

The Rear Axle

1): Removing a Brake Drum 2): Removing a Spoked Wheel

by SK Staff

It's weird. Or maybe just strange and coincidental? Within two days I received two inquiries on the removal of rear brake drums. So, here we go again.

Most, although not all rear brake drums - at least on cars from the mid-1920s up through today, have the rear brake drum tightly fitted to a tapered axle. For almost 100 years it has proven to be a pretty successful application. The rear axle shafts extend to both sides of the car or truck from the differential. Attachment within the differential does differ. Often the axles are splined at the inner ends and fit within a mating spline in the differential's side gears. Another application uses clips to hold the axle in place within the differential. Everything that we write, though, must be tempered with the admonition that nothing is set in stone. There are always variations.

Future issues will address the adjustment of brakes. But before the brakes can be adjusted, they must be in good condition. Whether mechanical rear brakes or hydraulic, the drum has to be removed in order to check the brakes and make necessary repairs. The first few steps, and the ones necessary to get the brake drum off the axle, are essentially the same.

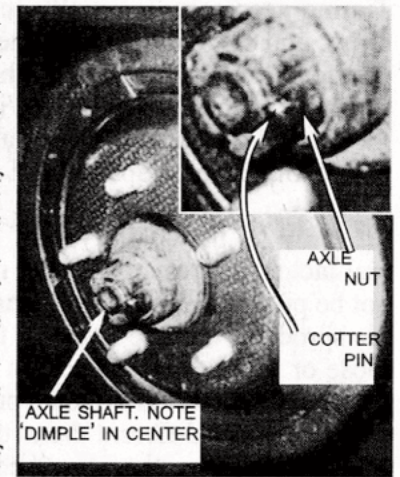
First, remove the tire and wheel. Block the front wheels, remove the hubcaps, and with a four-way tire wrench, a tire iron or breaker bar and socket, loosen the lug bolts or nuts. Do not remove them yet, but with the car on the ground, it is easier to break the nuts/bolts free. Jack up the rear of the vehicle enough so that the tires clear the ground and remove the lug nuts/bolts. Be sure to keep the right side and the left side fasteners separate. Some cars used right-hand threads on one side and left-hand threads on the other. Remove the tire/wheel and set it aside.

You will now be looking at the brake drum which is securely fastened to the axle. In the very center of the drum, the axle may have a dust/grease cover which has to be removed. Upon removal of the dust/grease cover, the threaded end of the axle, fastened by a large nut and further secured by a cotter pin, will be visible.

With a pair of pliers, straighten the bent legs of the cotter pin and remove it. Set it aside. Using a very large wrench, open-end, crescent, socket, or monkey (1), you will have to loosen that large nut. Have a friend step on the brakes to prevent the wheel from rotating while you use muscle to loosen the axle nut. Once loose, he can release the pressure on the brakes. Make sure that the hand brake is also released.

With the nut off, carefully examine the axle where it comes through the brake drum. There will be a square 'key' fitted into a groove in the axle as well as a matching groove in the drum. The key prevents the drum from rotating on the axle.

Now comes the exciting part: removing the drum. Chances are it is pressed so tightly onto the tapered axle that it is going to require special tools to get it off. A heavy-duty wheel puller is the best, and the correct, tool for this job. If you are going to be doing a lot of automotive work, it might pay to buy a set (get a good, made-in-USA set - expensive, but well worth the few extra dollars). Perhaps you can borrow a set from a friend or even



With the tire/wheel removed, the brake drum is exposed. The tapered axle with the axle nut and a cotter pin are in the center.

Three legs are good, but five or six are better and safer.

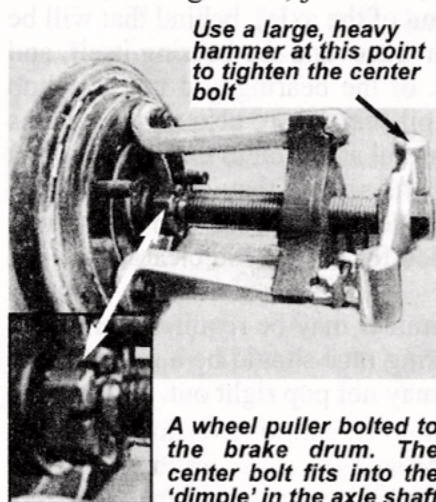


rent one from a large tool rental store. Most wheel pullers have three legs. I purchased two wheel pullers so that I could have extra legs - five for a five-lug wheel, six for a six or more lug wheel. The extra legs offer much better pressure distribution that do just three legs.



A puller with five-legs exerts a much more even pulling pressure to remove the drum than does a three-leg puller.

Before proceeding, loosely replace the axle nut - do not tighten it; just fit it onto the axle with

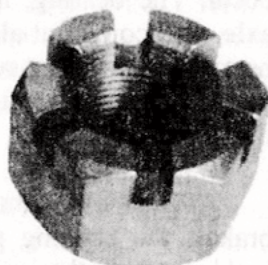


Use a large, heavy hammer at this point to tighten the center bolt

A wheel puller bolted to the brake drum. The center bolt fits into the 'dimple' in the axle shaft end. Note that the axle nut is loosely attached to the axle shaft, loose enough to allow the drum to break free but not fly off and cause injury.

more sensitive area.

Attach the wheel puller using the car's lug nuts or bolts. If you have a three-leg puller and a five bolt pattern, two holes will not have a leg attached. Do not attach all of the legs to adjacent holes or lugs. Attach a leg, skip a hole, attach a leg, attach the third leg and skip the fourth hole. With a five leg puller, attach a leg to each hole/stud.



A castellated nut has notches into which a cotter pin fits to prevent loosening. It is so called because the notches resemble the arrow-ports atop a castle.

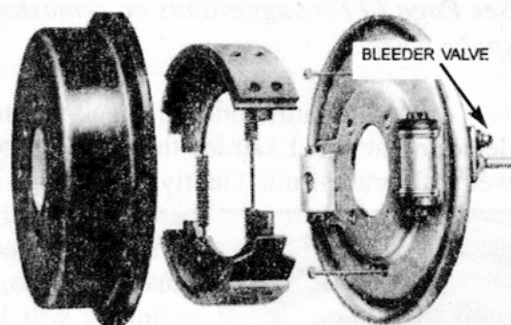
The center bolt of the puller must fit directly into

three or four threads catching. When the brake drum eventually pops loose, it will sound like a gunshot and have the kick of a cannon. The axle nut will prevent the drum from flying off, crushing your chest or smacking you in an even

the dimple in the center of the axle. As you apply pressure to the center bolt, the puller exerts a tremendous force on the brake drum through the legs. Sometimes, if the drum isn't too tight, that large crescent or monkey wrench might be adequate to turn the center bolt. Tighten the center bolt just a little and then relax. Continue until the brake drum releases with a loud 'POP.' A heavy-duty impact wrench with the correct size socket might work, but if all else fails, most wheel pullers come with an 'anvil.' This fits over the hex head of the center bolt. The anvil has flats on it. Using a very large and heavy hammer, strike the anvil on the side to exert a clockwise pressure on the center bolt. It might take a lot of hammering to break a really tight drum free. The more legs on the puller, the better the pressure distribution and the better your chance of getting the drum off.

If the drum does not come off, the two most likely reasons are that the drum is tightly pressed onto, and possibly even rusted onto, the tapered axle, or that the brakes are exerting pressure against the drum. In a hydraulic brake system, loosen a brake line or open the bleeder screw behind the wheel. If a problem in the brake system, possibly in the mas-

ter cylinder, does not allow the fluid to return, the pressure against the drum will be constant. Opening the



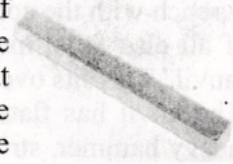
BRAKE DRUM BRAKE SHOES BACKING PLATE
If the drum seems to be stuck, make sure that the brakes are released. Bleed brake fluid pressure or adjust the shoes.

bleeder valve or loosening a line should relieve the pressure. It is also possible, on both mechanical and hydraulic brakes, that the brake shoes have been over-tightened and are pressing against the drum. Try loosening the pressure of the shoes. This procedure depends on the type of brake system that you have on the car.

With the brake pressure released, the wheel puller should work. If you suspect rust, squirt copi-

ous amounts of a penetrating oil, between the axle and drum, let it work for a day or two, repeat the penetrating oil and then try the puller again. You really shouldn't have that much difficulty removing the rear brake drums.

Once the brake drum 'pops' free, you may remove the puller and lug nuts/bolts, remove the axle nut and slide the drum off the axle. Be sure that you locate the key - a length of steel about 1/4" square. It may still be in the groove in the axle or in the groove in the drum. Set it aside.



With the drums off, you can examine the condition of the brake shoes, springs, hydraulics, and the drum itself. Clean the drum of all oil and grease, and examine the inside for grooves. If the brake shoes had worn down so much that the rivets were exposed, they may have cut grooves into the drum. If the grooves aren't too deep, they may be able to be turned down by a brake shop. The shop will measure the drums to see if adequate metal will remain after turning. If not, you will have to find replacement drums.

See Page 39 for suggestions on removing wooden-spoke wheels.

On hydraulic brakes, check the brake cylinders for leakage. Examine the cylinder to see if it is wet with brake fluid. Gently lift an edge of the rubber cup at either end of the cylinder to see if fluid runs out. If so, the brake cylinders will have to be replaced or rebuilt. If the inside of the brake cylinder is scored or glazed, it may have to be honed or relined. These are jobs best left to a professional shop. If the cylinder is in good condition and just requires a rebuild kit, it can probably be a DIY job, but if any machining - relining or honing - is required, your brakes are nothing to experiment with. Leave it to a pro.



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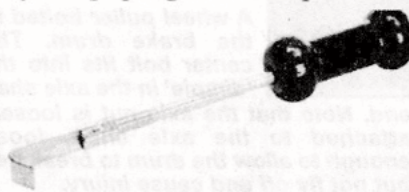
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Rear Wheel Seals and Bearings

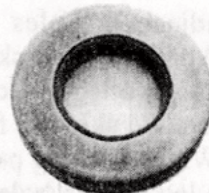
The rear wheel bearings are generally lubricated by a grease fitting on the axle close to each wheel. But the differential - the rear end gears - are lubricated by a heavy liquid grease/oil which is filled through a plug in the differential itself. That rear end lubricant can flow through the axle housings, but must be kept from spilling out into the hub and brake assembly. There are probably as many variations to the rear wheel seal assemblies as there are cars/trucks, but essentially they are all similar.

There will be an outer seal covering the bearing (some larger cars have two bearings, back to back on each end of the axle), behind that will be the bearing cup or 'race' and the bearing itself, and between the back of the bearing and the axle hub will be the inner oil seal. There also may be shims or spacers. Pay careful attention to exactly how you disassemble the parts so that they can be reassembled in the same order and that the correct number of shims is installed for proper end clearance.

A slide hammer may be required to remove the axle. The bearing race should be a snug fit into the housing, and may not pop right out. Replace the axle nut on the end of the axle, and with the slide hammer, grasp it and give it a solid pull. The axle, race and bearing should come right out. **IMPORTANT:** If the axle is clipped into the differential, the clip must be removed first or serious damage could occur. The bearing, having been pressed onto the axle, will come out along with the race. Behind the bearing, sometimes remaining in the axle housing and sometimes coming out with the bearing/axle, is the rear oil seal.



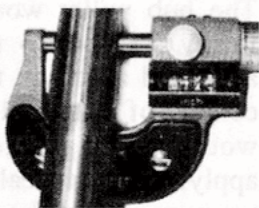
If, upon examining the brakes, the backing plate, the brake shoes or the inside of the brake drum, there is oil, that indicates that the rear inner seal is leaking and must be replaced. Sometimes the oil seal is felt, other times leather



The rear wheel seal may differ from vehicle to vehicle, but the purpose is to keep oil out of the brakes.

and possibly even cork. The seal has to be a precision fit over the axle; don't try to make your own. Chances are it will leak. Soak felt seals in oil before installing to prevent burning.

Take precise measurements of the outside diameter of the axle at the point that the oil seal fits (behind the bearing). Take those measurements along with the old seal to a large bearing supply house; they may be able to offer a replacement. Marque-specialty suppliers, possibly NAPA or similar after-market auto shops or your club parts store may have the correct seals.

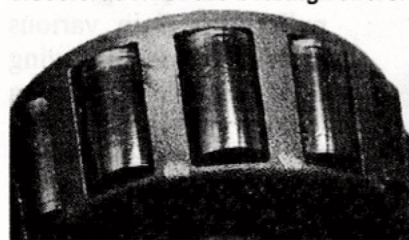


Before re-assembly, all of the components must be thoroughly cleaned. This is doubly important, if there was oil on the brake shoes. Wipe up any

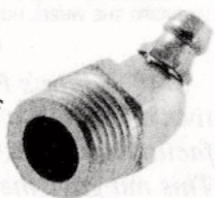


Above: a damaged bearing cage.

Below: Very evident scoring and discoloration of the bearing rollers.



wet oil, and then use a stiff brush (a bristle nail brush works well) and paint thinner (mineral spirits or turpentine) and dry thoroughly. Do not use gasoline, acetone or lacquer thinner. If the brake shoes are glazed or worn thin, replace them. Clean the bearing (paint thinner will do a good job, but make sure that none remains inside of the bearing rollers). Examine the bearing very carefully for scratches, any type of damage, heat discoloration, a broken cage or any other problem that could show up later. If in doubt, replace the bearing (it will have to be removed with a press, and the replacement pressed on). Even if the bearing looks good, examine the race for scratches or discoloration. If in doubt, replace it. And if you replace the bearing, use a new race. Do not interchange the left bearing with the right. Keep



Grease often gets hard within the Zerk fitting. It has to be cleaned out for future lubrication.

them separate. Make sure the bearing is packed with grease - if it is a new bearing, pack it before installation on the axle; if you are re-using the bearing, press fresh grease in the large end until it oozes out from between the rollers on the bearing face.

Remove the grease fitting from the axle, and clean it. Replace it, but don't tighten it down too much. It should not extend past the surface of the axle housing.

Install the inner seal, the axle shaft with the bearing on it and make sure that the splines engage with the side gears of the differential. Sometimes wiggling the shaft while using a slight rotation will seat the splines. Install the cap straight over the bearing, and use a brass drift and a brass hammer to tap it in all the way. Tap gently around the circumference, being certain that it seats straight and true.

Replace the shims and outer seal (again, it might pay at this point to replace the outer seal, too).

The rest of the installation is just the reverse of the disassembly. Once the backing plate is installed, brake shoes, springs, etc. can be re-installed.

Install the brake drum, the axle key, the washer and the nut. Preload the axle nut (this will seat the drum), relax the nut and then retighten until the cotter pin holes align with a castellation in the nut.

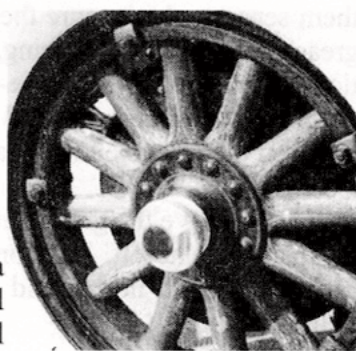
Replace the dust/grease cover, the tire and wheel, and torque the lugnuts/bolts. After both rear wheels are done, adjust the brakes. Be sure to tighten the brake line, if you loosened it earlier to relieve pressure. If the brakes are hydraulic, have a friend step on the pedal while you bleed the air from the brake line. Road test the car, and make any final adjustments.

S.K.

Editor's Note: The rear-wheel configuration differs from vehicle to vehicle. Please check the service manual for your car/truck, or refer to a *Chilton's* or *Motor's* manual for specific instructions. Photographs taken during disassembly will make re-assembly much easier.

REMOVING A SPOKE WHEEL

Removing a wooden-spoke wheel can present special problems. Like the later wheels which we covered above, the axle for a spoke wheel is often tapered. And, like the later wheels, rust is often the 'glue' that firmly attaches the wheel to the axle.



A typical wooden spoke wheel. Note brake drum behind spokes (rear wheels).

Old-timers will have all kinds of suggestions for getting that spoke wheel off the axle. Some work, some are downright dangerous.

The 'hub caps' on a spoke wheel are really just that: caps that cover the hub of the wheel. The hub caps often screw onto, or into the wheel hub and cover the axle nut.

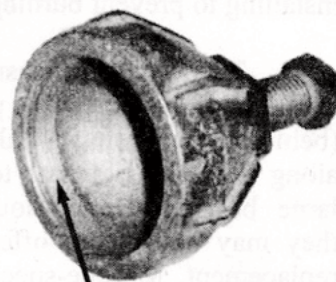
After jacking up the car and removing the hub cap with a special wrench, the threaded axle end will be exposed. A nut, washer and key prevent the wheel from coming loose. In theory, once the axle nut and washer are removed, the entire tire and wheel should come right off the axle. Good luck! It just doesn't work that way.



Because the wheel is relatively fragile, the amount of force has to be carefully applied. But in most cases, that, too, will fail. One of the dangerous methods alluded to earlier is for the axle nut to be replaced very loosely on the axle, and the car driven with a lot of turns and even bumping the curb to break the bond between the wheel and axle.

A much better method is to use a specialized wheel puller. The wheel puller mentioned above, on page 36, will not work. There are no lugs or studs with which to attach the puller. When new, pullers were available to fit most spoke-wheeled cars. The diameter and thread of axles differed

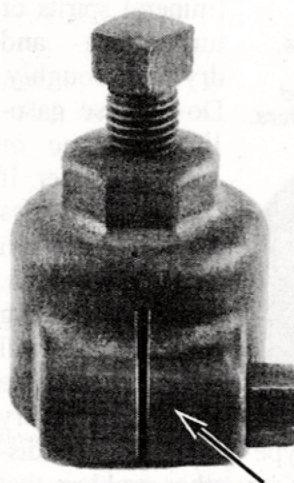
among manufacturers and often among models within a single marque. The original factory wheel puller consisted of a hollow cone with an inside thread to match the hub thread. (Often those threads were tapered, making the problem even more difficult.) The hub puller would firmly screw onto the axle, and a bolt in the center of the puller would be tightened, applying a great deal of pressure against the axle shaft while pulling on the wheel hub.



THREADS MATCH THE THREADS ON THE WHEEL HUB.

Often striking the center bolt, when tight, will set up vibrations to help break the rust and bond. After striking the bolt a couple of times, try tightening the bolt again. Often only a half, or even a quarter of a turn is possible, but keep at it; it's beginning to move.

Another type of spoke-wheel puller is a generic type, designed to fit a number of diameters and threads (although even these 'generic' pullers come in various sizes). Instead of having threads inside the cone, a clamp grabs the wheel hub, and the center nut applies the force. They don't work as well as the specialized threaded puller, and they can damage the wheel threads, but that wheel has to come off.



THE CLAMP ON THIS WHEEL PULLER GRASPS THE WHEEL HUB.

Editor's Personal Note: Not nearly as effective, I located a large nut at a truck maintenance facility which fit the wheel hub on one of my cars. This nut gave me a place to 'grab' with a traditional three-jaw hub puller.

S.K.

(1) What is the difference between a 'Monkey' wrench and a 'Stillson' wrench? See page 40.