certainly not the intention to learn these formulas, but we show them to make you aware of what happens when the electrical couplings are not taken care of (read extra resistors so voltage drops). Before you know it, your beloved VW will let you down ...

How can you calculate the voltage across each resistor? You can calculate the current and thus determine the voltage across each resistor (Ohm's law), or use this simple formula:

$$U_{bulb} = U_{batt.} \times (R_{bulb} / R_{total})$$

$$U_{bulb} = 12V \times (13{,}8\ \Omega / 14{,}9\ \Omega)$$

$$U_{bulb} = 11{,}11\ V$$

The bulb in this example gets 10% less voltage than needed. It doesn't seem much difference, but an light bulb loses a lot of its intensity even with a small drop in voltage.

Voltage losses

The formula also shows that the smaller the resistor of the "real consumer", the more the other unwanted resistors will take voltage away from the battery voltage. If the consumer would have a resistance of barely 4 Ω , this consumer would get less than 10 V:

$$U_{bulb} = 12V \times (4{,}0\ \Omega / 5{,}1\ \Omega)$$

$$U_{bulb} = 9{,}41\ V$$

After all, this is an important lesson to use in the workshop. Each resistor connected in series with the consumer will remove part of the battery voltage. The smaller the resistor of the consumer, the worse the problem will be (read, the lower the voltage across this consumer).

The starter motor, ignition coil, wiper motor and headlights are such low resistance consumers. With the ignition coil we speak of a primary winding with an average resistance of 4 Ω (therefore the example on the left with 4 Ω).

The starter motor and the ignition coil need the full battery voltage to function properly. It is therefore very important that the connections between battery and consumers are in good condition and offer as little resistance as possible. What you want is for the full 12 V or 6 V to reach the consumers. All electrical resistances in the list on the previous page, except for the "real" consumer, should be eliminated. In other words, all unwanted resistors should be reduced to zero, as far as possible.

voltage drops

With the 6 V installation it all gets a bit worse when the connections are not in good condition. For starters there is only half of the voltage available to the ignition coil, starter motor, ... to power them. So any voltage loss will be felt more strongly in a 6 V installation.

Another problem with 6 V installations is that twice as much current is needed to develop the same power, as can be seen in this formula:

$$P = U \times I$$

If the voltage U is half, namely 6 V instead of 12 V, then the current must be twice as large to develop the same power. The power required from the starter motor to run the engine remains the same, as well as the power required from the ignition coil, whether it is 6 V or 12 V (well, about the same).

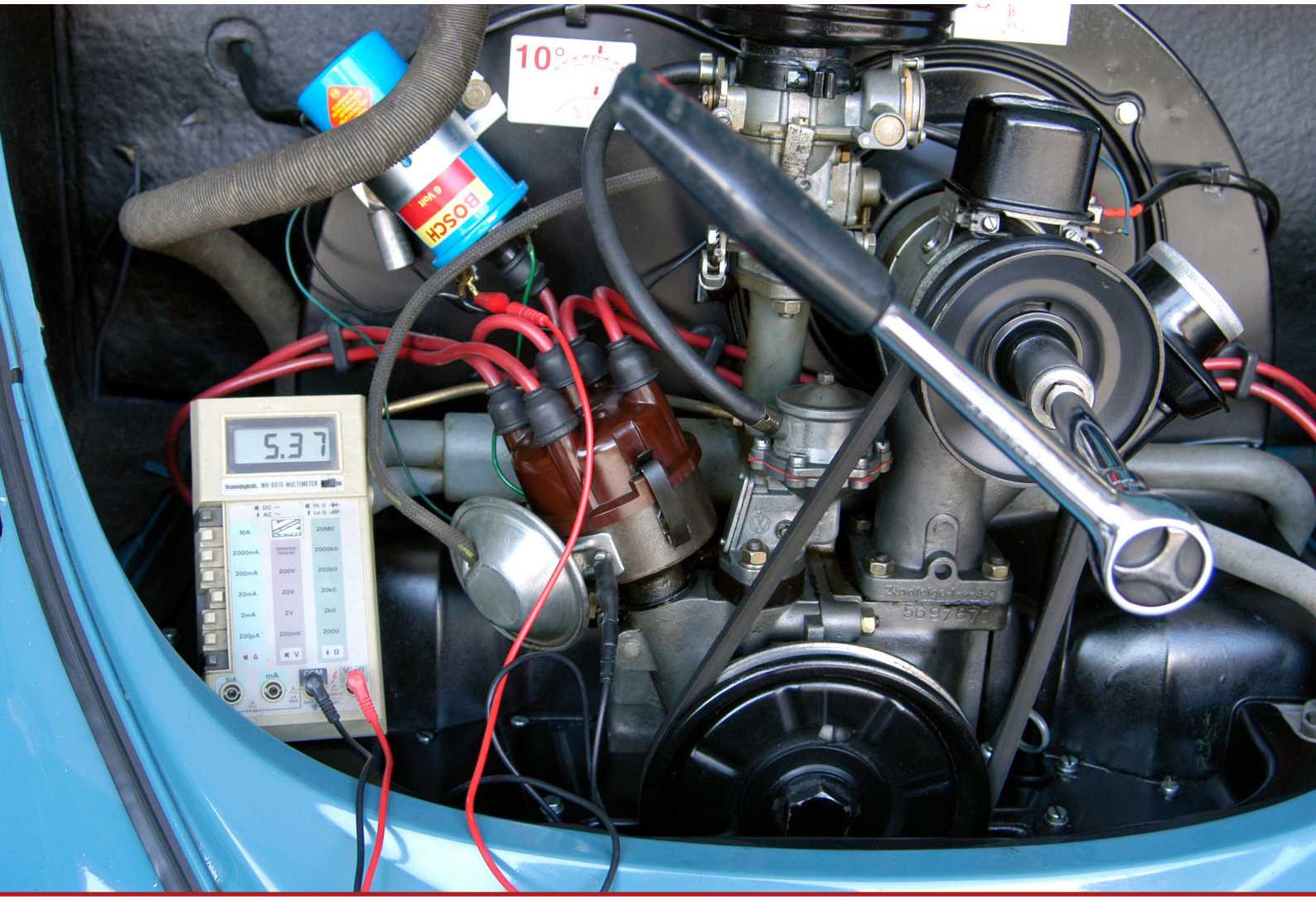
In 6 V installations, the current is greater to develop the same power, so the conductors (electric cables) must be thicker to offer less resistance.

Voltage losses will also generate extra heat. If we take again that 1.1 Ω from our previous example, this extra resistance would consume about 1 W of power. So all the connections together form a loss of 1 W with the corresponding unnecessary heat.

From theory to practice

Do you have a classic Volkswagen nearby to test? Turn on the ignition and measure the voltage between the positive terminal of the ignition coil and the ground. We did that on a 1200 VW with a 6 V installation. The voltage was 5.37 V. When the points are closed, the voltage even drops to 4,44 V.

A loss of 10% of the battery voltage due to resistances built up between battery and ignition coil. Just think of the losses that can occur in the ignition switch when it is no longer in optimal condition (see edition 08 page 11).



voltage drops

Now the question is, what can you do to ensure that there are as few voltage drops as possible?

Most unrestored Volkswagens have had many owners and many mechanics who have done good and less good repairs to the electrical circuit. Check all electrical connections, including the fuse box where it sometimes goes wrong. Corrosion is the killjoy.

The battery terminals must be tightened properly, the battery terminals must be free of corrosion. Battery polar grease helps for better conductivity.

The ground connection of the battery to the chassis is very important, all current consumed by your VW flows through that one cable. Corrosion of the chassis and floorpan is a main issue when it comes to electrical conductivity.

With restored VW's sometimes the problem is that the restoration was done too perfectly. A thick layer of paint, usually powder coating, gets in the way of good conductivity of the ground cables. Before connecting a cable to ground (chassis), make sure all paint, primer and any zinc coating is removed, these are all additional electrical resistances.

If you install extra contacts, fuses or switches, they must be of good quality, to provide a minimum electrical resistance.

The length of the cables also plays a role, albeit a small one. Make sure the cables are as short as possible. The final problem is the sum of all small problems added along the way.
The thickness of the cables plays a crucial role, but we will discuss this in the next edition of this series.

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CLASSIC CAR PARTS


FG 984H

#68 Brakes

Introduction

In the previous edition we replaced the front drum brakes. Everything subject to wear and tear was replaced with new parts. Take a look at edition 22 if you want to know more about it.

In edition 12 we explained the construction of the drum brakes, and showed the difference between the front brakes and the rear brakes. For a good preparation we advise you to go through both articles again.

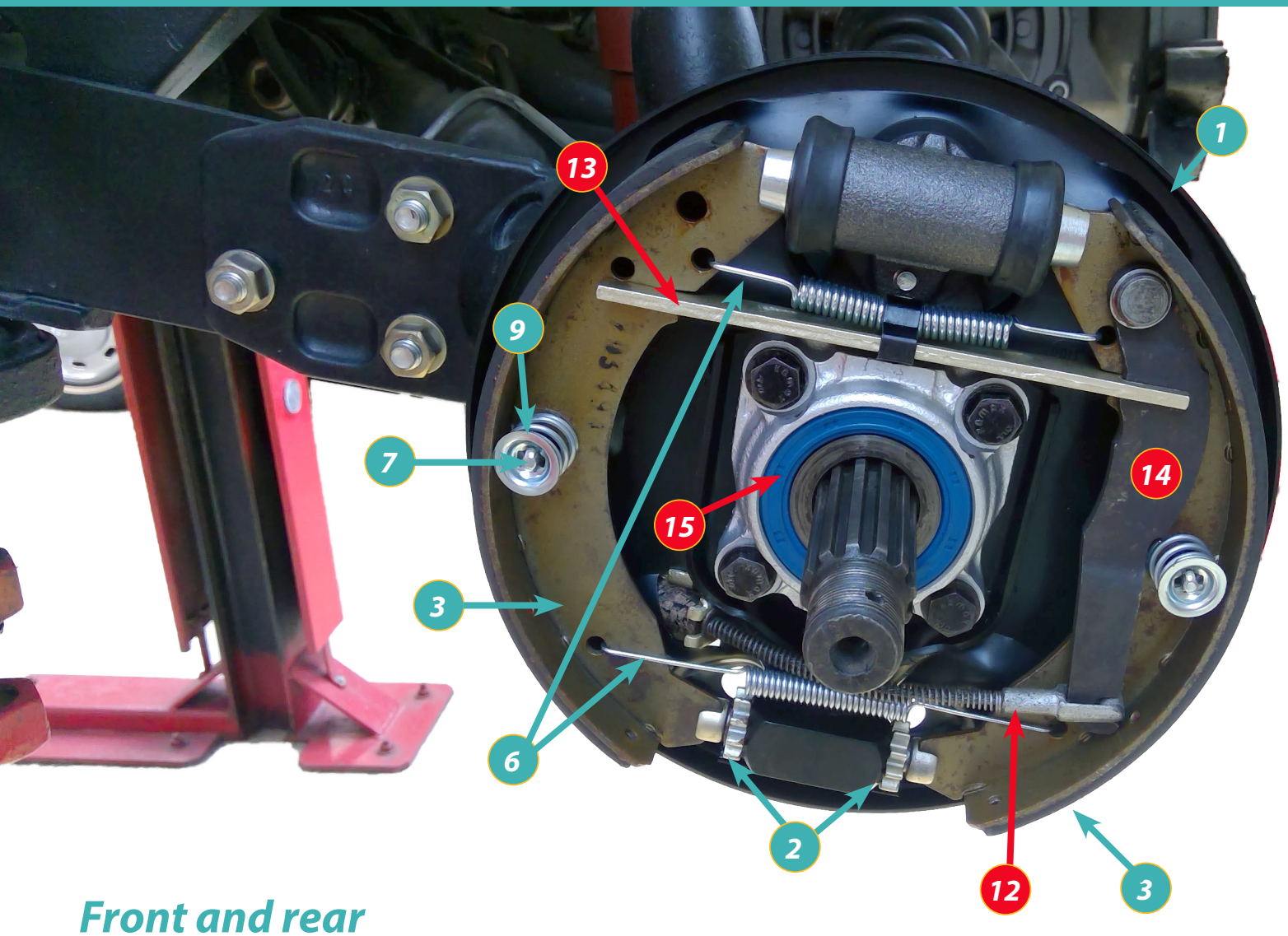
We will replace the drum brakes at the rear of a Volkswagen 1303 convertible. If you want to do this for another type of VW, the procedure is quite similar. We show the end result of our work on the next page. We replaced the brake backing plate, the wheel brake cylinder, the brake shoes and springs as we did for the front brake in edition 22. We also replaced the retaining rings.

We show each part with circles and numbers, the **red numbers** are typical for the rear brake. We use the same numbering as in edition 22.

1. **Backing plate**
2. **Adjusting bolt for brake shoes**
3. **Brake shoes**
4. **Wheel brake cylinder**
6. **Retracting springs**
7. **Brake shoes hold down pins**
9. **Brake shoe lock springs / dishes**
12. **Handbrake cable**
13. **Handbrake push bar**
14. **Handbrake lever**
15. **Grease seal**

Always replace left and right brake shoes together!

brake disassembly



Front and rear

The big difference between front (see edition 22) and rear is that the handbrake is operated at the back. The additional parts that take care of the handbrake control (**red circles**) will be discussed.

Also, the bearings are different at the back than at the front. The rear wheels should not be able to rotate, they are supported with needle or ball bearings and not with conical bearings like on the front. Wheel play adjustment of the rear wheels is not necessary here, the large 36 mm nut is fixed with 300 Nm (consult the work-shop manual of your VW model), so no play here.

Preparations

The car must be driven on a stable surface in order to use the jack. We use a two-column lifting jack, but that is not necessary to replace the rear brakes.

The high force on the 36 mm rear axle nut is best removed when the car is still on the ground, with the handbrake engaged (picture 1). That way you can apply great forces on the nut.

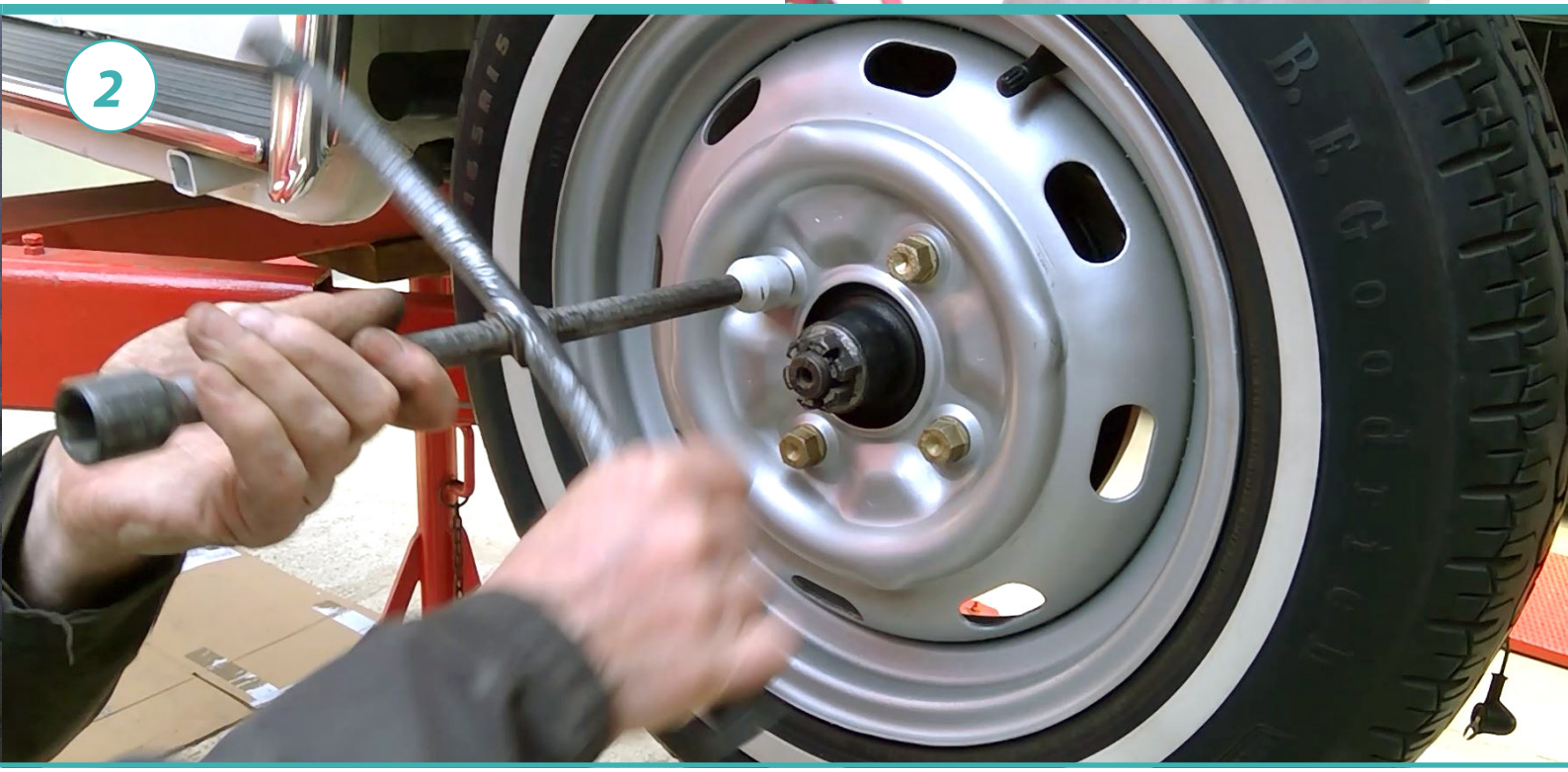
This nut should be fixed with 300 Nm (30 mkg). Use a torque wrench or ratchet with a long arm, ideal 1 meter.

300 Nm or 30 mkg, corresponds to a force of 30 kg when using a wrench arm 1 meter long. When the wrench arm is 0.5 meters, then you need 60 kg of force to get the nut moving. This is not convenient, and dangerous, you could slip and damage the nut, or yourself.


1

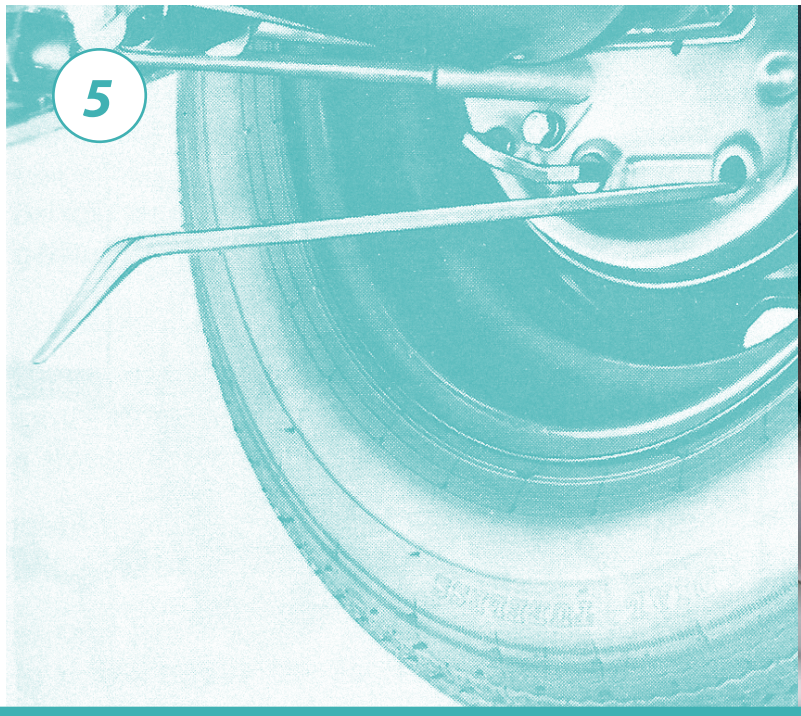
brake disassembly

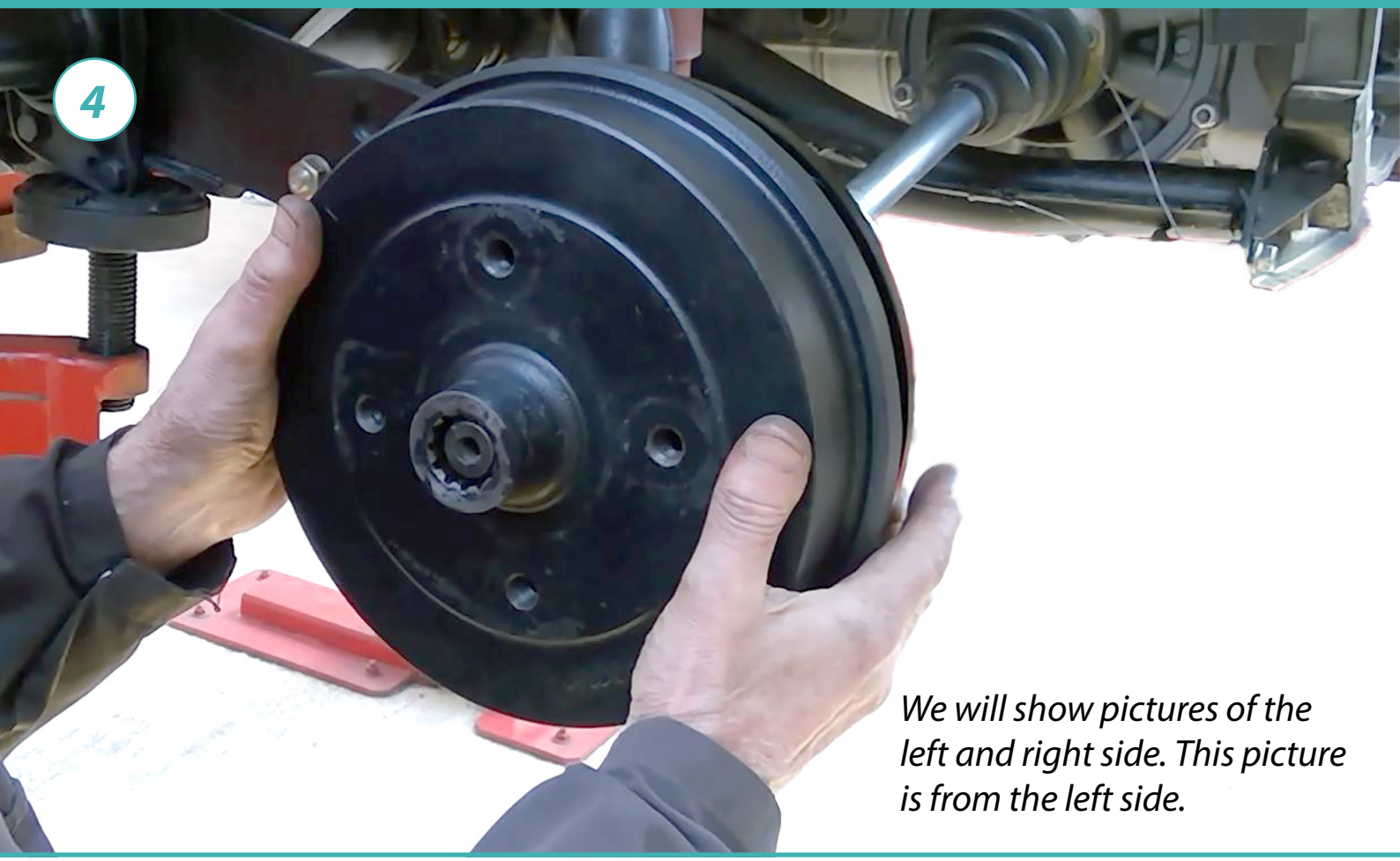
So make sure you have such a long torque wrench, or a long ratchet. A hollow tube over a smaller ratchet is also possible, but we don't recommend this because it can become dangerous.
When the tension on the 36 mm nut is gone, you can jack up the car. Do not unscrew the 36 mm nut completely, the brake drum might come loose! Disconnect the wheels from the drum (picture 2). Then you can unscrew the 36 mm (picture 3).



Disassembly

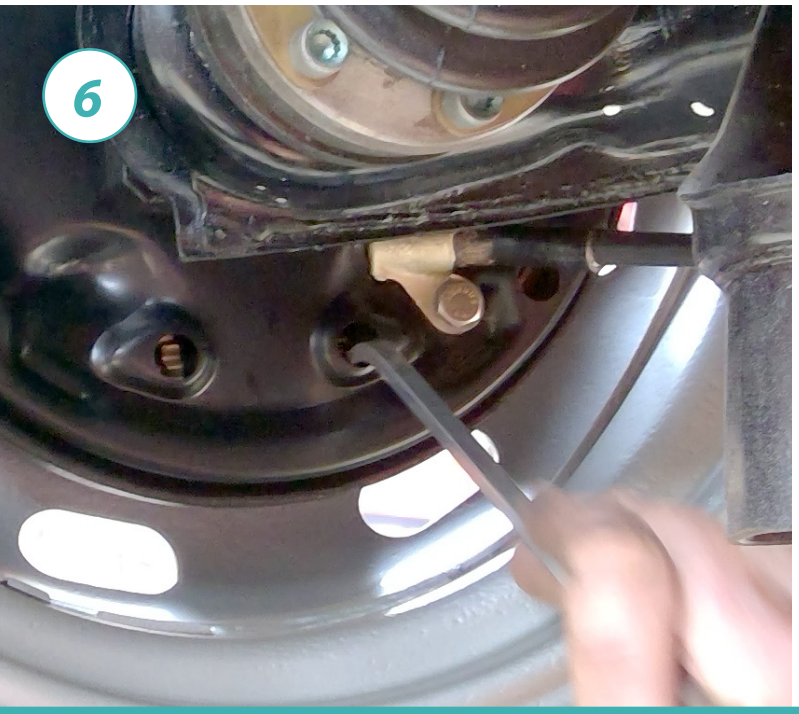
If the brake drum is difficult to remove, turn the brake shoe adjustment bolts (at the back of the brake backing plate, pictures 5, 6 and 7) in such a way that the brake shoes no longer rub against the drum. To do this, use a special tool as shown in the picture, not a standard screwdriver. With a screwdriver you will damage the opening in the brake backing plate.

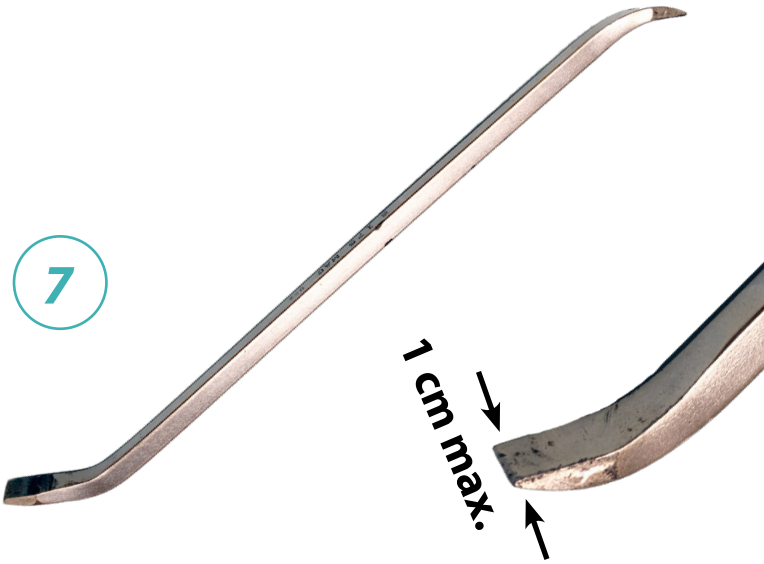




We will show pictures of the left and right side. This picture is from the left side.

brake disassembly

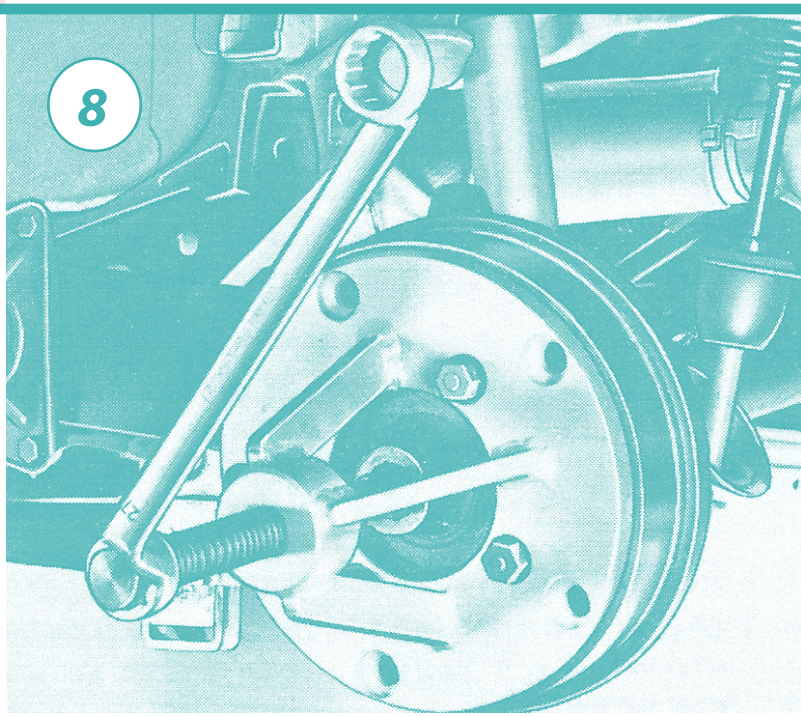




With this tool you will be able to adjust the brake shoes through the hole in the brake backing plate, without damaging it. Once damaged, the inspection plugs will no longer fit and will get lost.

If you still feel a lot of resistance, use a rubber hammer to tap at the back of the drum. Be careful not to damage the brake anchor plate unnecessarily.

Volkswagen advises to use a puller, as we show on the picture (picture 8 © Bentley Publishing). Of course, the average enthusiast doesn't have such a puller at home. Usually you will succeed with some patience and a few taps on the drum.



The adjustment of the brakes will be discussed in detail in a next edition of this series.

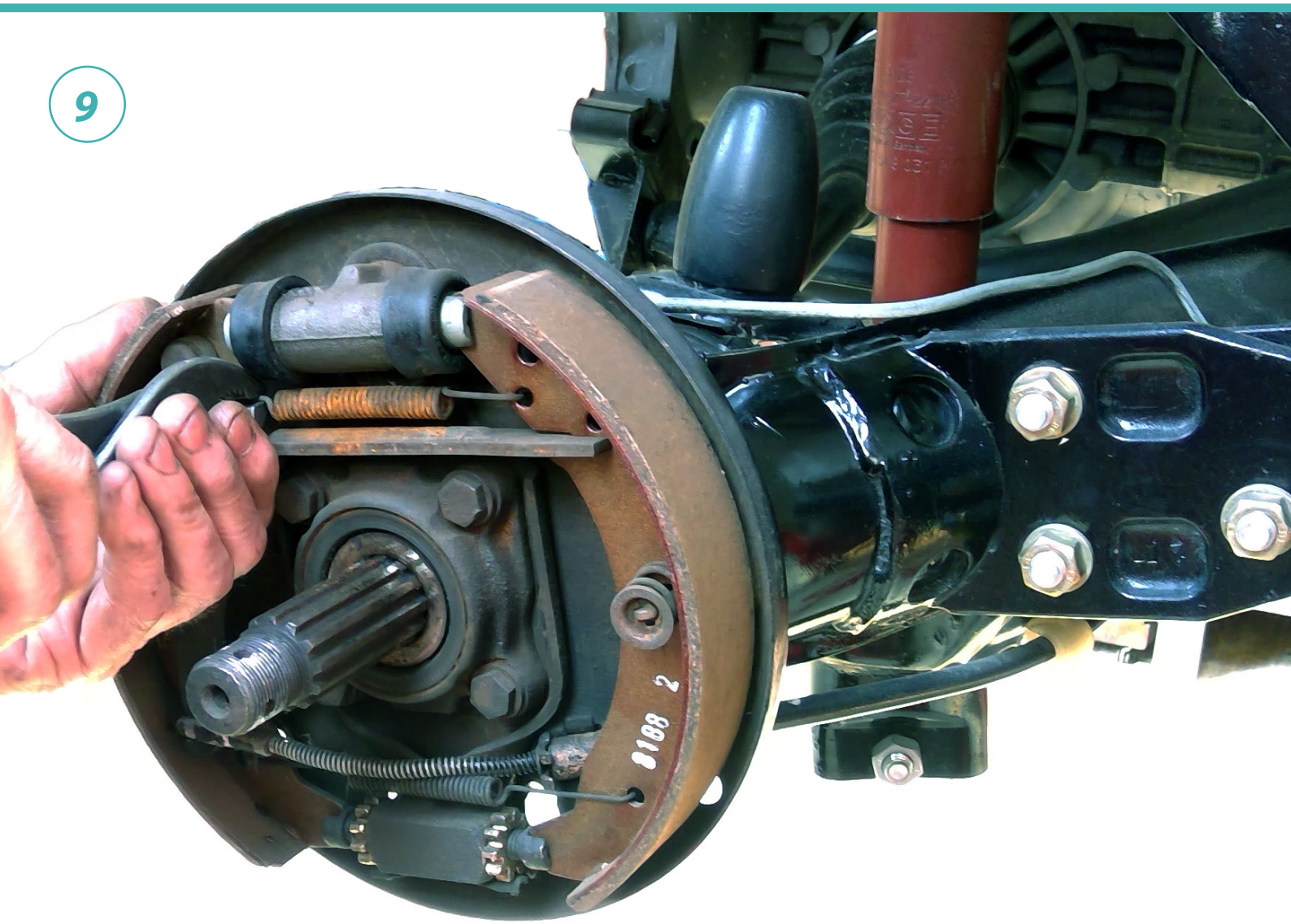
#68 Brakes

Below on picture 9 you see the rear brake parts after the brake drum has been removed. A lot of surface rust, but that's normal. The friction material of the brake shoes contains metal particles that disperse in the drum at every brake action. The reason for replacement on this VW 1303 was because the brake backing plates were damaged.

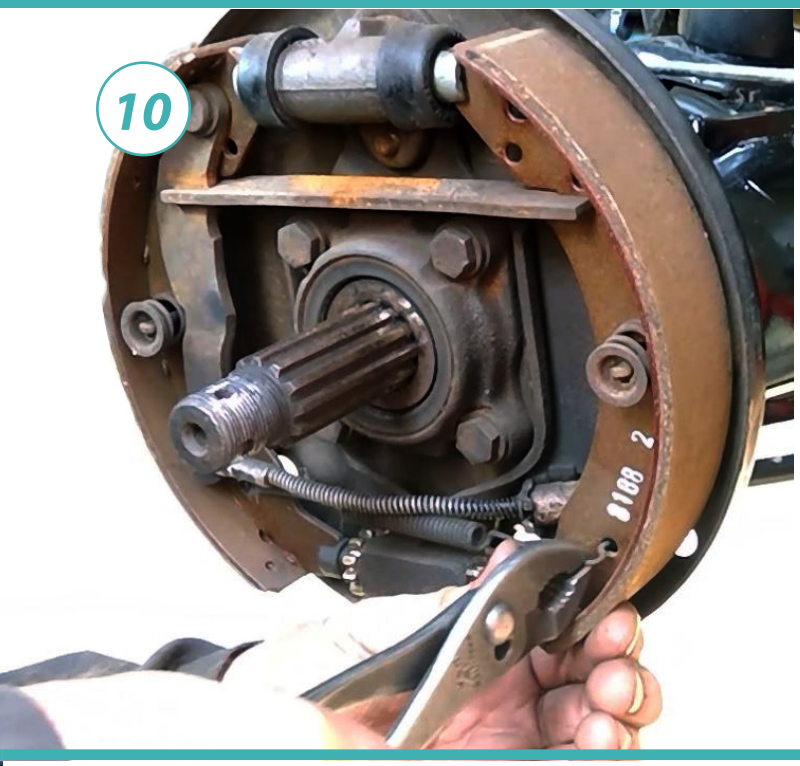
Because of the additional parts for the handbrake, such as the push rod and lever, we will proceed differently for disassembly and assembly of the parts of the rear brake than for the front brake in edition 22.

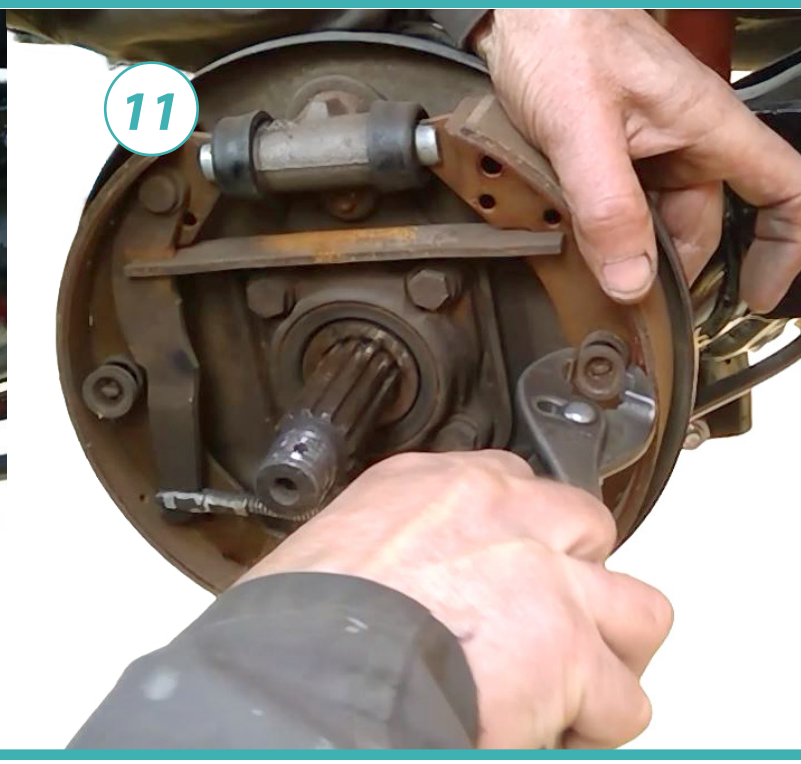
We'll start by loosening the brake shoe retracting springs (pictures 9 and 10).

9



brake disassembly



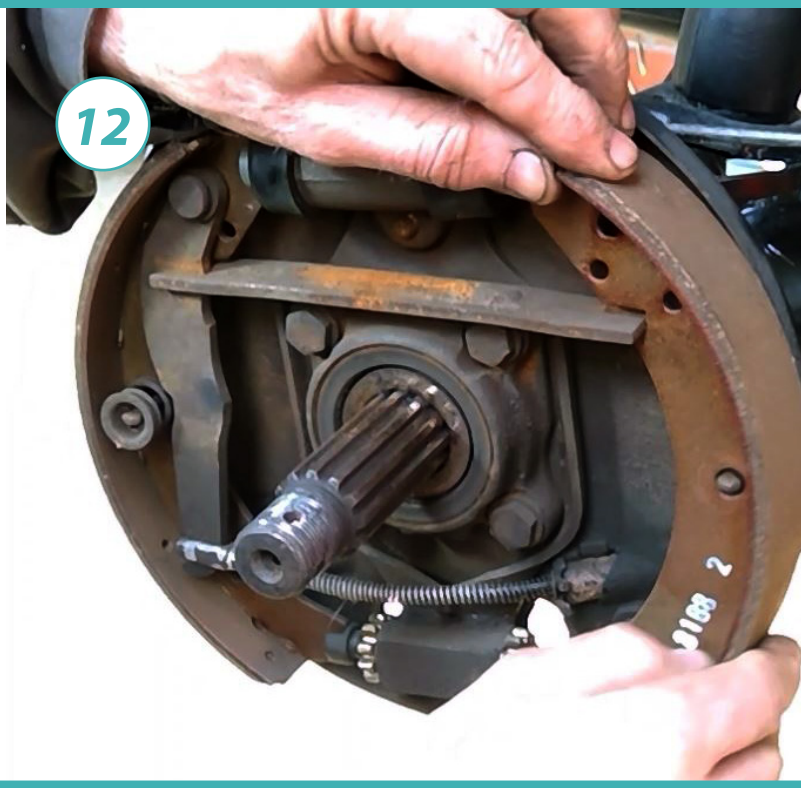


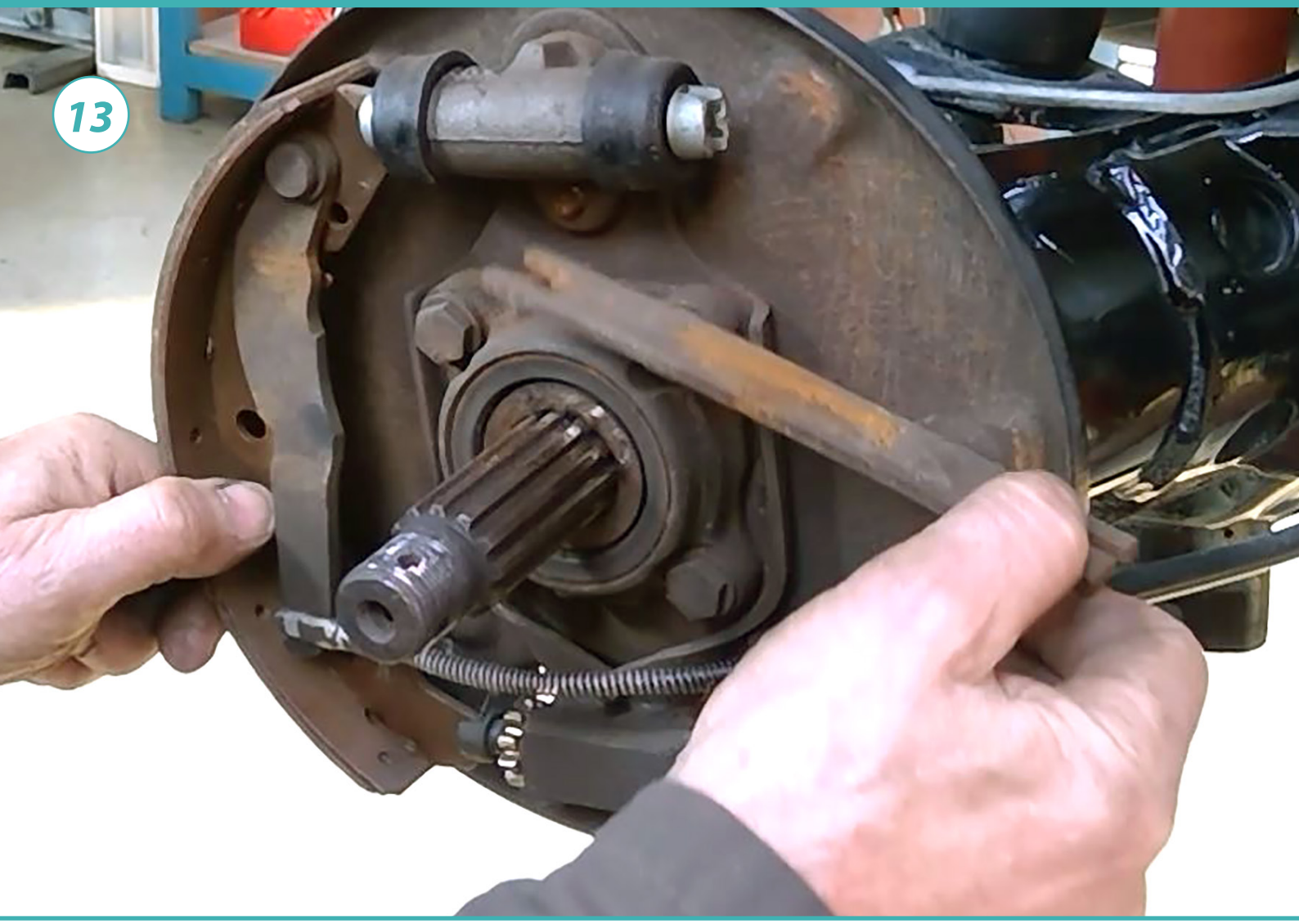
You can do this with a gripper or a special tool designed to loosen springs (picture below). Because all parts will be replaced, it doesn't really matter here that we damage the spring with a gripper. If you want to reuse the springs, we recommend using a spring puller as shown here.

On picture 11 above we show how the metal retainers of the brake shoe springs are loosened. In edition 22 we discussed this in detail, the same approach applies to the rear brakes. You can see in the picture that you have to block the hold down pin at the rear, then push the metal retainer inwards and then turn it a quarter turn to unlock it. Here we do this with a gripper because we will replace all the parts anyway. In edition 22 we discussed special tools.

With the retracting springs loose, the brake shoe can now be removed (picture 12), the brake shoe with the lever stays in place for a while. The hold down pin can now be removed from the brake backing plate.

Keep all old parts carefully to compare them with the new parts before assembly!

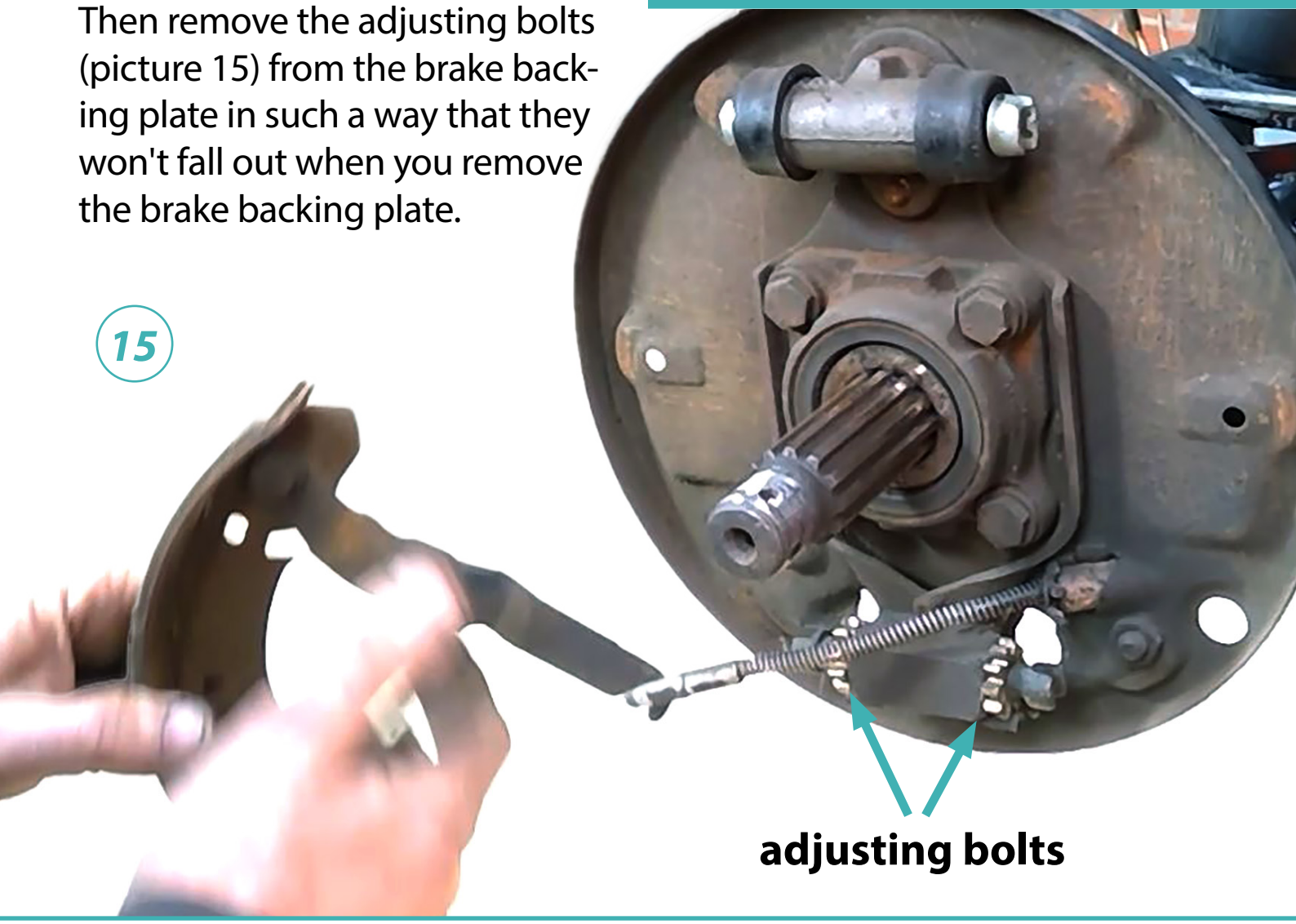


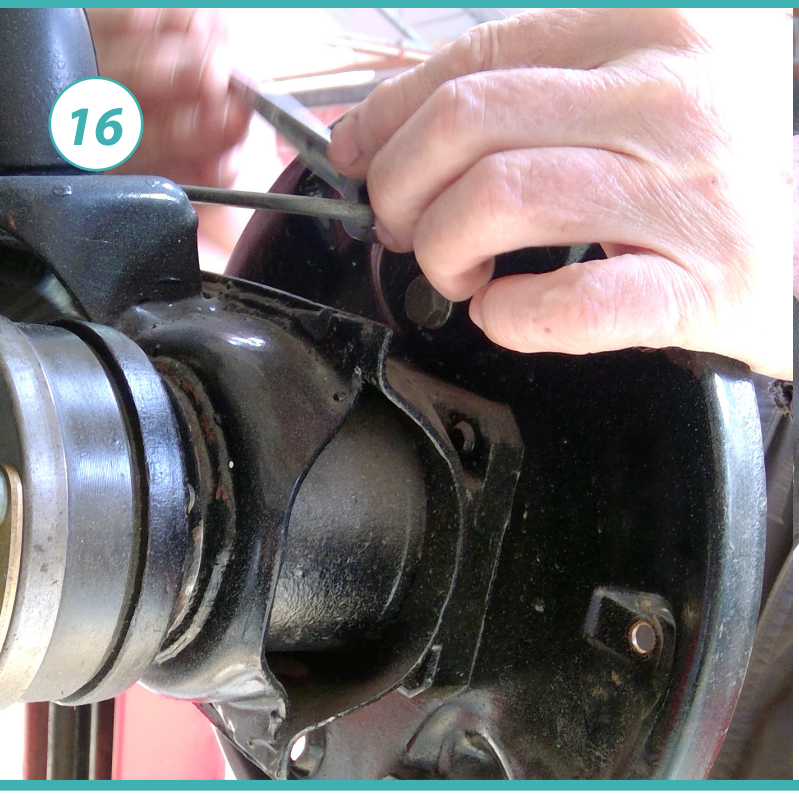


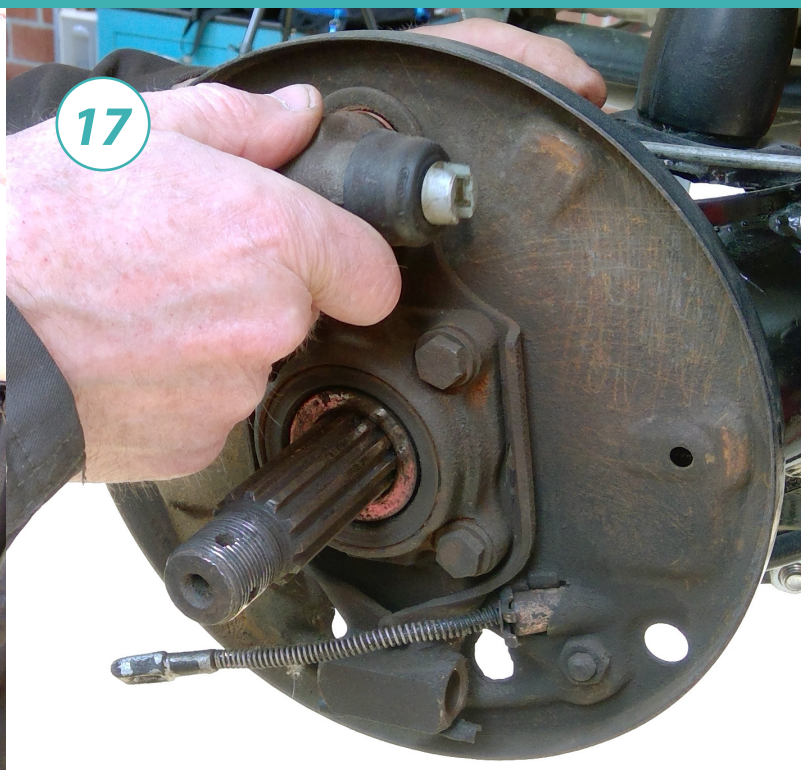
brake disassembly

The push bar is now free and can be removed (picture 13). Now release the retracting spring from the other brake shoe, remove the handbrake push rod and then the brake shoe together with the handbrake push bar (picture 14). The handbrake lever is hooked to the handbrake cable, but by tilting the cable you can easily disconnect the cable (picture 15).

Then remove the adjusting bolts (picture 15) from the brake backing plate in such a way that they won't fall out when you remove the brake backing plate.







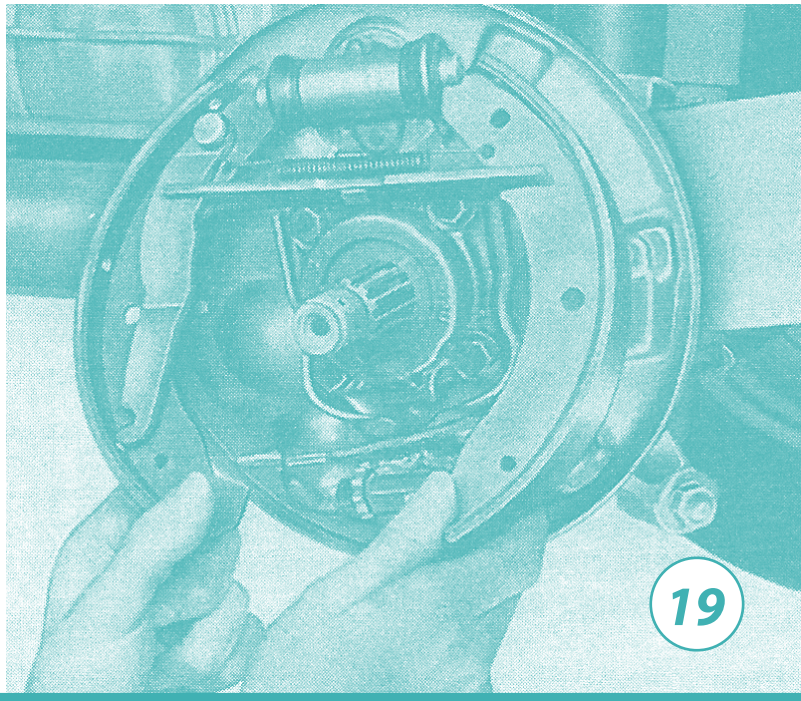
Loosen the hydraulic brake line at the back of the wheel brake cylinder (picture 16). Preferably use a partially closed wrench of 11 mm (photo below) that provides more grip on the nut. The nuts of the brake lines are made of soft material (and usually very tight due to the combination of heat and corrosion) and will quickly be damaged if you apply a lot of force with only three sides of a classic wrench.

Loosen the wheel brake cylinder (see also edition 22) by loosening the bolt at the back of the brake backing plate (picture 17). Remove the wheel brake cylinder and store it in a closed container, the brake fluid is very corrosive.

Clean everything, there must have been some brake fluid spilled while removing the wheel brake cylinder (picture 18).

brake disassembly

In the Volkswagen manuals you'll find a different way of disassembling, where only the lower retracting spring is loosened (picture 19). Both brake shoes with push rod and lever are removed as one part, while the upper spring holds the whole together. The handbrake cable must then first be disconnected.



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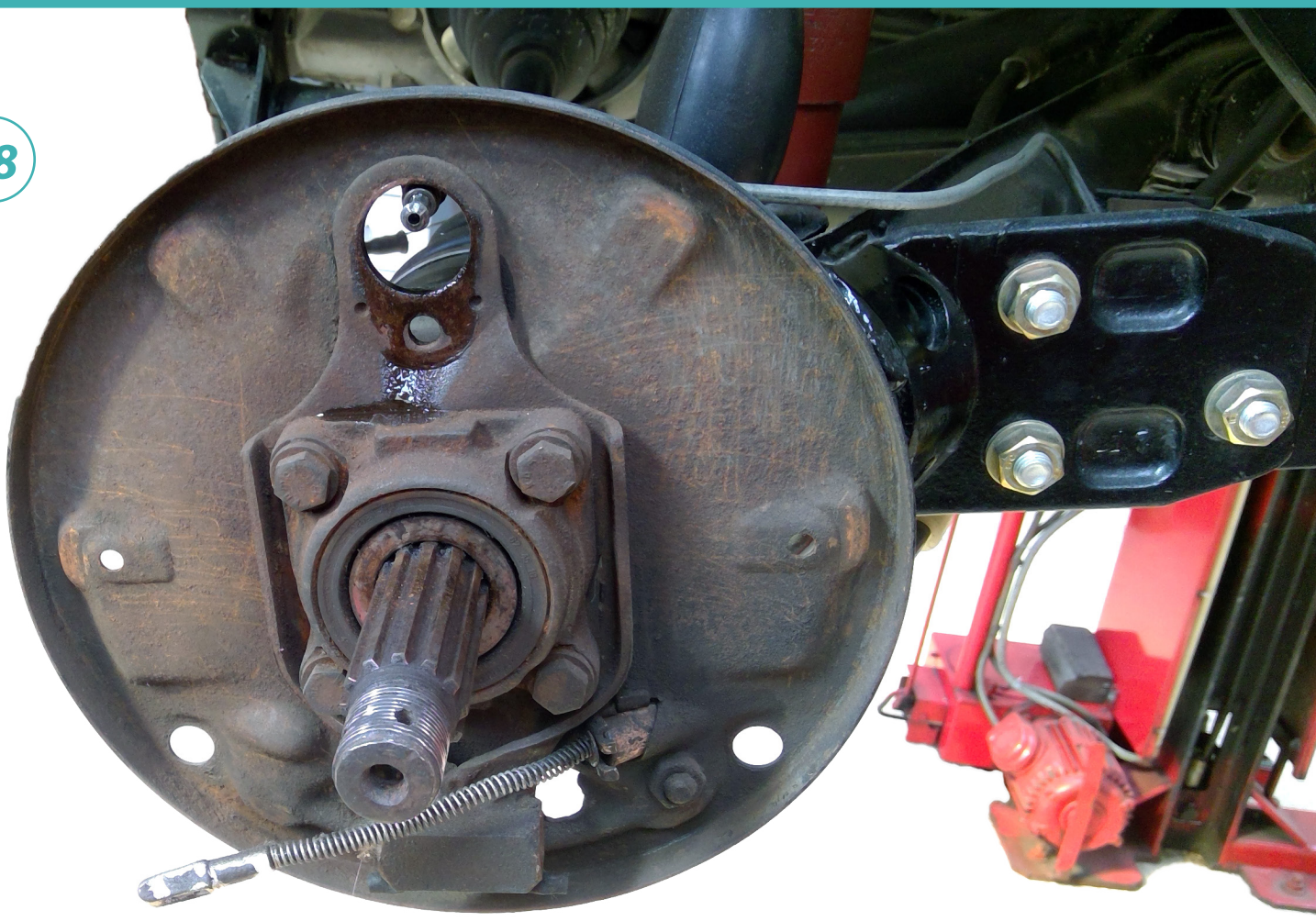
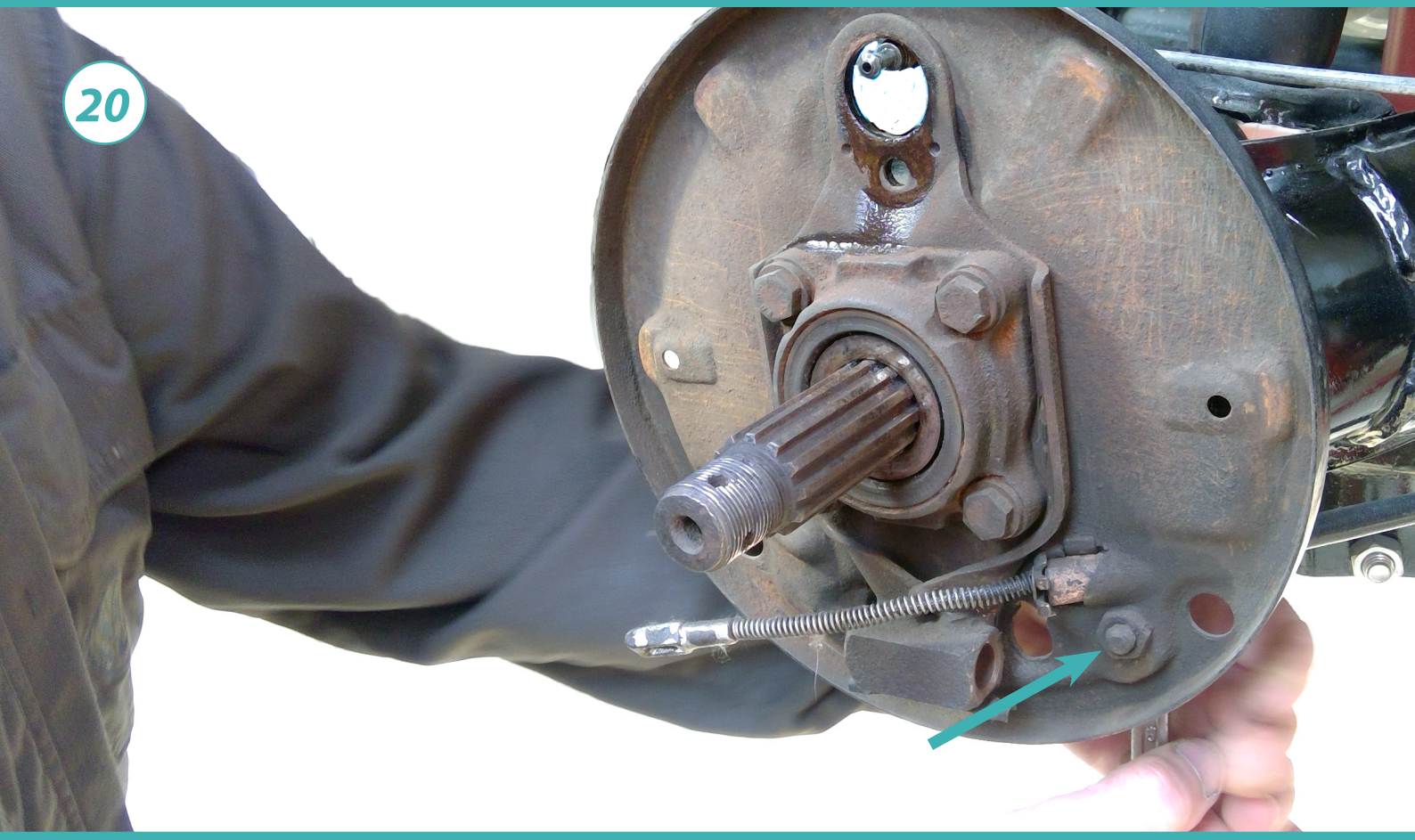
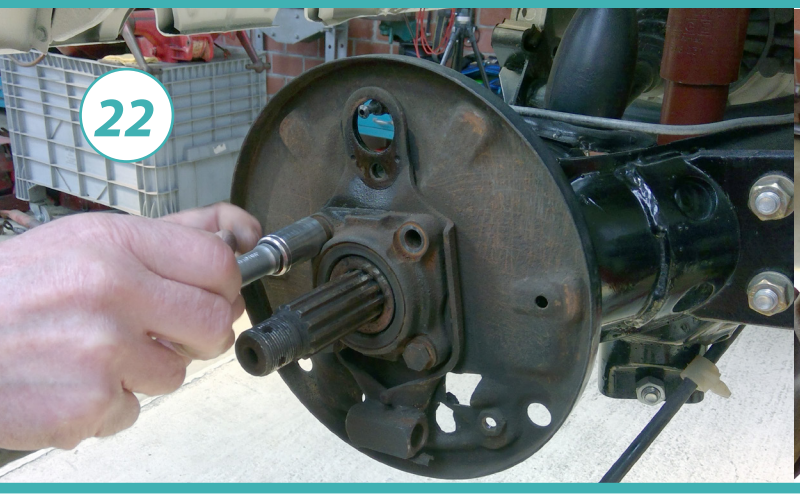


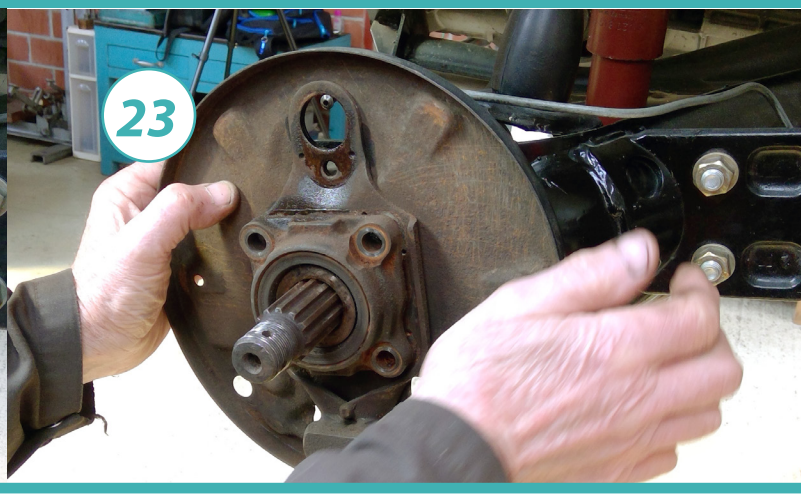


The handbrake cable still needs to be disconnected. The bolt that holds the clamp on the brake backing plate can be very tight due to dirt and corrosion (picture 20). Use WD40 or a similar product one hour in advance before trying to unscrew the bolt.

On the picture on the right (picture 21) we show the clamp of the handbrake cable of our VW 1303. Mounting may be different for other types.

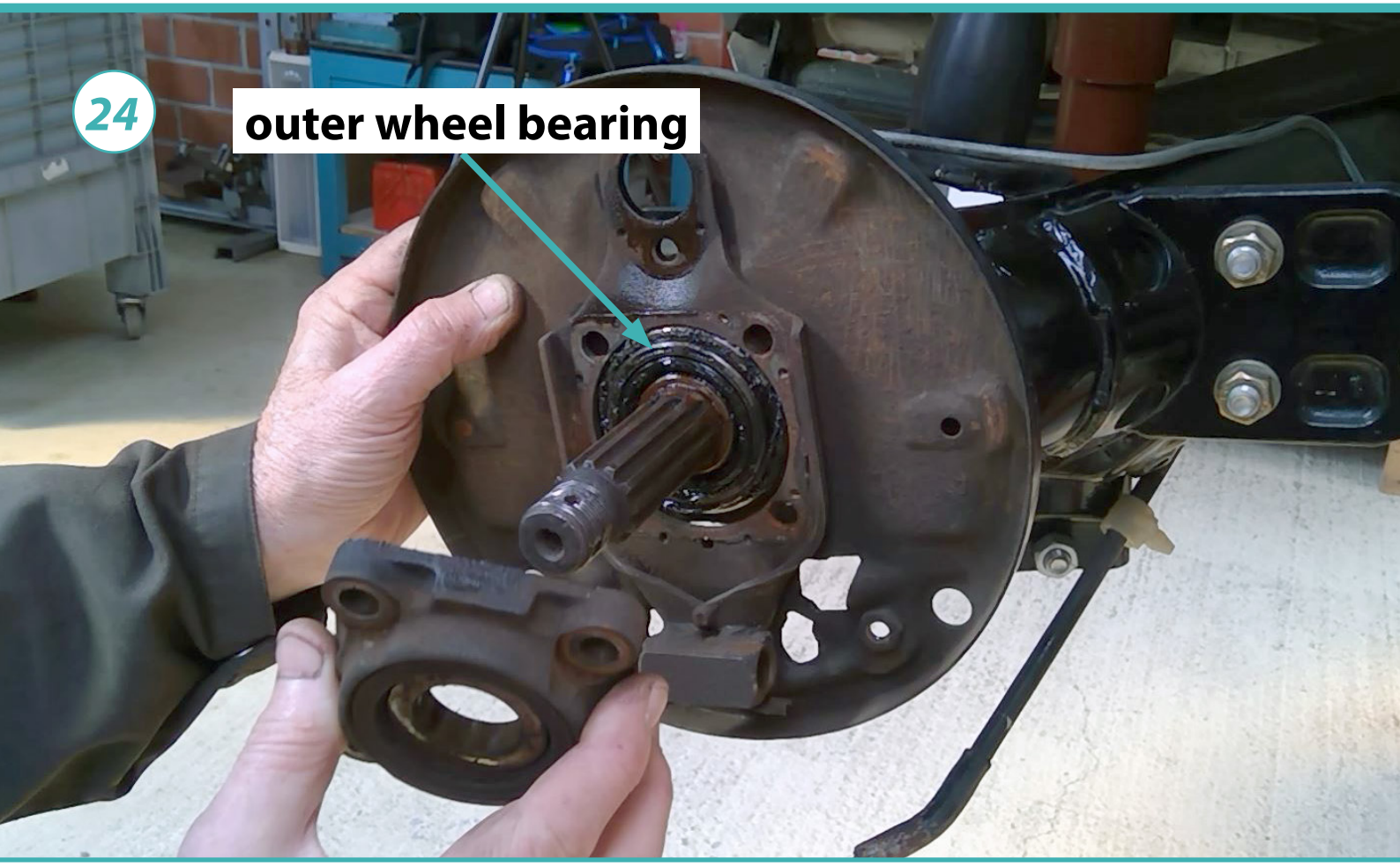
brake disassembly



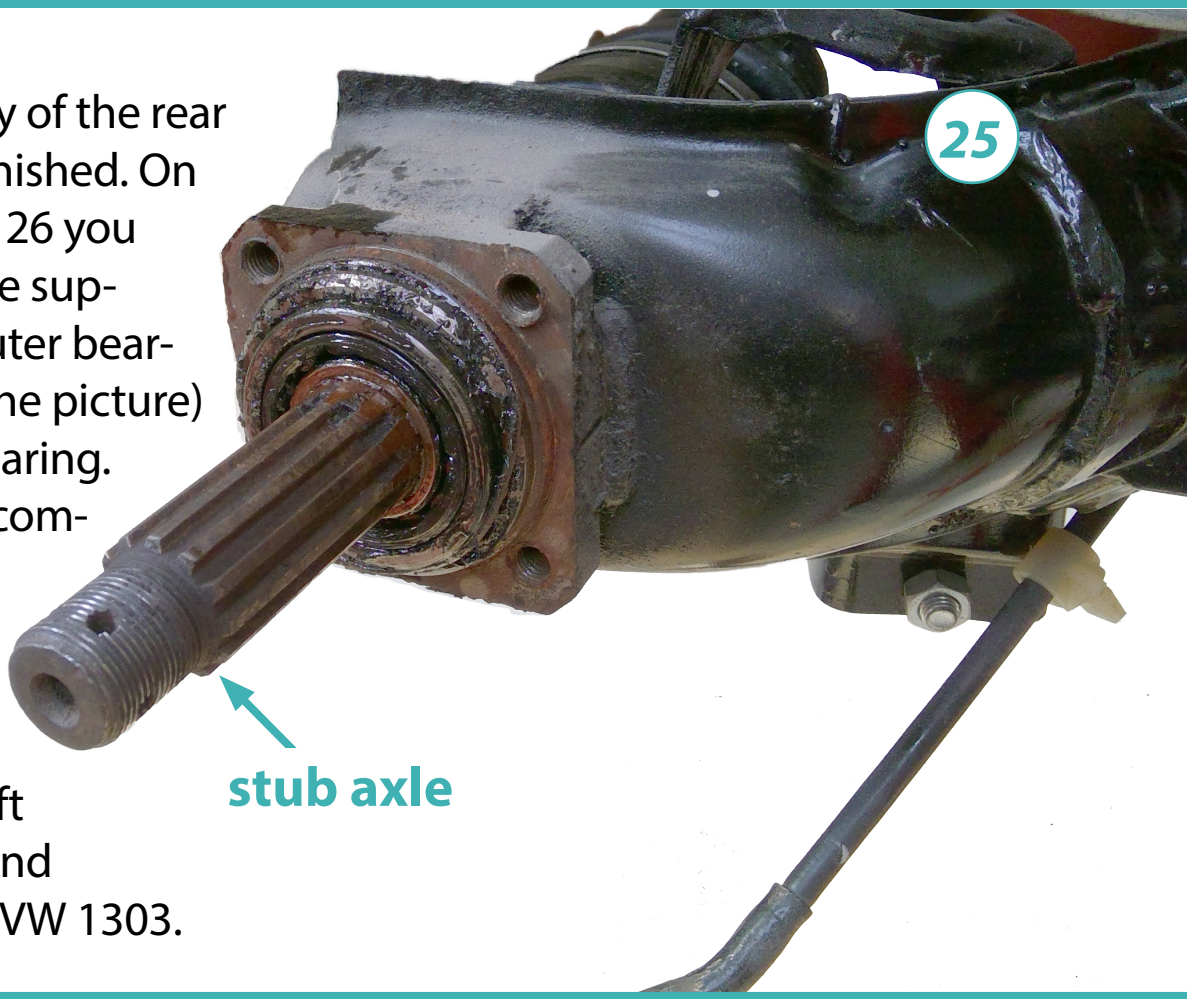


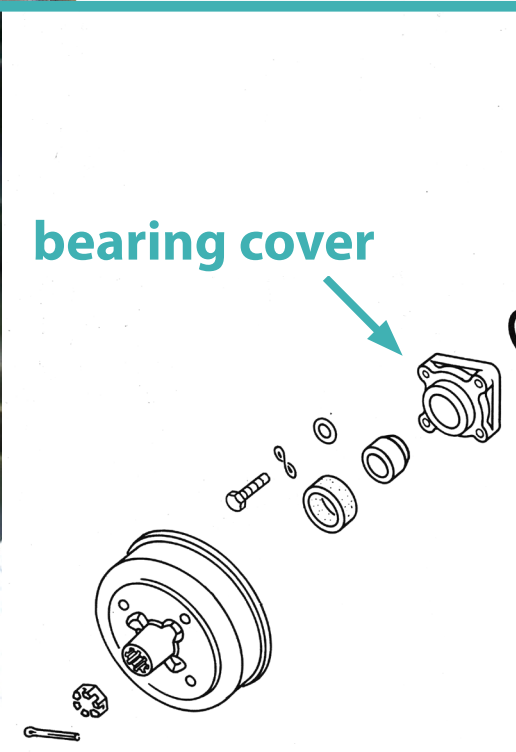
The brake backing plate is held in place by four bolts with washer and spring washer (picture 22). The bolts also hold the bearing cover in place. Here also use WD40 if the parts haven't been apart for a long time.

Pull the brake backing plate, and the bearing cover will come loose with it (pictures 23 and 24). The outer wheel bearing is visible. Replacing the wheel bearings is a story in itself, we will discuss this in a next edition.



The disassembly of the rear brake parts is finished. On pictures 25 and 26 you see the stub axle supported by an outer bearing (visible on the picture) and an inner bearing. For the sake of completeness we have added a drawing of the construction of the drive shaft with stub axle and bearings of our VW 1303.

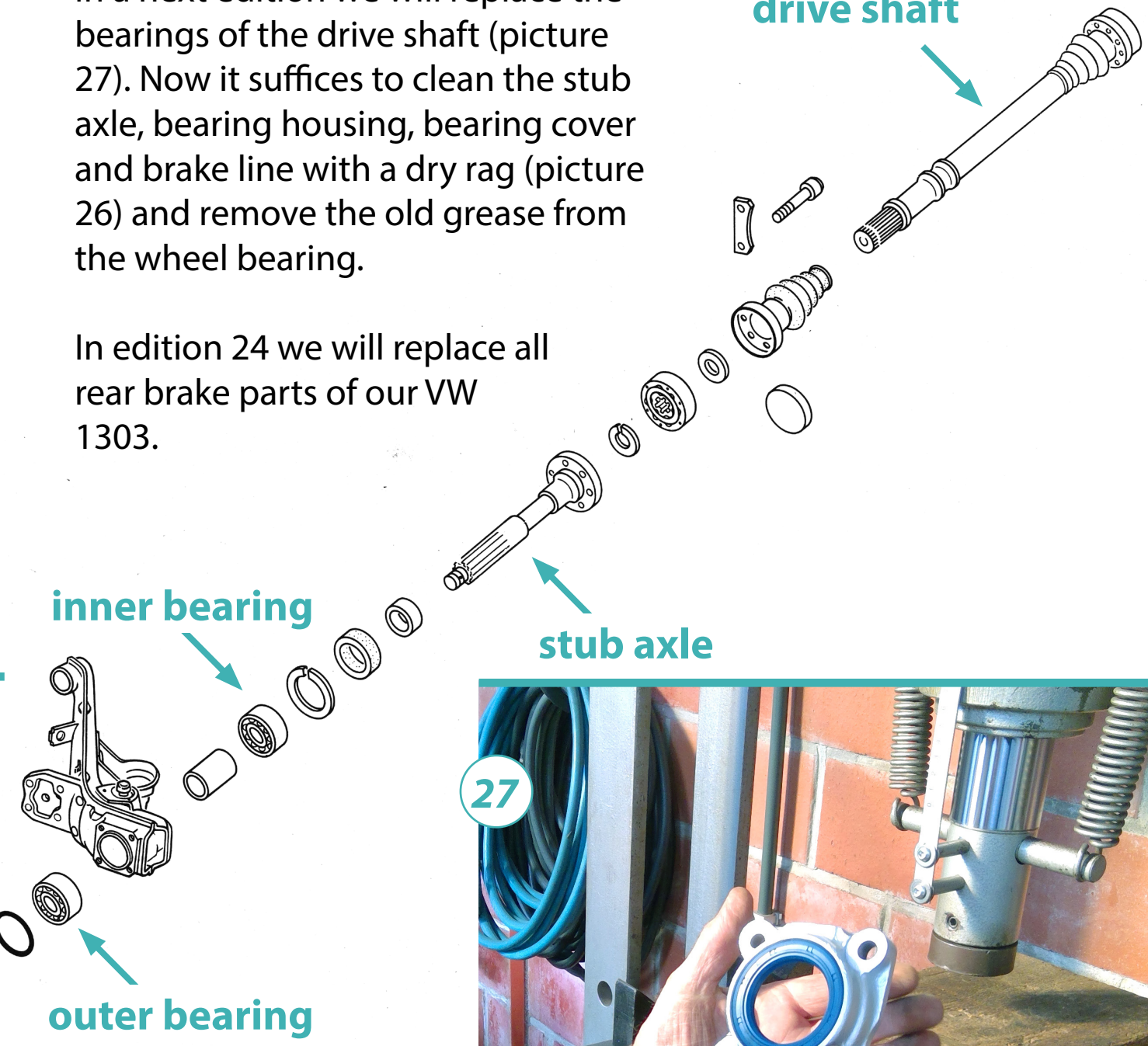


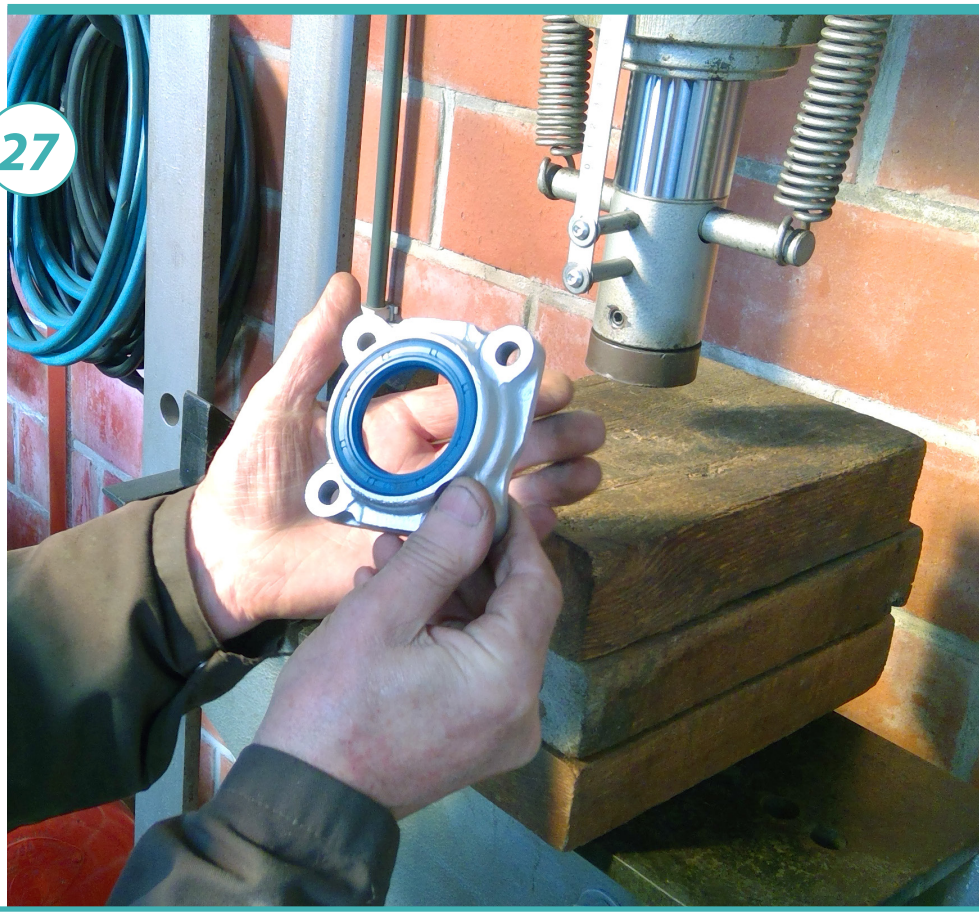


brake disassembly

In a next edition we will replace the bearings of the drive shaft (picture 27). Now it suffices to clean the stub axle, bearing housing, bearing cover and brake line with a dry rag (picture 26) and remove the old grease from the wheel bearing.

In edition 24 we will replace all rear brake parts of our VW 1303.



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ROTTERDAM
C/NO.4D
MADE IN TAIWAN
R.O.C.
PPP
ROTTERDAM
C/NO.6D
MADE IN TAIWAN
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ROTTERDAM
C/NO.B5
MADE IN TAIWAN
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PPP
ROTTERDAM
C/NO.2D
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R.O.C.
ITEM NO. PB-P531
QTY: 60PCS
N.W.: 10
G.W.: 12
P/O: 12129
PPP
ROTTERDAM
C/NO.
MADE IN TAIWAN
PPP
ROTTERDAM
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MADE IN TAIWAN
P/O NO.WN.12123
ITEM NO.:
Q'TY: 50 PCS.
N.W.: 18 KGS.
G.W.: 19
PPP
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#69 Rear axle

Introduction

In edition 08 we gave a short introduction about the suspension of our old Volkswagens. We made an abstraction of the two types of drive shafts that Volkswagen used on all air-cooled models, especially the old **swing axle** and the modern **IRS** (independent rear suspension).

Around 1969 the first models with IRS rolled out of the factory, this meant a big step in offering more comfort. The IRS rear axle also offered better handling compared to the swing axles that characterized the VW Beetle until 1969. The entry models continued to be produced with the old swing axle drive shafts for a few more years.

When we start talking about the suspension, many enthusiasts will get stressed. At first sight, this is a complex chapter, but when we dissect everything and present it simply, it's not that bad. Understanding the theory is something else than doing repairs on the rear axle of course. Therefore, in the next editions we will describe each operation in a separate article.

In the following editions we will disassemble and assemble the bearing housing of the IRS, replace the drive shafts of the swing axle and IRS, replace the rear wheel bearings, explain the geometry of both types and adjust the height of the car by changing the position of the torsion bars.

Basic parts

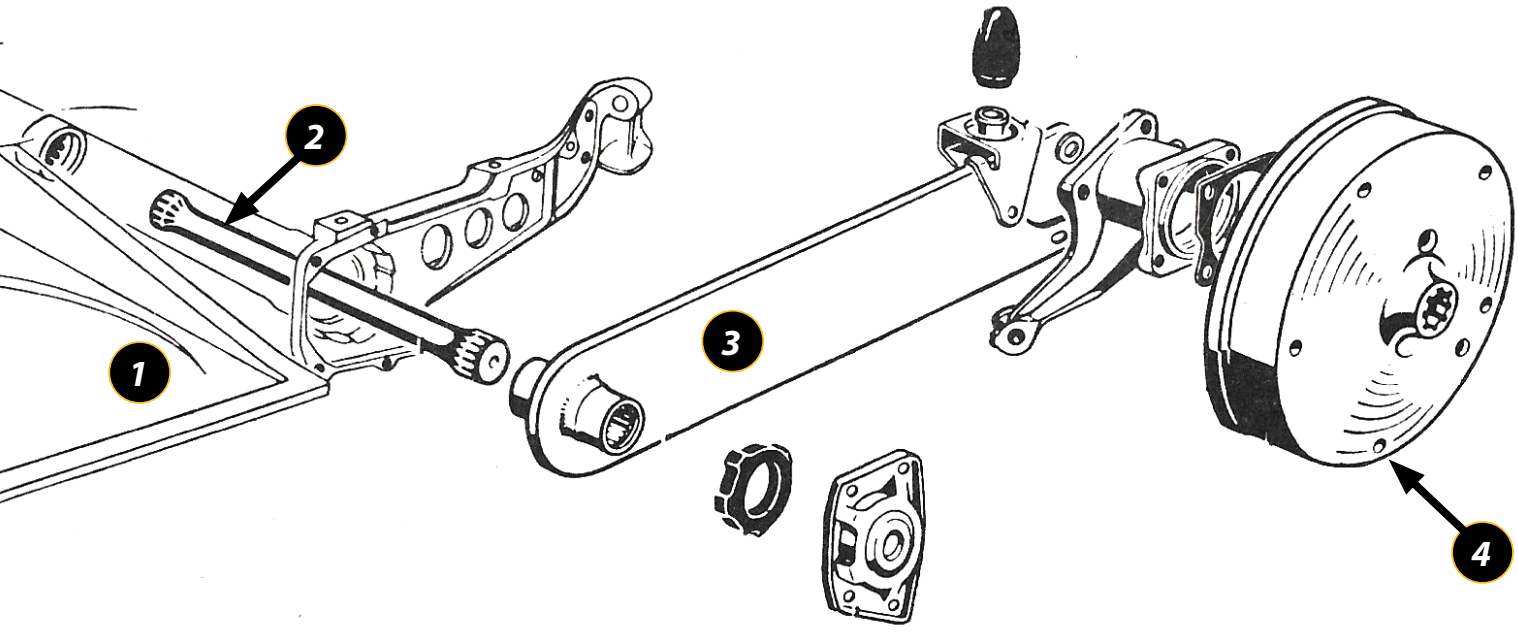
But now let's start dissecting the different parts of the rear axle. The rear suspension consists of the following parts:

- **suspension**
- **shock absorber**
- **drive shaft**
- **wheels**

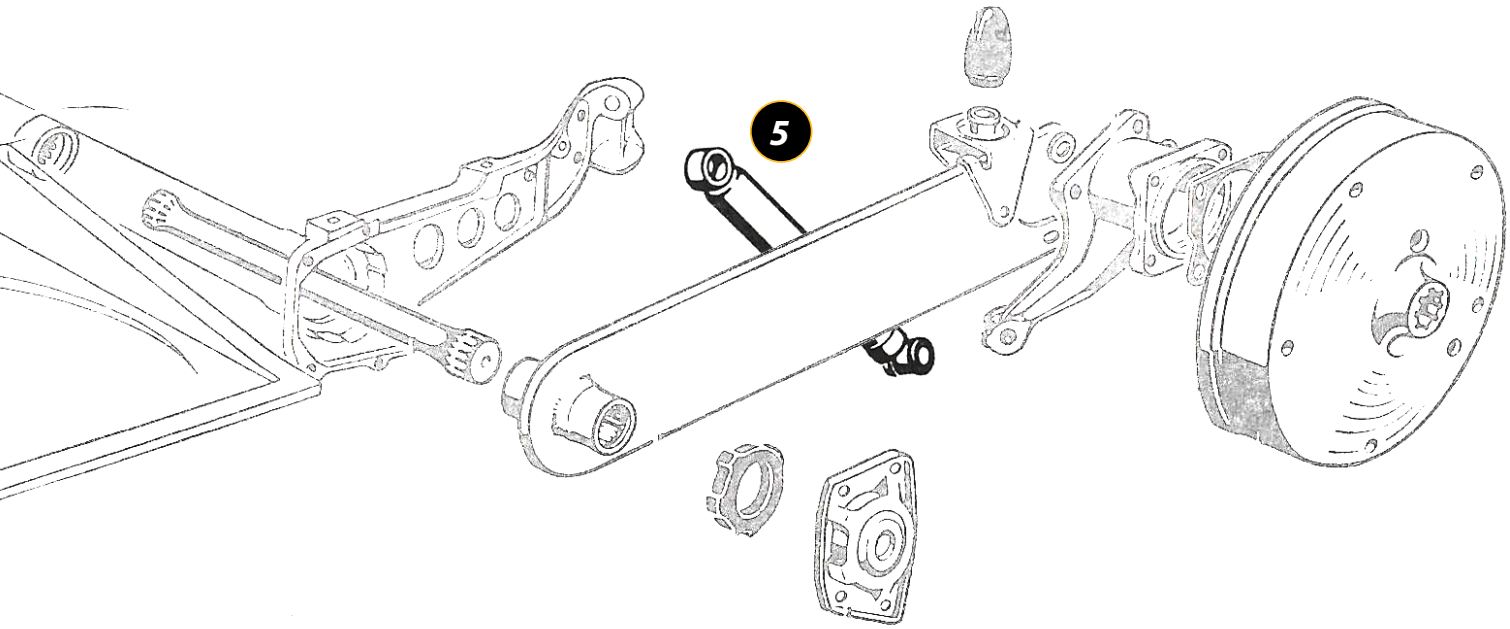
The suspension

1. **chassis**
2. **torsion bar left**
3. **spring plate**
4. **brake drum**

The rear suspension has always remained the same over the years of production, with spring plates and torsion bars (drawing below is of a swing axle, but the principle remains the same for IRS), see also edition 08. The suspension makes the wheels spring against the chassis (1), to absorb the irregularities of the road. Two torsion bars (2) are used, one on each side of the car. The torsion bars are connected to the rear axle by means of spring plates (3).

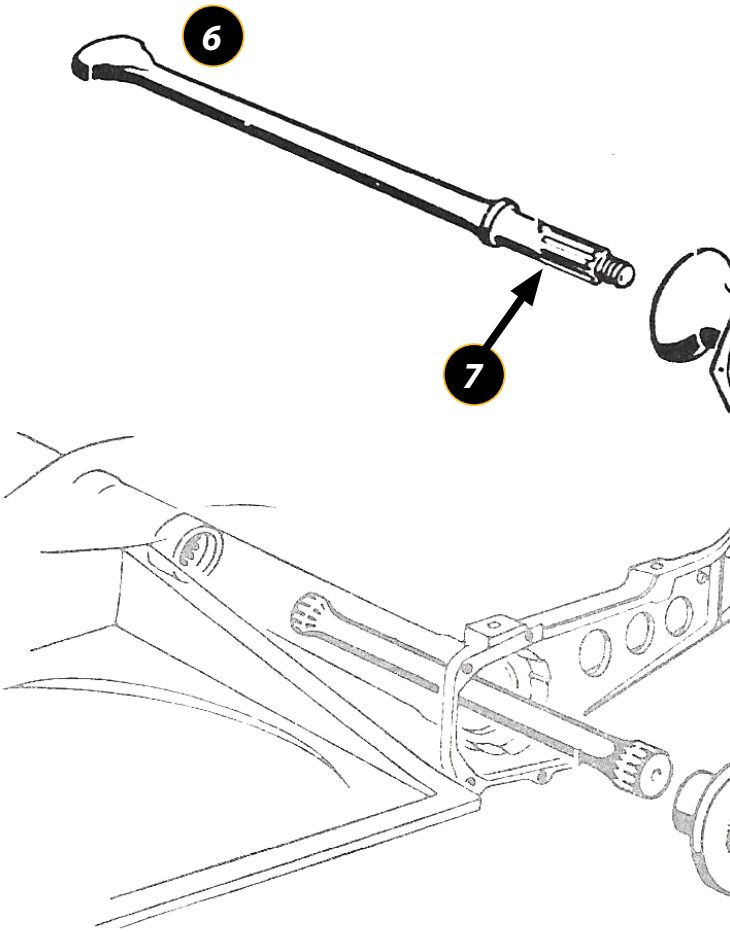


#69 Rear axle



Shock absorber

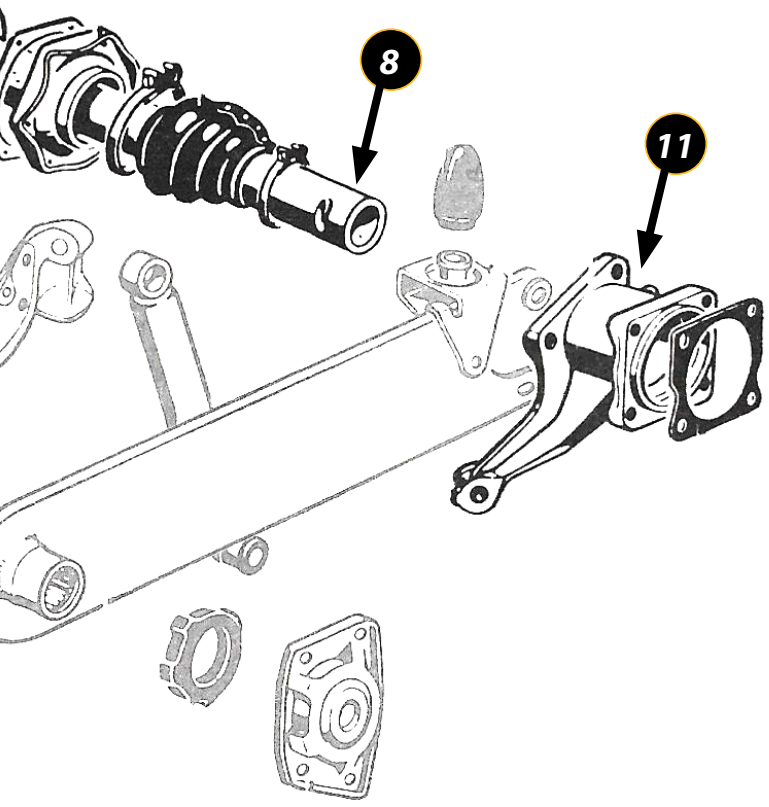
The torsion bars will make the rear axle go up and down, separate from the chassis. Raising and lowering the chassis would not be comfortable if the movement would not be controlled, this is done by means of the shock absorbers (5) that connect the chassis to the wheels. Without the shock absorbers, the rear axle can go up and down uncontrolled with disastrous consequences. A good adapted shock absorber for the application (sporty, comfort, ...) is important.



Drive shafts - swing axle

It is only when we get to the drive shaft that the big differences between swing axles and IRS are noticeable. Below we show the oldest type of drive shaft, the swing axle. The drive shaft (6) on the left of the drawing, engages in the gearbox which in turn is driven by the engine. On the other side of the drive shaft there is a stub axle (7) on which the brake drum grips.

Characteristic of the swing axle is that the drive shaft consists of one part (including stub axle). The drive shaft is not visible with this type of drive, it is protected by a hollow tube (8) filled with gearbox oil. It is this oil that will lubricate the rear wheel bearings (9). A bearing cover (10) ensures that the gearbox oil does not flow into the brake drum.



5 **shock absorber**

6 **drive shaft - swing axle**

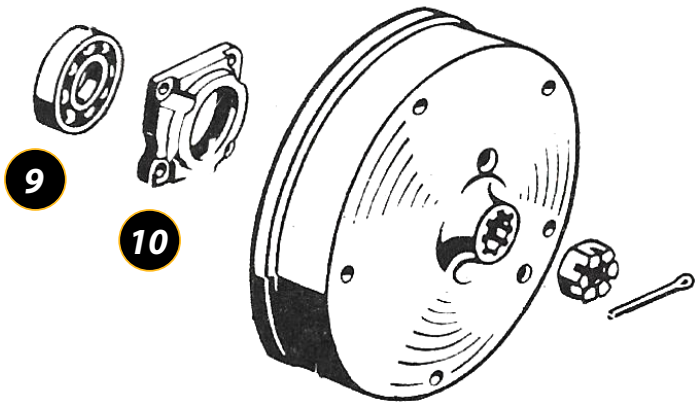
7 **stub axle of the drive shaft**

8 **axle pipe/hollow tube**

9 **rear wheel bearing**

10 **bearing cover**

11 **bearing flange**

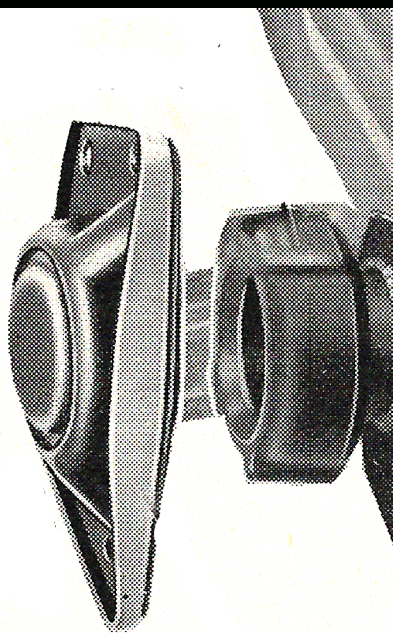


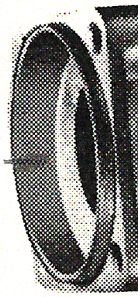
#69 Rear axle

This drawing shows how the hollow tube or axle tube (11) in which the drive shaft slides is attached to the spring plate (3), which in turn is attached to the torsion bar (2). It is the torsion bar that allows the rear axle to move up and down.

With this type of rear axle, the spring plate consists of one piece and is attached to the bearing flange (11). The spring plate can be moved relative to the bearing flange to adjust the camber angle of the rear wheels. We will discuss wheel geometry in the next issues of this technical series.

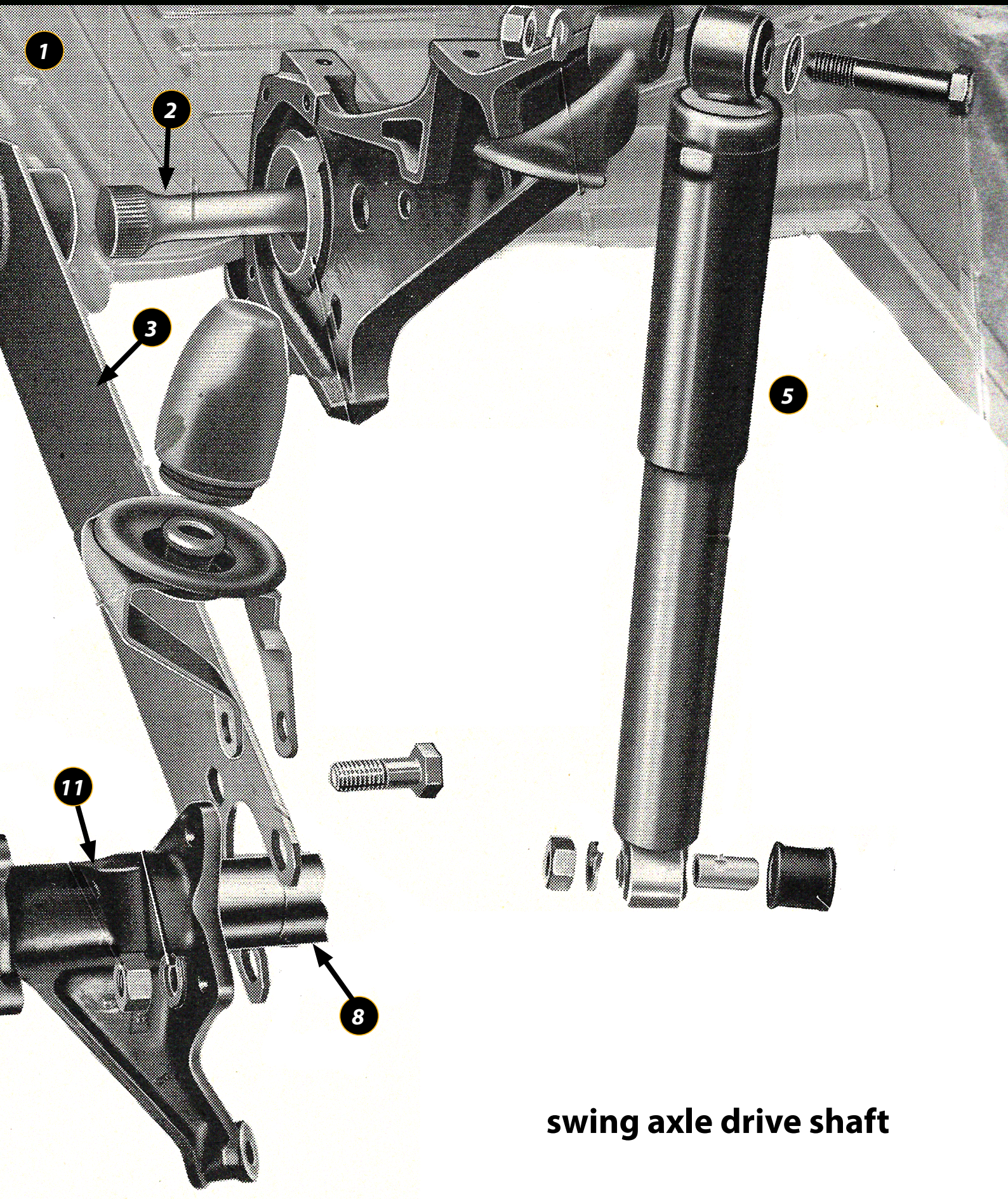
In the following pages we will show a detail of the bearing flange and how the drive shaft is supported in this bearing flange. In a future issue, we will show how the rear wheel bearing is replaced.





- **1** chassis
- **2** torsion bar left
- **3** spring plate
- **5** shock absorber
- **8** axle pipe
- **11** bearing flange

swing axle and IRS

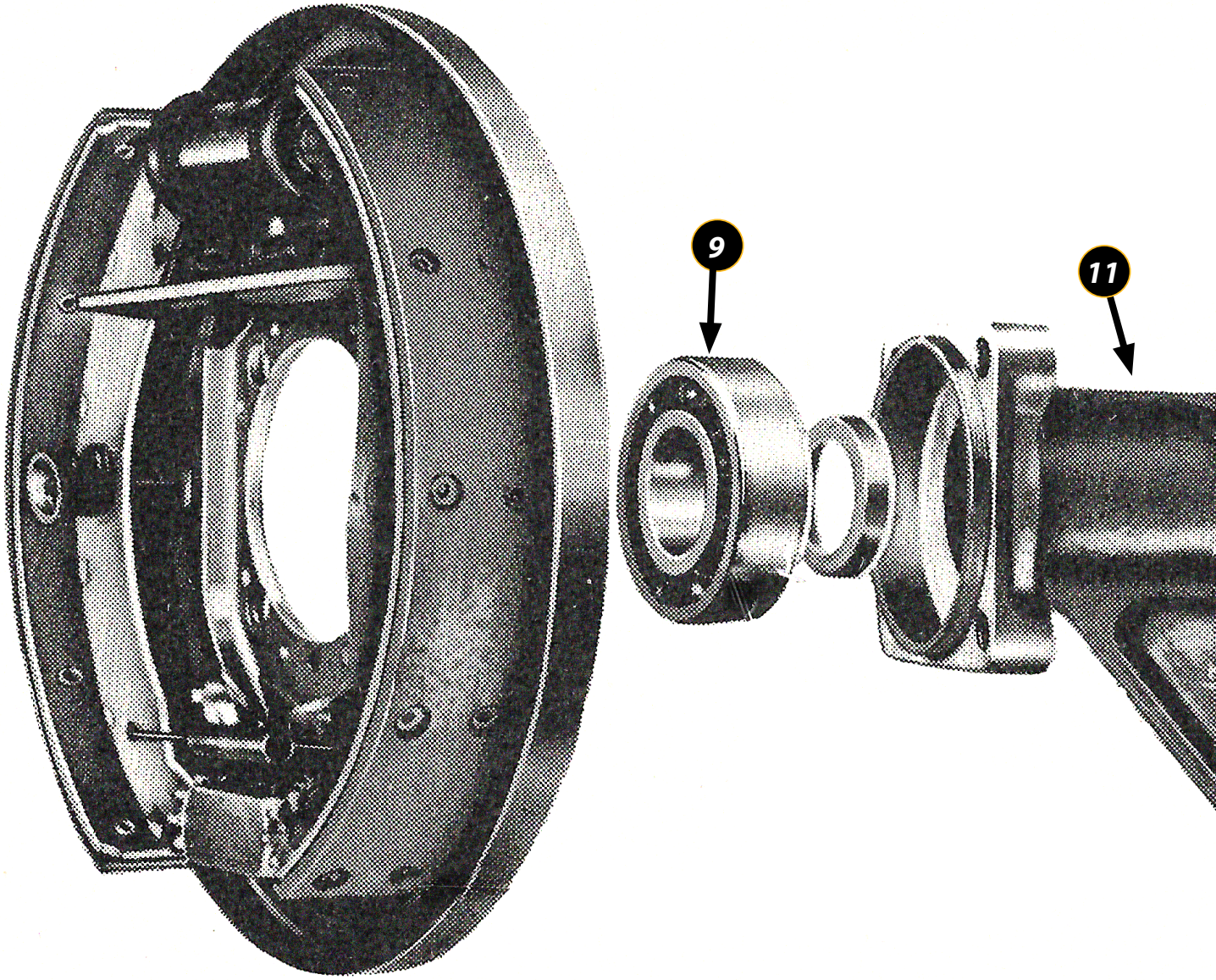


swing axle drive shaft

#69 Rear axle

As shown in the drawing below and on the previous pages, the drive shaft (6) is in the shaft pipe (8) and slides through the bearing flange (11).

The drive shaft rotates in the bearing flange and must therefore be supported. This is done in the swing axle version with one roller bearing (9) which is pressed into the bearing flange.



swing axle and IRS

This roller bearing will not wear out so fast, it turns in a bath of gearbox oil. The oil flows from the gearbox through the axle pipe to the roller bearing. The axle pipe tilts downwards on the side of the wheel, if the height of the car at the back is factory original.

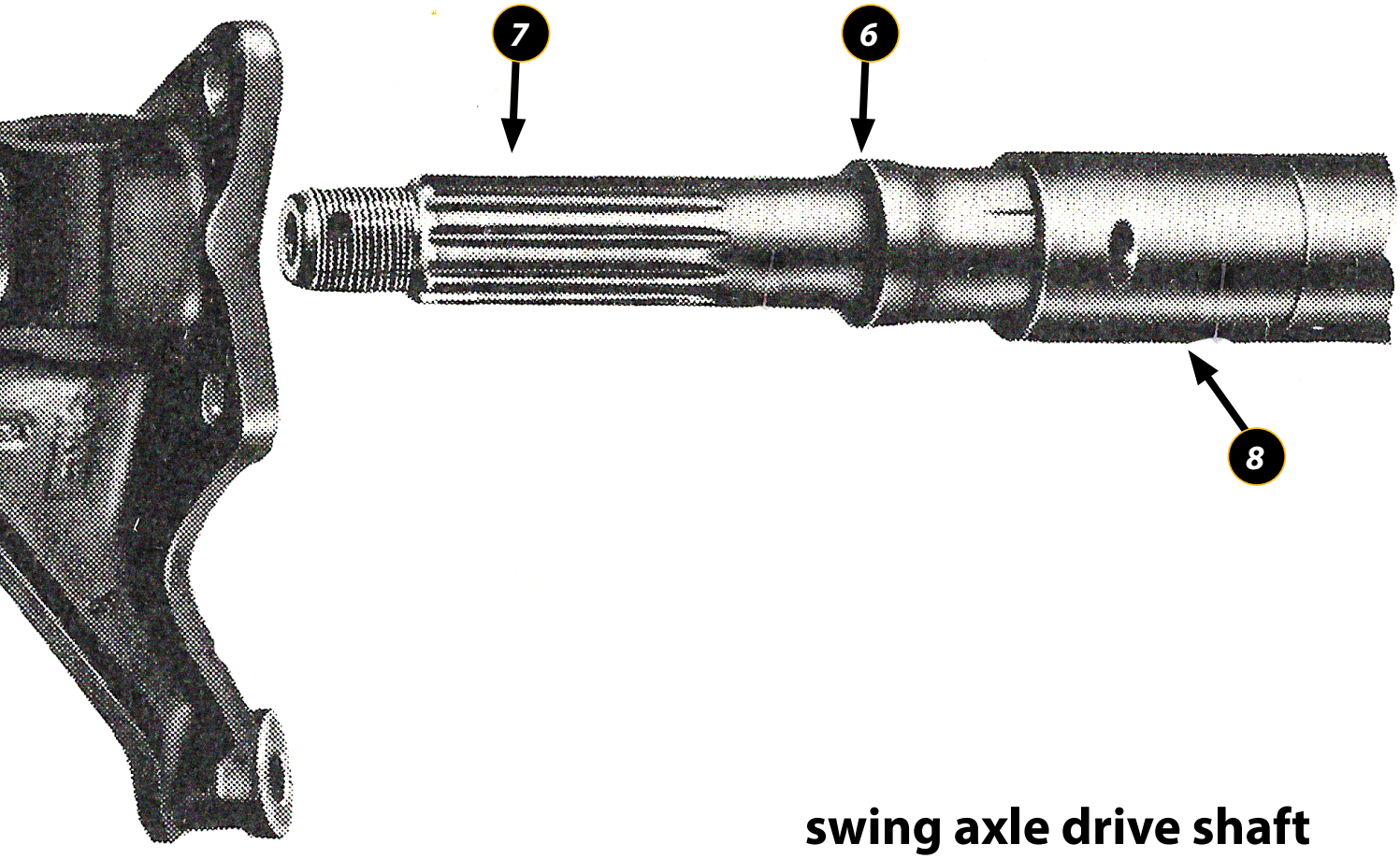
If this is not the case, the "open" roller bearing must be replaced by a "closed" roller bearing provided with bearing grease.

6 drive shaft **7** stub axle

8 shaft pipe

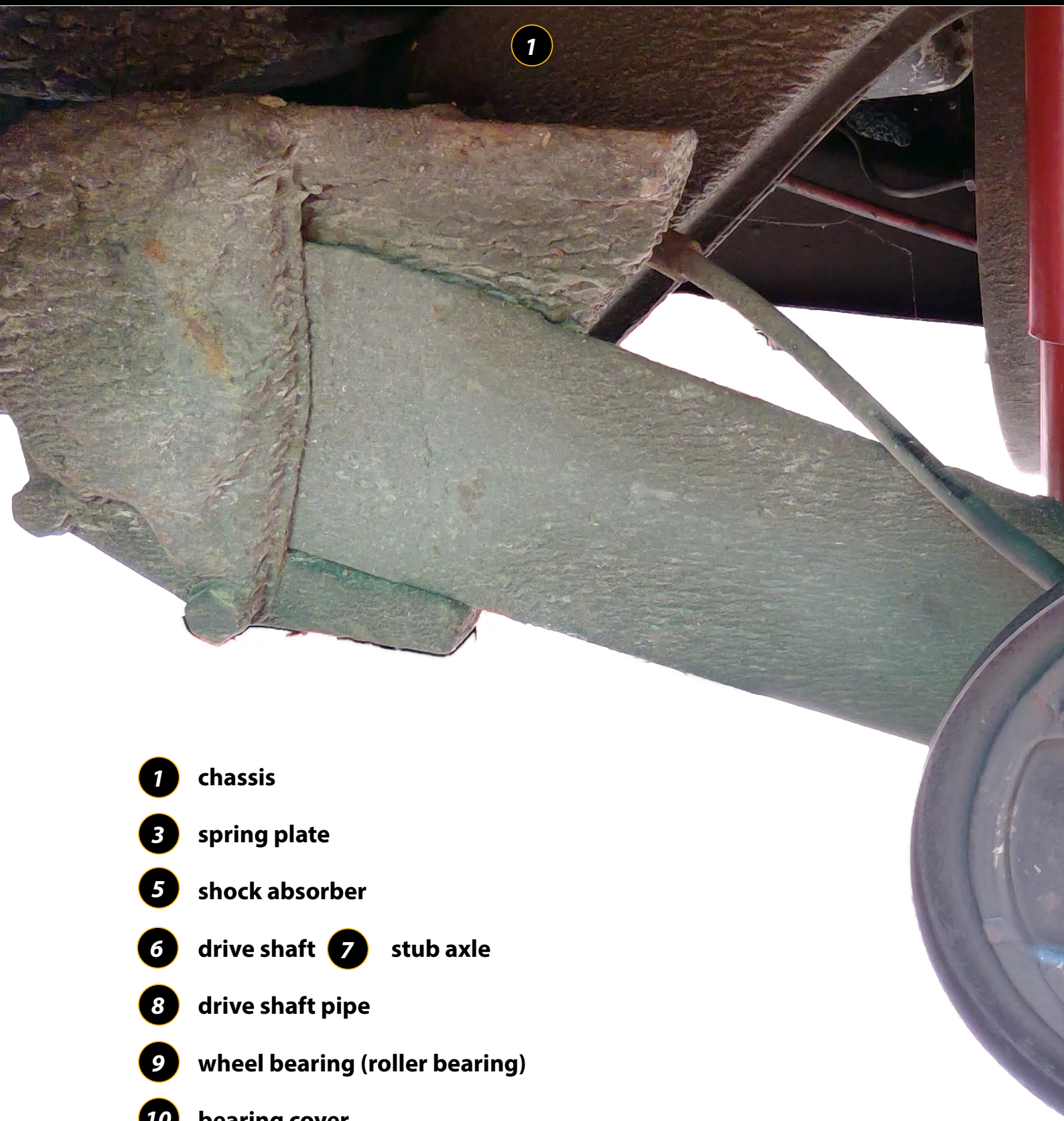
9 wheel bearing (roller bearing)

11 bearing flange



swing axle drive shaft

#69 Rear axle



1 chassis

3 spring plate

5 shock absorber

6 drive shaft 7 stub axle

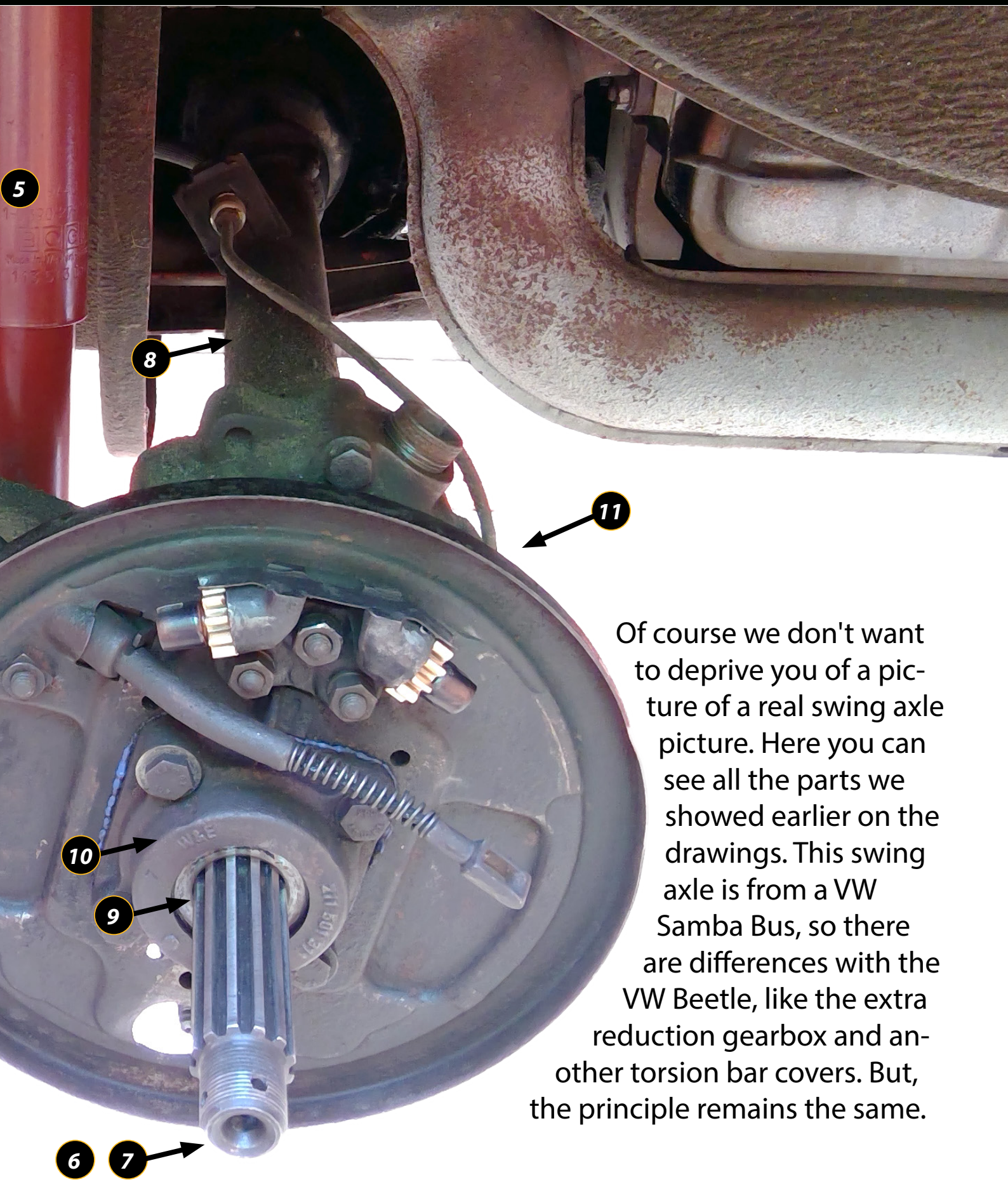
8 drive shaft pipe

9 wheel bearing (roller bearing)

10 bearing cover

11 bearing flange

swing axle and IRS



Of course we don't want to deprive you of a picture of a real swing axle picture. Here you can see all the parts we showed earlier on the drawings. This swing axle is from a VW Samba Bus, so there are differences with the VW Beetle, like the extra reduction gearbox and another torsion bar covers. But, the principle remains the same.

#69 Rear axle

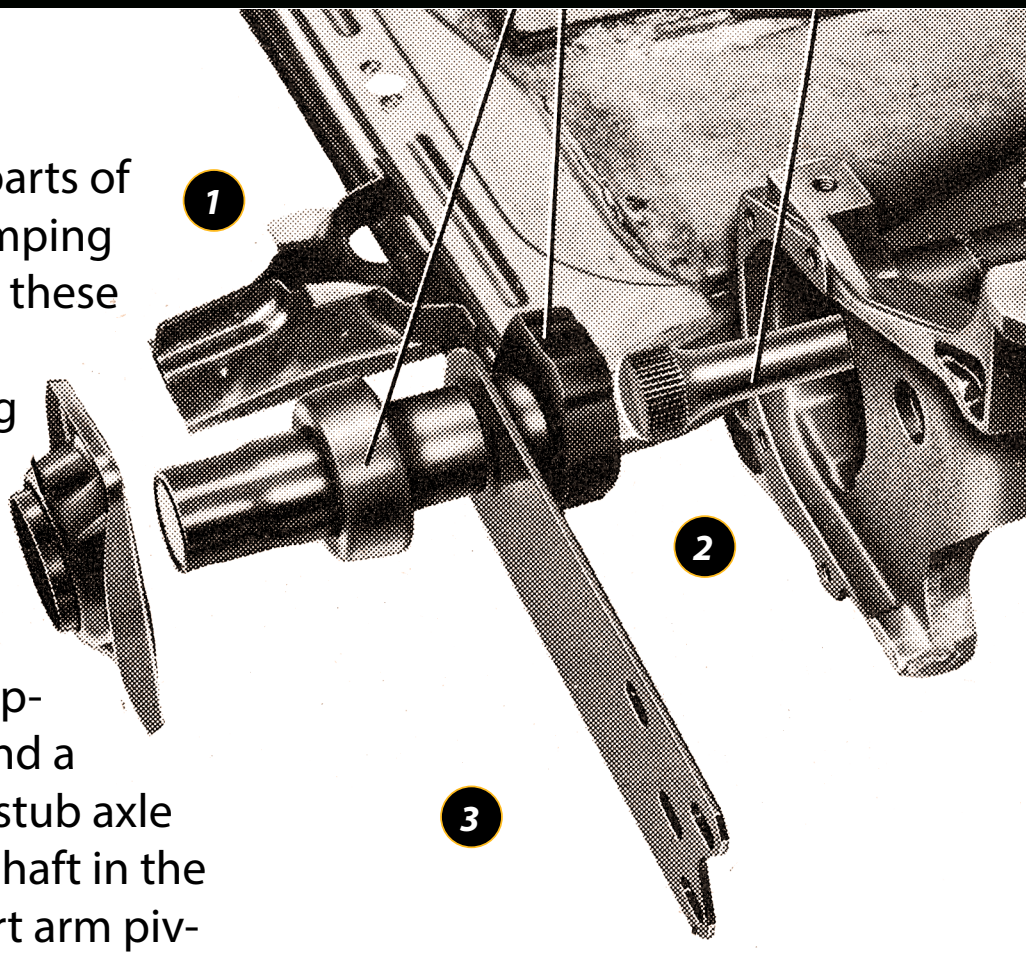
Drive shaft - IRS

The already discussed parts of the suspension and damping can be seen here again, these parts are almost identical to those of the swing axle version.

What is new is the separate support arm (17) (reaction arm) which supports the brake drum and a separate stub axle (the stub axle is not part of the drive shaft in the IRS version). The support arm pivots to the chassis by means of a bolt (14).

Here the spring plate is attached to the support arm with bolts, it is with these bolts that the camber angle can be controlled.

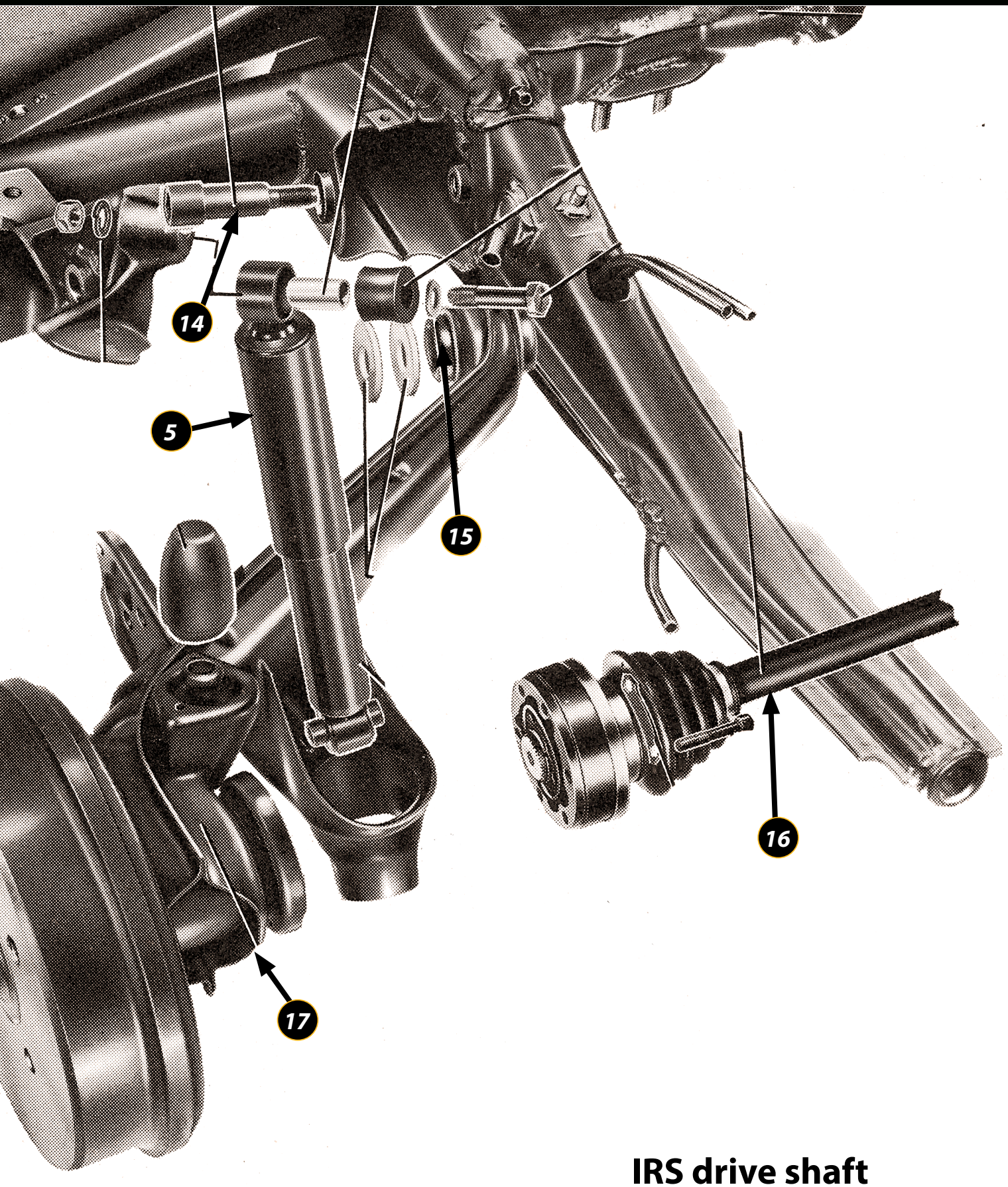
The IRS drive shaft (16) (also called propeller shaft) is visibly arranged, without an axle pipe, and is connected to the separate axle journal by means of bolts.



1. chassis
2. torsion bar left
3. spring plate
4. brake drum
5. shock absorber

14. support arm bolt (stud)
15. support arm silentblock
16. IRS drive shaft
17. reaction arm (support arm)

swing axle and IRS

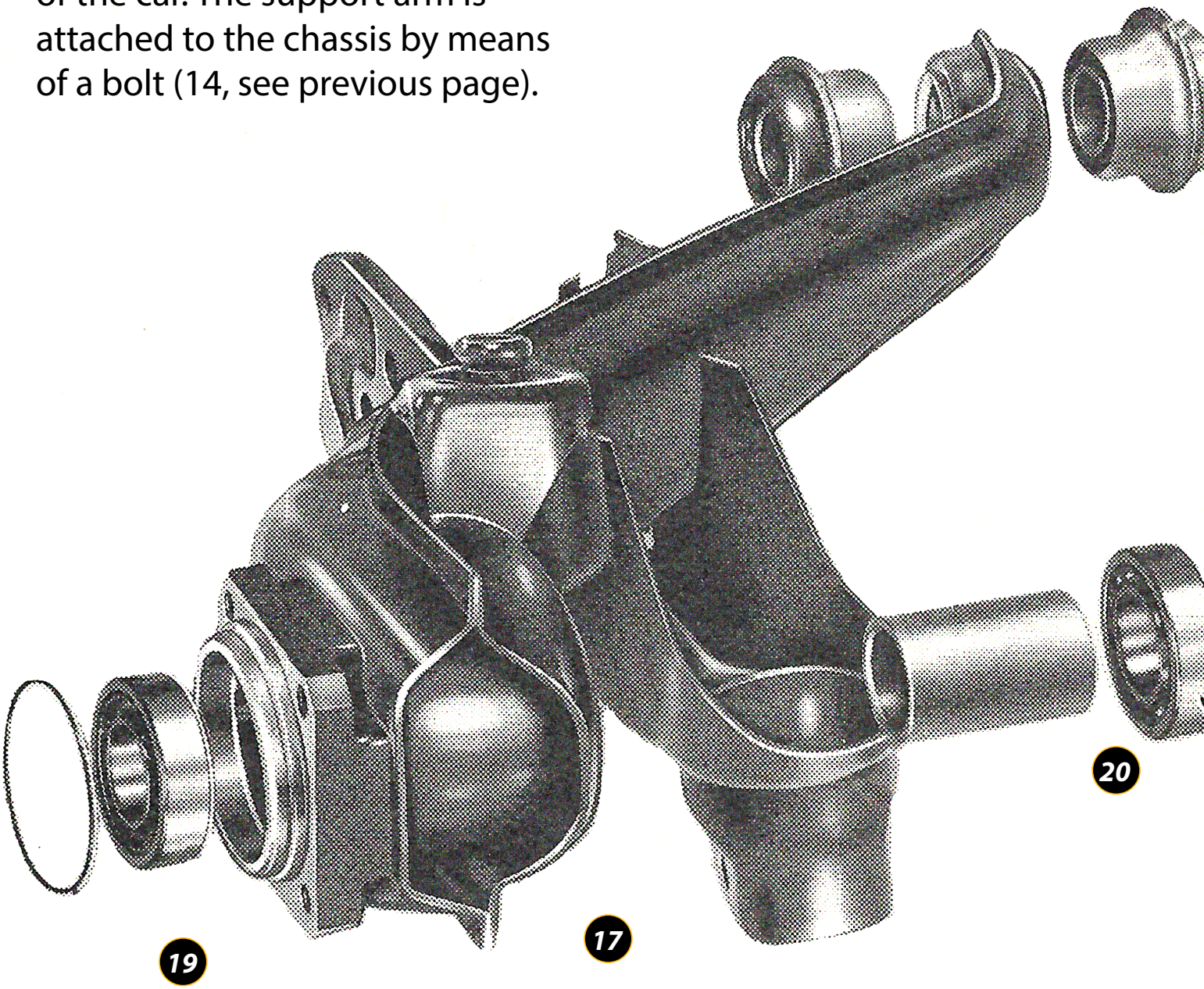


IRS drive shaft

#69 Rear axle

This detailed drawing of the support arm (17) of the IRS version clearly shows the difference with the swing axle. A separate support arm or reaction arm provides more comfort at the rear of the car. The support arm is attached to the chassis by means of a bolt (14, see previous page).

The IRS drive shaft is attached to a stub axle (18), which is pushed through the bearing flange (17), over which the brake drum slides.



In the bearing flange, the stub axle is supported by two bearings, an outer and inner bearing, a roller bearing and a ball bearing respectively. The grease is retained in the bearing flange by grease seals.

In a next edition we will return in detail to the construction of the IRS suspension, and we will show how to replace the wheel bearings.

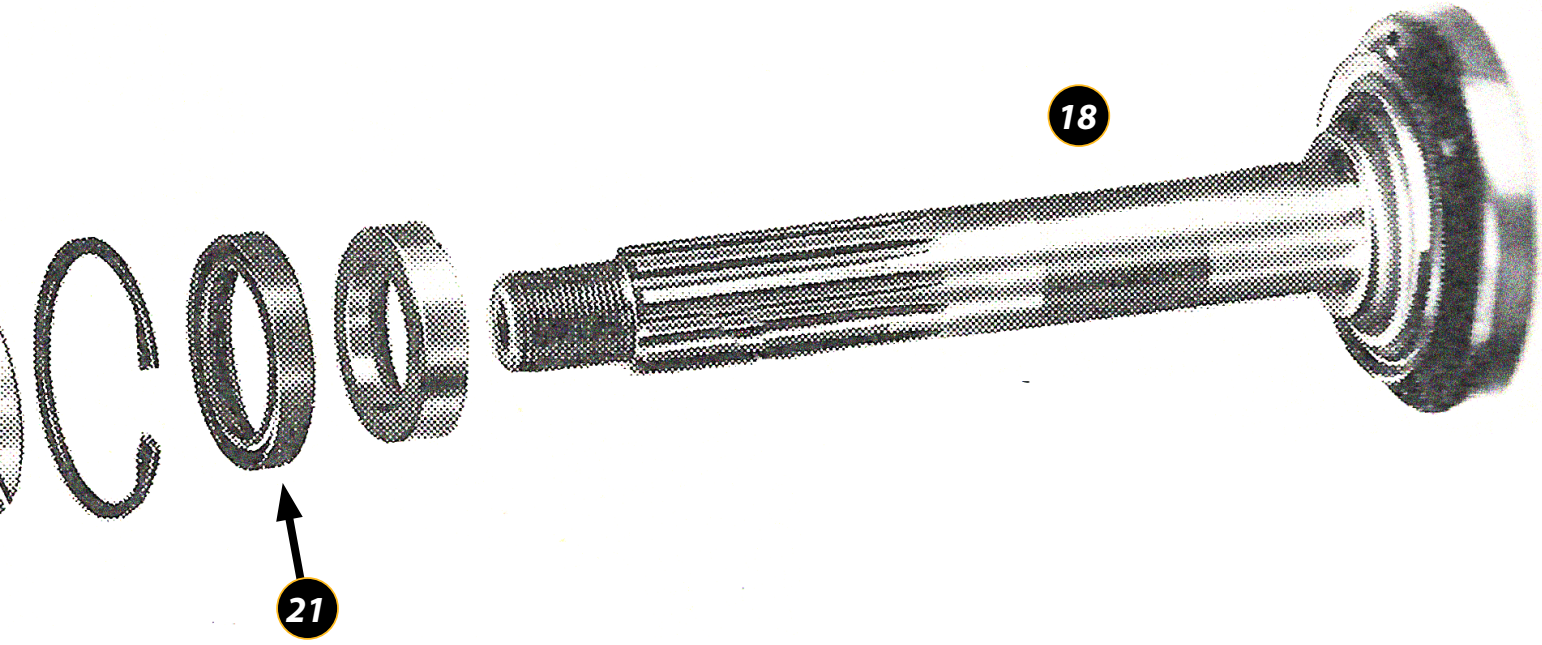
17 **reaction arm (support arm)**

18 **stub axle**

19 **outer wheel bearing (roller bearing)**

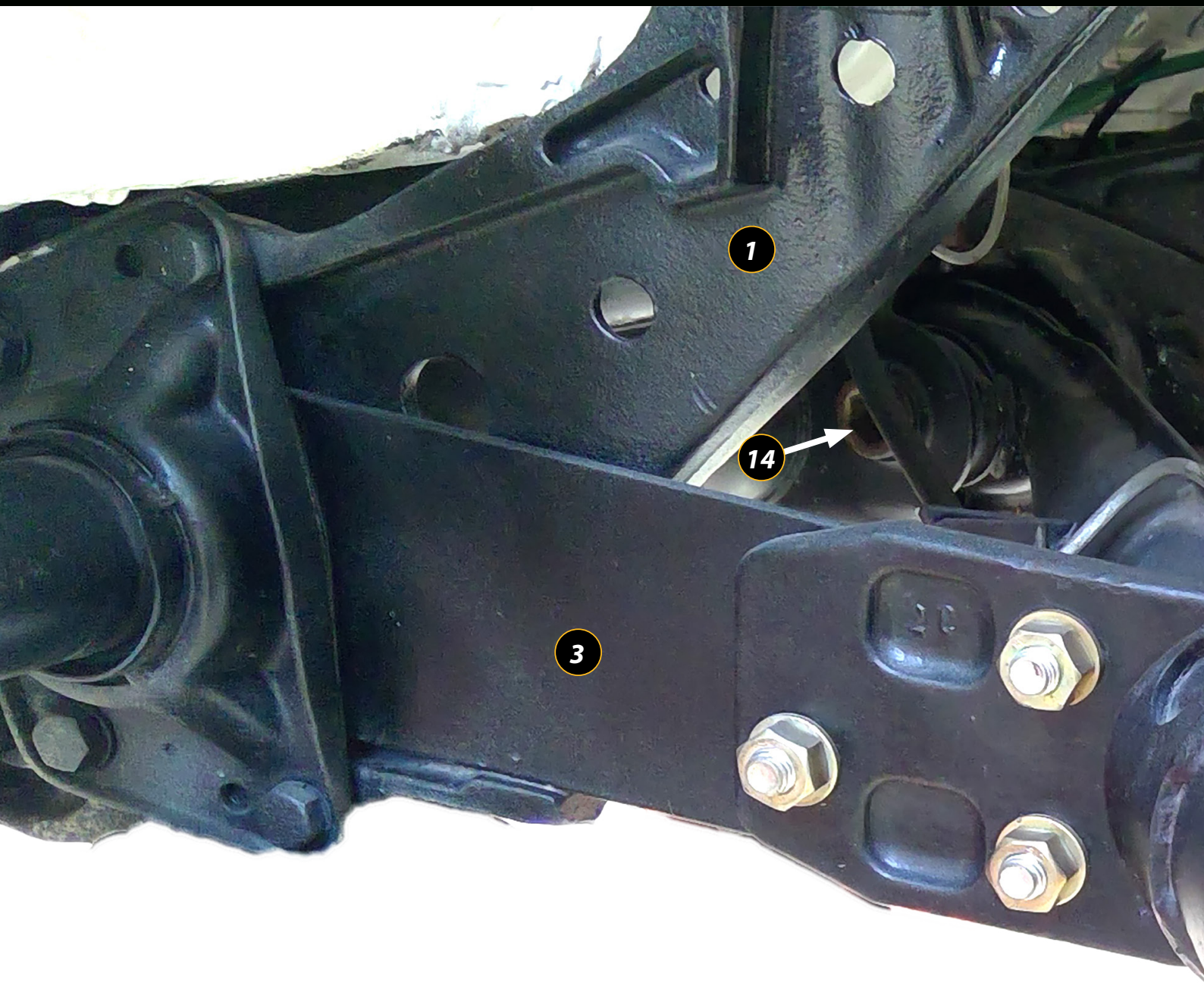
20 **inner wheel bearing (ball bearing)**

21 **grease ring**



IRS drive shaft

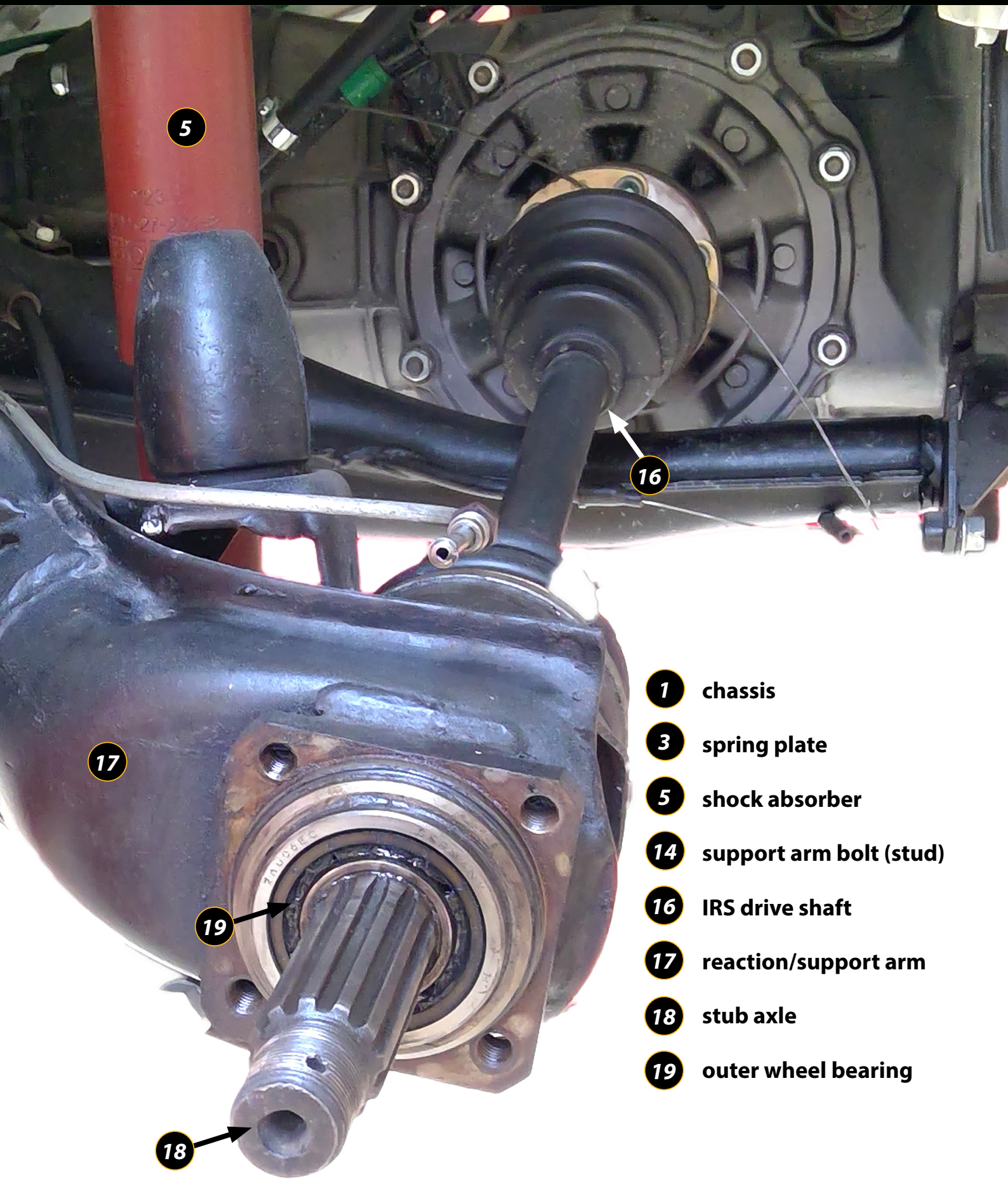
#69 Rear axle



This picture shows the IRS drive of a VW 1303. All the parts we showed earlier in the drawing are now shown in practice.

In the next editions we will disassemble and overhaul both the swing axle and the IRS in detail.

swing axle and IRS



1 chassis

3 spring plate

5 shock absorber

14 support arm bolt (stud)

16 IRS drive shaft

17 reaction/support arm

18 stub axle

19 outer wheel bearing

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