

FOURWHEELING ACADEMY

ARB AIR LOCKERS

Text and Photos by Harry Lewellyn

For those who've seen what I call a "choice" type locker (defined below) in action, the typical comment is, "Yeah, now I get it!" In this article, I'll cover differentials from womb to tomb and show a close-up or two on installing an ARB air locker. Throughout, I copiously plagiarize my book, *Shifting Into 4WD*. The da Vinci sidebar provides a little differential history. I do not include electronic traction control in this article.

Many thanks go out to John Lemieux of All Wheel Drive for his help and information. He's been my running gear guru for years.

SUMMARY

Leonardo da Vinci ranks pretty high on my creative, inventive people list. As best we can tell, he was the first to conceptually design and record a "differential."

Installing an air locker is beyond the capability of the average backyard mechanic, so leave it to the experts. The rewards of having one go far beyond even the wildest expectations. They are worth every penny you spend.

Basically, open differentials (what comes in most stock vehicles) are at the root of getting stuck ninety-nine percent of the time. One tire is in the air or on a poor traction surface. It spins. This does not allow the other tire to work to its full capability. With an air (choice) locker, you simply turn it on, which locks both tires together, and you move on. It's as simple as that.

This is in contrast to what I call "no choice" lockers. These are not differential at all. They act like a solid, straight axle when going straight, but as you make a turn, an internal mechanism unlocks, removes power from the outside tire and only delivers power to the inside tire. There is no differential action or torque

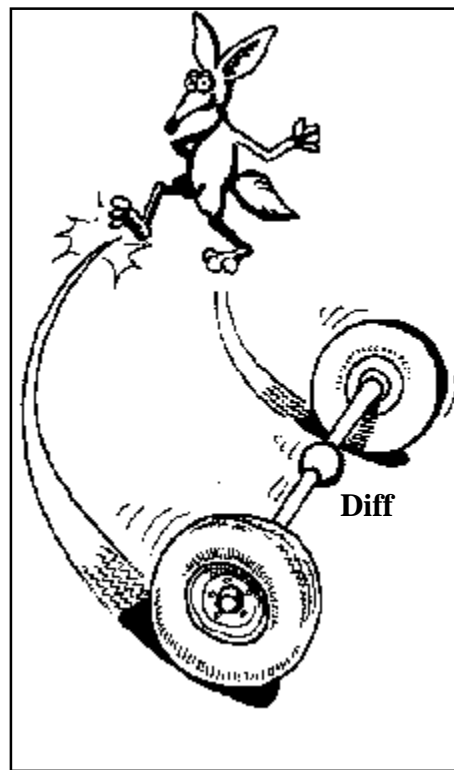


Figure 1 A differential allows you to go around curves without wheel hop.

balancing whatsoever. You have two-wheel drive going straight and one-wheel drive when it unlocks in a curve.

WHY DIFFERENTIALS?

Simply put, the answer to "why differentials" is to make it easier to go around curves. As Figure 1 shows, the inside and outside wheels of any axle travel different distances.

Picture two absolutely identical wheels and tires welded to a solid axle. That's the way the first automobile drive axles were. Racers call this solid axle setup a spool. Remember that for later.

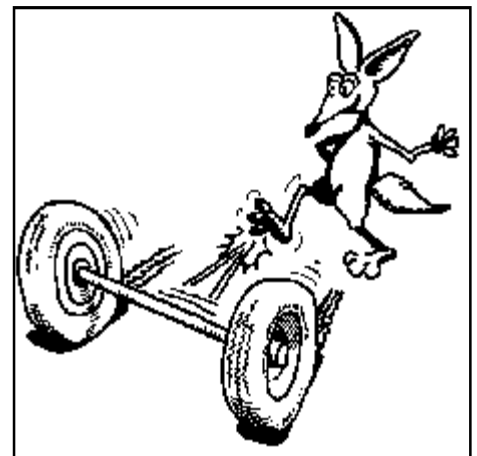


Figure 2 A "spool" always wants to go straight with tires and wheels of equal size. It vigorously resists turns.

Lay this spool gimmick on flat, level ground and give it a push. Can you see it rolling straight, away from you? The two identical tires are turning at exactly the same rate, which means the unit will move in an absolute straight line per Figure 2.

If you tried to make a turn with our automotive spool, something would have to give. You can't have two identical tires

See ARB/p3

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FREE STAUN DEFLATORS

I'll keep it short and sweet. Help us find a new advertiser that places an ad in the 2005 Bonus Issue newsletter and you get a FREE set of Staun automatic tire deflators. Any product or location welcome.

As you know, the annual Bonus Issue contains advertising and it is super effective. Reason: Our mail list is 4WD-user focused. It is comprised of folks who actively use their 4WDs. And since it is also our catalog, it seems to hang around throughout the year. It has what we call, "coffee table longevity." It is mailed to

over 8,000 addresses and sent to many, many events and 4WD trainings as a "bag stuffer." Our rates are very reasonable and we like to think we are easy to work with.

To win your Staunies, simply provide us with your contact or turn the store or 4WD-/travel-related business on to us. We'll take it from there.

PS – There is no limit to the number of deflator sets you can earn.



From the Silver Coyote

By Harry Lewellyn

A couple of things need correcting in the last issue. The free download copy of the newsletter on our Web site is correct, but the hard copies we mailed had the following errors.

The Extreme Outback Products' Web site designation at the end of the ExtremeAire Compressor article is wrong. The correct reference (shown correctly in the first paragraph) is www.extremeoutback.com.

The caption for Figure 3, page 5 is all screwed up. It should read: "A- Rounded case edges means no lost skin or cut hoses. B- Straight-on locking chuck is easier to use. C- 10X air filter means less frequent cleaning. D- Mating cable connectors means no chance of reverse battery connection. E- Deep throat gauge means no air-loss readings. F- Stainless steel hardware means no rust and long life."

OFF ROAD EVENTS

Meet George and Tamara Carousos, the fine people who bring us Extreme Outback Products, at the Sand Sports Super Show, October 17 through 19! They are kindly allowing us to share their booth at this fun-filled Costa Mesa Fairground event! See the bottom of page 8 for details.

We'll both also be tending our own booths at the upcoming Off Road Expo in Pomona on October 9 and 10. Support our industry with your attendance and see some of the latest 4WD products and accessories on the market! See page 8.

Support Toys For Tots on October 30 and 31 at the Off-Road Poker Run near Barstow, CA. All proceeds go toward local charities. See www.barstowpoker.run.com for details.

SIERRA TREK REPORT

We ran a Staun Products booth at last August's 38th annual Sierra Trek near Truckee, CA. That was our first Trek of many to come and was quite an eye-opener. There were three trails with difficulty varying from SUV-friendly to short wheel base tough.

Come next August, consider attending this well organized, scenic event. You'll meet great people, have a wonderful time, be treated to outstanding scenery and certainly improve your 4WD skills.

If you are a member of Cal4Wheel, you'll see plenty of announcements in its newsletter, *In Gear*. If not, we suggest you join this conscientious organization.

CLASSES AND TOURS

There are several tours on the calendar through the balance of the year; check

out Coming Events on page 8. Note the September 26 *Arrowhead Adventure* has been rescheduled from September 5. This easy drive up and down "the hill" is guaranteed to be a fun Sunday outing.

The *Introducing the Hammers* ultra-skills trip has also been moved to October 1 and 2.

October 23 brings our last "class" of the year: the fascinating and colorful *Indian Rock Art Adventure* near Barstow. See page 8 for details. Mom, the kids love this one!

The following weekend takes us into the high desert near Victorville on *Lunch in Lucerne*. This easy daytrip reveals a variety of unique desert features, including some of the toughest 4WD trails in California!

And for those of you with a little more time, Copper Canyon awaits us this November 12 through 23. We've added the former silver mining town of *Batopilas* to our itinerary. One of two canyon "bottoms" we'll visit in the 6-7 canyon complex, this historically (and once ore) rich area will take us back at least 50 years into history!



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Copy Editor: Jenna Kane

ECO4WD is committed to passive appreciation of Mother Nature and ecological backcountry travel on unpaved roads.

The ECO4WD newsletter is published every other month. Subscriptions are \$14 for six issues. January

through September features the Coyote's technical articles and are 20 pages. The 40-page November-December *Bonus Issue* is the only issue that contains advertising. Contact ECO4WD for advertising rates or to receive a free Bonus Issue. Bulk copies are also available. For Newsletter Reprints on selected topics and back issue orders, see page 10. Back issues are \$3.00 each.

We encourage the submission of articles and photo-

graphs for publication and reserve the right to edit them. Submissions are only returned when accompanied by a stamped, self-addressed envelope.

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welded to one solid axle, make a turn, and not have something fuss. Can you picture how hard it would be to make turns and maneuver mountain roads with this type of set up? It would hop and protest every curve in the highway.

Engineers were aware of this when they first designed powered vehicles. Old Dinah, a steam-powered tractor that hauled borax in Death Valley well over a century ago had one. It was only natural that differentials were later put in automobiles.

That's good news! With a differential "splitting" the force to the drive tires, we can now smoothly go around corners without wheel hop. But unfortunately, bad news accompanies this headline. The same feature that allows you to smoothly take a corner also creates problems on uneven, left-right traction terrain.

This is where it gets touchy because there are so many misconceptions and preconceived ideas (bad old husbands' tales) about differentials. However, Newton and Einstein would agree with what I'm about to present.

DRIVE WHEEL MISCONCEPTION

Most folks will tell you that if you jack up one tire of a stock, open differential (simulating ice or loose sand), all of the power goes to that tire only. Zero force would go to the tire on the ground. You may have heard that 4WD is really only 2WD because of this. That seems reasonable enough since one tire (each axle) spins and the others are stationary. But folks, that just ain't so, as our "Drive Wheel Test – Part II" article in the Nov.-Dec. 2002 Bonus Issue proved. You may download that newsletter at: www.eco4wd.com/products/newsletter

DIFFERENTIALS

As above, about ninety-nine percent of the time you're stuck, with 2WD or 4WD, differentials are the culprit. I'm talking about those complicated critters in the middle of your axles. These, "I wonder how they ever figured 'em out" engineering marvels, are what revolutionized paved road travel way back when Henry first put tire to pavement. However, they repeatably, reliably and predictably slow, impede, retard, and bring to a tire-spinning halt every unpaved traveler who's ever set tire to challenge their pride and joy.

Understanding what differentials do is key to getting around the backcountry. However, differentials are the nemesis of

mechanical engineers and 4WD writers alike. Diffs are complicated! With one in hand, some folks can understand how they work. With just words, it is difficult to grasp the exact concept, but let's give it a go anyway.

There are two basic types of differentials in the Coyote's automotive world: 1) Open (stock) and 2) Closed. Closed differentials can be broken down into two categories: 1) Limited slip and 2) (full) Locker.

OPEN DIFFERENTIAL

All an open differential does is balance the torque (drive force) between the left and right tires. There are no, zero, nada, zilch exceptions for an open differential! It balances the torque to the side (tire) with the least traction (friction). It always (neglecting miniscule internal fictional forces) delivers the same amount of force to each tire. That means if one tire is completely off the ground, there is no friction or resistance on that tire; hence, no drive force is produced by that tire. Obviously, it's not touching the ground! Follow on.

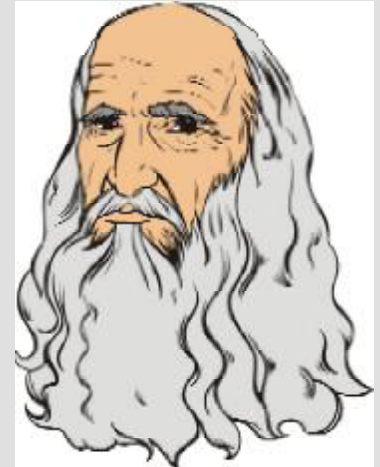
Now, since the differential wants to balance the torque, the other tire also receives zero drive force. In this case, that means neither (off- nor on-the-ground tire) provides any drive force to move the vehicle. If the spinning tire somehow gets more traction, then the same change is delivered to the apparently unpowered, static side.

Picture one tire in loose sand. The other tire is stationary and the sandy-traction tire spins. However, 'ol Spinnin' Sandy does offer a little resistance (friction) on his side. Again, the differential does its balancing act. Even though the non-spinning tire appears to do nothing, both tires are delivering the same amount of drive force to the ground. Unfortunately, the combined force of both tires may not always be enough to move the 4X.

CLOSED DIFFERENTIALS

Engineers also knew of open differential shortcomings and designed a variety of solutions. The 4WD buffs call these traction-aiding devices closed differentials. You may know them as limited-slips, posi-tractions or lockers.

I further divide closed differentials as follows. Let's call one category limited-slips and the other (full) lockers. Without getting in too deep, let's just say limited-slips don't lock up 100 percent. They do a limited job. Lockers do the full deed: They lock left and right tires 100 percent



The great painter, scientist, engineer, architect, futurist and Renaissance man, Leonardo da Vinci, was born out of wedlock in the northern Italian town of Vinci on April 15, 1452. His successful notary father raised him after his peasant mother abandoned him several years after birth. He combined his interest in nature with his artistic abilities to become the Leonardo we know today. He was centuries ahead of his time.

Leonardo conceptually developed many land and water vehicles for peace and war. His horseless carriage was powered by springs and sported a differential, of his design, to accommodate turns. Some early (modern) automobiles lacked this important feature.

However, da Vinci may not have been the first to invent and use a differential, just the first one to make written record of his device. The Antikythera mechanism was found in a shipwreck off Greece and is dated at 87 BC. It uses a differential in a solar system clock.

Leonardo died on May 2, 1519 as a member of the French court in Amboise, France. He is more popular now than while he lived.

together, exactly like a spool. As best I can tell, even electronic traction control is a limited slip device. It is not capable of 100 percent, full torque lock-up.

My first locker was in a Model A Ford. We disassembled the rear end, welded the spider gears to the axle gears and got around quite well. But when we hit the asphalt, she really let us know she didn't

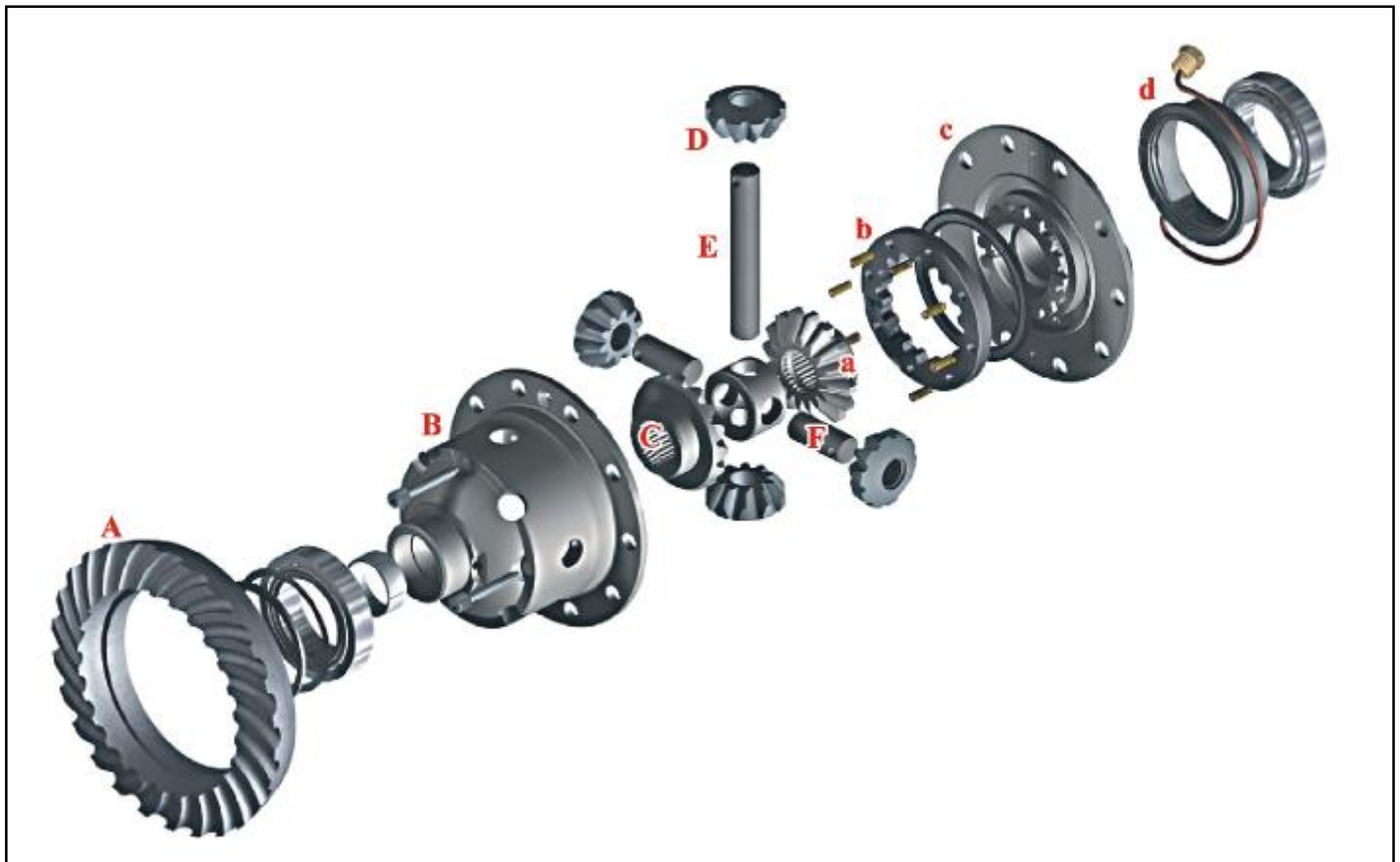


Figure 3 This ARB blow-up is very similar to an open diff. Capital letters designate common parts and lower case letters are unique ARB parts. A is the ring or crown gear (wheel); B, the carrier or diff housing/case; C, the axle or end gear; D, the spider gears (4), or as they are called on the ARB Web site, pinyon gears, and E and F are spider gear shafts. a is the special ARB axle gear; b, the clutch gear; c, the flange cap assembly, and d, the compressed air entry collar.

like it! More on these gears in a moment.

LIMITED SLIPS

The problem with limited slips is that they do not “bias,” as it is called, enough torque to the good traction tire to be effective in the “real” rough. A simple 2x4 board “hill” in front of one front tire is enough to stop every one I’ve tested. If you’ve taken my Discovering 4WD class, you’ve seen this demonstrated. Here’s why limited slips are generally worthless in the real rough!

When I look at the bias specifications on most limited slips, they are typically adjusted to 200 to 500 lb.-ft. of torque. In the real rough, you may need upwards of 5,000 lb.-ft of torque to move. Limited slips are like having a friend try to push you up a steep hill. He’ll do his best, but most likely, he’s just not big enough. True lockers are like King Kong. They move you up the incline with ease!

LOCKERS

A true locker acts like a spool. Actually, I subdivide lockers into two categories. One is the no-choice version and the other is driver selectable, or the choice type.

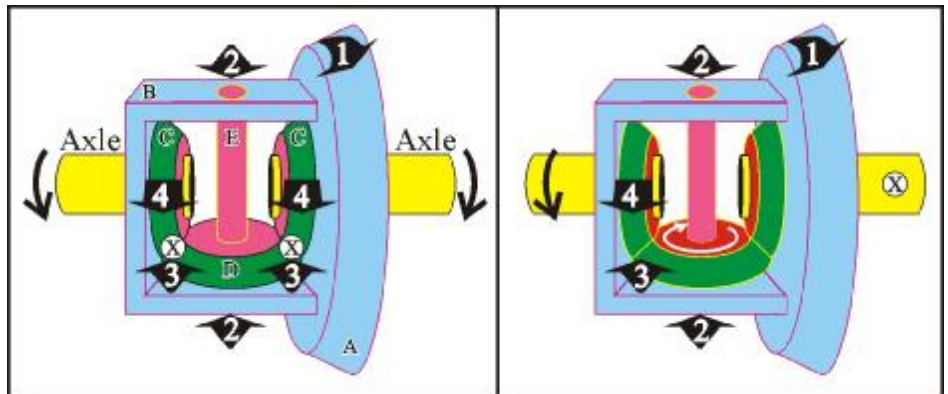


Figure 4 Pre the text, follow the force (1, 2, 3, etc.) through the diff to dispel the drive wheel concept. Part designation is identical to Figure 3 and the circled X means no movement at that intersection.

NO-CHOICE LOCKER

No-choice does not mean no-brainer. Quite the contrary. Even though they have been improved drastically, no-choice lockers require added driving awareness and skill. They are bulletproof-tough, but the act of unlocking may come as a noisy, dangerous revelation at the wrong time. They

can introduce a handling surprise if you’re not prepared.

Actually, this type of locker is not a differential at all. It is a spool until you make a turn. This action unlocks the spool and delivers power to the inside tire only. As you straighten out, with a resounding chatter, chatter, chatter, clunk, it locks

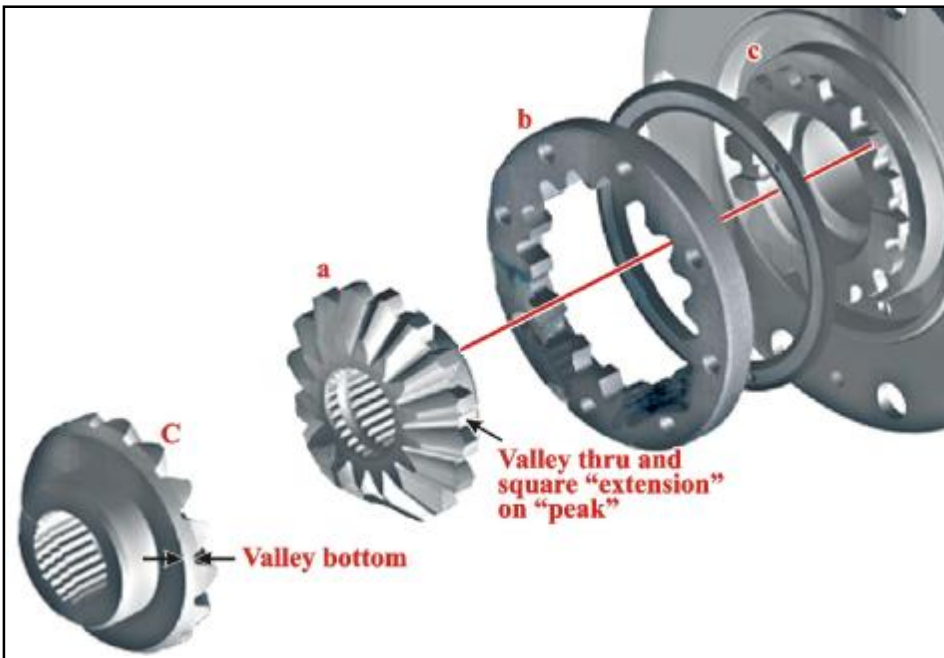


Figure 5 In an ARB air locker, one axle gear (a) is locked to the diff case flange cap assembly via clutch gear movement. The line shows the three parts (a, b, c) that are locked together. Figure 6 shows unlocked (top) and locked (bottom).

back into a spool. At no time does it deliver power to both tires in a curve.

CHOICE LOCKER

The choice type locker is the best of both the open and closed differential worlds. You make the choice to lock or leave open the differential. It acts like a conventional open differential with all of the inherent highway benefits when open. When you need it, you simply activate the mechanism and it becomes 100 percent locked up (closed). Power goes to either or both tires whether they are in the air, on the ground, going straight, on a curve, power on or off. The ARB air locker is such a device.

HOW DIFFS WORK

At first glance, Figure 3 can be pretty intimidating, but like most complicated things, break 'em down into little concepts and pieces, and it's a lot easier to understand. What we're going to do is follow the forces through an open diff, eliminating parts that perform duplicate functions. Then we'll relate that to how an ARB air locker works. The first step is to name the parts. For that, see the caption for Figure 3.

DIFF PARTS

All capital letters designate standard items in an open diff. The lower case lettered components are ARB air locker specific. Parts b and d don't exist in an open diff, and c and a are made a little differently than a standard diff. Other than that, they are about the same.

FOLLOW THE FORCE

What I've done to simplify the illustrations is eliminate all of the teeth in each gear showing only where the forces act upon each other. Since all of the spider gears act in exactly the same way, I eliminated all but one so you can "see" inside a little easier. Actually, some diffs have two spiders and others, four. The numbered arrows follow the force from point to point. Note that Figure 4-left also uses the same "letters" from Figure 3 to bring the photo and schematic drawings together. First let's take an open diff driving perfectly straight on level ground with equal traction on both tires.

GOING STRAIGHT

There is no diff action when going straight with an open diff. Referring to Figure 4-left, the driveshaft turns a gear called the pinion gear (not shown). This rotates A (force arrow 1), and in turn, rotates the spider shaft (E) like a baton .

Force arrows 3 push equally on the two axle gears (C) and identically rotate the tires. Note the spider (D) does not rotate about its shaft, but nevertheless puts force at the axle gears. I use a circled X to designate no relative movement.

ONE WHEEL SPINNING

Let's now take the situation (Figure 4-right) where the right tire (axle) has firm, 100% traction (not spinning) and the left tire is on slippery black ice (spinning). The force up to point 3 is identical, so it contributes its part to spinning the left tire, but there's a new guy in the act.

Since the right axle gear is fixed, the spider shaft (E) now "walks" the spider gear around that axle gear. This rotates the spider, which in turn spins the left axle gear (tire) even more. Did you know that with an open diff, when a single tire spins, it spins twice as fast as normal? More on that below.

TURNING

When you make a turn on full traction surface, a little bit of both from above happens. There is a little additional spin added to one tire by the other. This is impossible to illustrate.

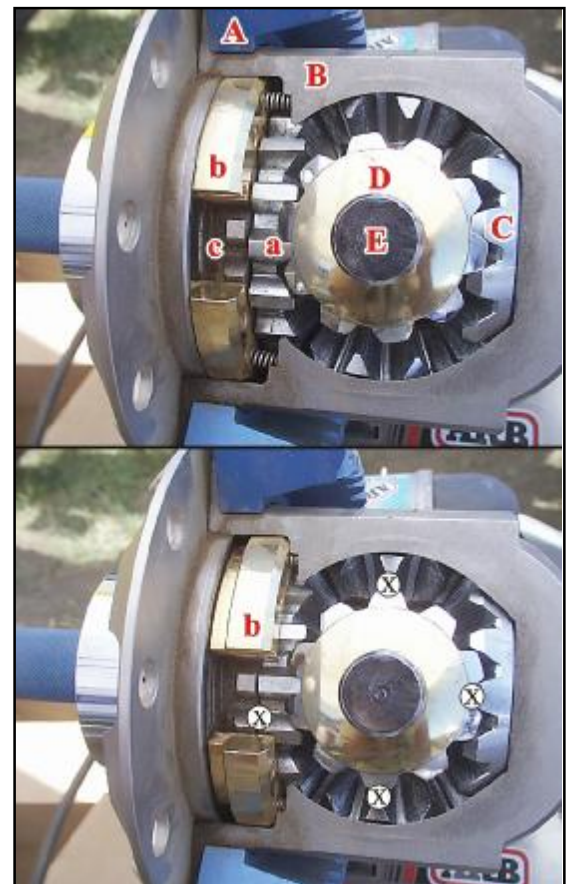


Figure 6 Note b in cutaway of an ARB air locker: unlocked (top) and locked (bottom).

In essence, what's happening is that the inside tire's axle gear "walks" just a little around the spider, which rotates the outside tire just a little faster. Put another way, the outside tire can now travel farther than the inside tire.

DRIVE WHEEL CONCEPT

The drive wheel concept is a misconception of long standing, but it is wrong, nonetheless. Besides the tests performed in the referenced 2002 article, take another look at Figure 4-top. Note the force applied to the axle gears (3) is applied at two identical spots on D. Think of this like a little teeter-totter with equal-length arms. This "teeter-totter" is where open diffs balance the torque. There can never be more force on one side of a spider gear than on the other or it will rotate. As more force appears on one side, the other side spins faster and the lesser spinning side balances to the spinning side's torque. It's the only thing that it can do: Balance the torque!

LOCKER PRINCIPLE

For an open diff to work, all of the gears within the diff housing must turn freely. Do anything to prevent rotation of any gear, in any manner, and you're back to a spool: no diff action. All an air locker does is "lock up" these gears. Let's see how an ARB does that.

Figure 5 is a close-up of the ARB "end" of Figure 3. Note closely that C is not identical to the ARB counterpart, a. C's teeth have a solid "back." In a, the valleys are cut clear through, plus there is a little "extension" of a sort on each tooth. Now also note that c has teeth just outside the axle pass-through hole. In addition, there is an "extra" part, d.

To activate, b receives air pressure from d and moves to the left in the "locked" direction. This locks a, b, c and, by virtue of c being assembled to B, all together. When the air pressure is released, springs return b to the "open" position. This shows how ARB air lockers have an open, fail-safe mode.

In more detail, lock-up is achieved when b moves left just enough to simultaneously engage the inner teeth of c and a's extensions. Follow the line: This locks c, via b, to a. With a locked to c, there is no chance of diff action; hence we have a spool. Figure 6 is a dissected ARB air locker, open (top) and locked (bottom).

LOCKER BENEFITS

There are two distinct advantages to a locker. The most obvious is traction. When the chips are down, that magical blue ARB button will get you out of more

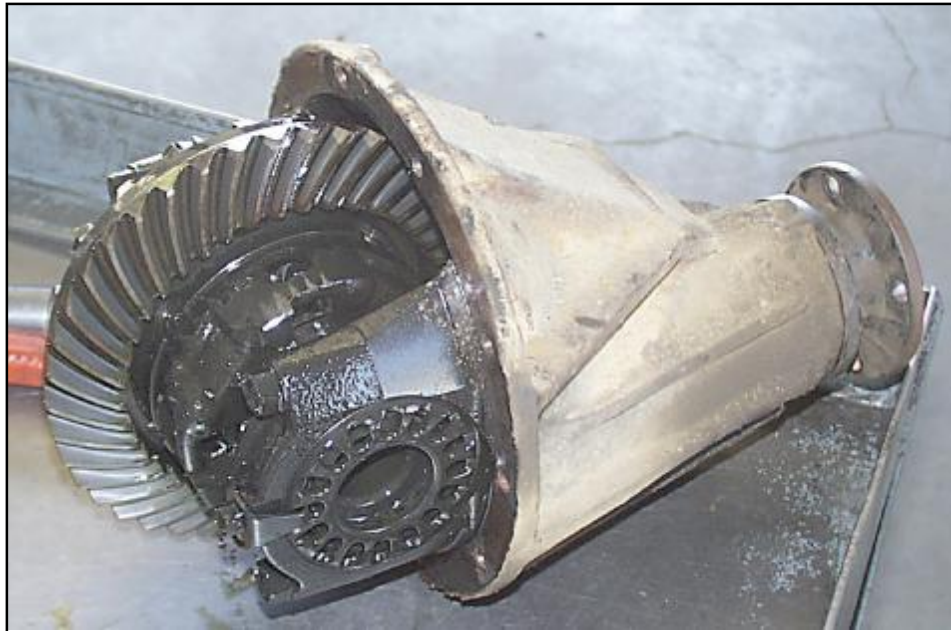


Figure 7 Third member of a Toyota rear diff.

trouble than any other single thing you can do to your 4WD!

The other advantage is less known and more subtle. Have you ever noticed going down steep, rough hills, with an open diff, it seems like you speed up a bit as the tires temporarily "float" over holes, off the ground? Your speed literally doubles as explained above. With not too extreme of a hill, you feel the 4X slow back down when you pass the hole.

With a locker, you do not get this "differential" speed-up, slow-down. This means no burst of speed or potential loss of braking and control.

Meanwhile, back on traction, with wheel spin, think of the open diff like higher gears. When a wheel spins, with no vehicular movement, it's like you just shifted into a 2X higher gear. For the rough, you don't want that. Low gears are what get you through the tough going. With a spinning open diff, you've got half the gearing. Not a good thing!

ARB IMPROVEMENT

All of the most recent designs and some redesigned ARB models have timed gear sets. That means that the clutch gear (b) will only engage when all of the spiders and axle gears are fully and completely meshed. That also means the ARB will withstand being engaged while a tire is spinning, under power! That's a good thing. Careful inspection of Figure 6 shows this.

ARB INSTALLATION

I typically take on everything mechanical, but I leave diffs to the experts like John Lemieux of All Wheel Drive. However, there are two basic types of drive axles, one of which lets you do part of the work.

There is the "all in one" type axle where everything comes together at the last minute in one giant assembly and the "third member" type (see Figure 7). This type allows you to remove the geared innards as a unit to take to the diff expert for the touchy stuff. The touchy stuff has to do with a skillfully coordinated attack on gear mesh position, gear backlash and bearing setup.

To do the third member type, you simply remove the driveshaft and the brake backing plate assemblies, pull the axles, unbolt the third member and cart that off to your expert.

Incidentally, many 4WD shops feel the same about diffs as I do: They send them to the experts for work, so why not do the same?

EXPERT SOURCE

You deserve to use the services of John Lemieux's All Wheel Drive (909 277-1037) for all of your running gear needs. Give him a try.



NEW SIDEKICK PRODUCTS

By Harry Lewellyn

Rick Russell never ceases to amaze me with his energy and creativity. He has just updated his Glamis map, introduced two other maps and a new product, Bandana Maps. Rick has been producing off road maps since 1988.

GLAMIS UPDATE

The revision to this most popular sand dune recreation area is now available. It includes a larger topographical map which details the dunes from Mammoth Wash on the north to Buttercup on the south. Also included are the locations of major sand hills, RR track crossings, Wilderness Area Boundaries, campgrounds, stores, highways and GPS coordinates. The 13½" x 16" full color map retails for \$3.00.

NEW MAPS

There are two new maps, and I'm sure they will prove very popular.

As Moab is a major 4WD attraction in southeastern Utah, Rick added this to his list of available maps. It includes written

trail descriptions and locations for the most popular Easter Jeep Safari trails. Full color pictures enhance the area statistics and GPS coordinates.

Although Johnson Valley, CA has the reputation as being the home to the infamous double black diamond Hammers, there are plenty of other attractions that abound. This is where I conduct my *Lunch in Lucerne* tour and *Lucerne Sand Session* class. Go see the easy stuff and use the map to get to observation points for the Hammers as I do on the Lucerne tour.

BANDANA MAPS

I suppose just 'cause you can, Rick now prints select maps on bandanas. Actually, it's a great idea, particularly for motorcycles, quads, buggies and hikers where space is at a premium. There are two 22"x22", cotton, 100% washable bandana maps now available.

Glamis is very popular area with the

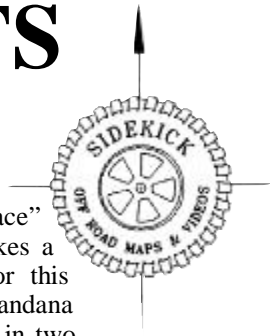
"limited space" folks, so it makes a lot of sense for this area to be a bandana map. It comes in two fabric colors, black and red, and contains all of the map-related information on the paper version.

The Moab bandana map is printed on natural color fabric and includes all Easter Safari trails.

SOURCE

Sidekick can be contacted by telephone, (877) 628-7227 or (909) 628-7227; mail, P.O. Box 727, Chino, CA 91708-0727; email, mail@sidekickoffroad.com; or, visit its Web site: www.sidekickoffroad.com

Keep your nose clean.



TRAIL TIP DRIVE WHEEL

"SHIFTING into 4WD" dispells many Old Husbands' Tales. Chapter 4 (How It Works), page 92, attacks the worst one of all: the Drive Wheel misconception. Tour the book at ww.eco4wd.com/Xbook_preview/1preview.htm Order the book on the last page of this newsletter or from our Web site. View past Trail Tips at www.eco4wd.com/trail_tips

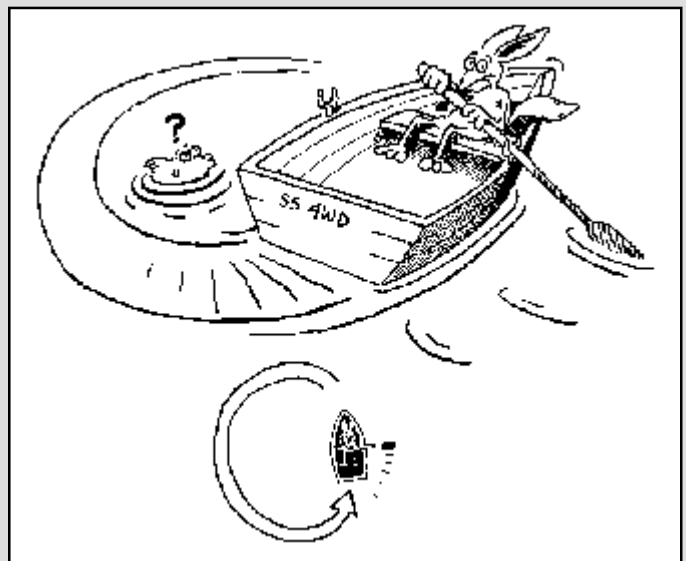


Old Husband's Tale

When you're good 'n stuck in 4WD, seeing only one tire spin on each axle is what led to the misconception that these are the drive wheels! They are spinning, so they have to be the drive wheels, right?

Remember burning out (laying rubber, smoking the tires, digging out) on the asphalt in high school? Unless you had a real powerhouse, you typically saw one heavy black tire mark and almost nothing on the other side. Now carry this drive wheel concept a little further. If only one tire was moving the tire-smoker, why didn't it go in a circle?

Rowing a boat is a perfect analogy. Power only one oar and you will move in a circle. That would have to be the case if differentials had a preferred drive wheel. And don't confuse things if you know about the J stroke technique for paddling a canoe! The vehicle would go in a circle if there were only one drive wheel! There is no such thing as a drive wheel. That makes about as much sense as a one-ended rope. It just can't be!



ECO4WD COMING EVENTS

<u>EVENT</u>	<u>DATE</u>	<u>DETAILS ~ See note below</u>
<u>LAST CALL!</u> Arrowhead Adventure	Sept. 26 (<i>changed</i>)	Easy back way into CA's San Bernardino mountains /p28
<u>LAST CALL!</u> By God, to Bodie! (C/H)	September 11 to 13	Historic California ghost town tour /p31
SAND SPORT SUPER SHOW **	September 17 to 19	Stop by our STAUN PRODUCTS booth at the O.C. Fairgrounds **
<u>LAST CALL!</u> Golden...Trails (C/H)	September 18 to 20	Historic California tour /p32
<u>LAST CALL!</u> Intro. the Hammers (C)	Oct. 1 to 2 (<i>changed</i>)	Extreme black diamond in Johnson Valley, CA /p33
OFF ROAD EXPO **	October 9 to 10	Stop by our STAUN PRODUCTS booth at the Pomona Fairplex **
<u>LAST CALL!</u> Death Valley II (C)	October 15 to 18	4WD camping mini-vacation /p32
<u>LAST CALL!</u> Indian Rock Art Adv. **	October 23	Easy introductory tour near Barstow, CA (see below)**
<u>LAST CALL!</u> Lunch in Lucerne	October 30	Easy exploring trip in CA's high desert near Victorville /p24

2005

2005

2005

<u>LAST CALL!</u> Copper Canyon, Mex. (H)	November 12 to 23	A driving vacation through Mexico's backcountry /p27
Death Valley I (H)	January TBA	4WD mini vacation from Furnace Creek Ranch /p23
Pinyon Mountain (C)	February TBA	Anza-Borrego, CA most difficult-skills trip /p23
Truckhaven (C)	February TBA	Anza-Borrego, CA most difficult-skills trip /p24
Baja Whales and Rock Art (H)	March TBA	Great intro to Baja, Mexico—open to all vehicles! /p25
Lunch in Lucerne	March TBA	Easy exploring trip into CA's high desert near Victorville /p24
Borrego Boondoggle (H)	March TBA	Three good days of badlands adventure in Anza-Borrego /25
Lucerne Sand Session	April TBA	Sand driving skills trip in CA's high desert near Victorville /p26
Mojave Expedition/Bonus Trip	April TBA	Historic California tour—see bottom for Mojave details /p26
Copper Canyon	April TBA	A driving vacation through Mexico's backcountry /p27
Baja Adventure ~ New for 2006! ~	March 2006 TBA	Approx 8 days mostly camping to Sea of Cortez, Baja (see web site)

* = R. S. College (714) 480-7390 (C) = Camping (H) = Hotel (C/H) = Camp or hotel  = Schedule subject to change

DETAILS: The page references (above) refer to the ECO4WD *BONUS ISSUE 2004* newsletter. Request a **FREE** hard copy by: mailing your USPS address (USA only) or emailing your address with "newsletter" in the subject. Download it for **FREE** at www.eco4wd.com/products/newsletter_choice.htm. See www.eco4wd.com/tours for more on our tours. Also see our **TRIP POLICY** in the Bonus Issue or www.eco4wd.com/about_us/policy.htm for registration details.

~ ~ ~ ~ ~ ** UPCOMING ACTIVITIES ** ~ ~ ~ ~ ~

**Visit us at the SAND SPORTS SUPER SHOW

Fri., Sat., and Sun. Sept. 17 - 19

ORANGE COUNTY FAIRGROUNDS @ 88 Fair Dr., Costa Mesa, CA 92626

See the latest innovations, products, and accessories in the sand dune and off-road industry! **Tickets: \$8 Adults (13 & up)**

Win great prizes. Free admission to the Automotive Road of Dreams antique museum. Free admission to the O.C. swap meet. Discount tickets to Costa Mesa International Speedway. Free parking & re-entry. Music & entertainment.

For more info, visit

www.sandsportssupershow.com

WE'RE SHARING BOOTH #3300 IN BLDG. 14 WITH EXTREME OUTBACK PRODUCTS!

**Visit us at the OFF ROAD EXPO

Sat. and Sun. October 9 - 10

POMONA FAIRPLEX @ 1101 W. McKinley Ave., Pomona, CA 91768

All the latest parts and accessories on display at the largest offroad show in America! **Tickets: \$10 Adults (12 & up)**

This is a show for the entire offroad community. Includes: rock crawling, trail riding, off road racing, sand sports, street performance, motorcycles, ATVs, camping, and adventure travel!

For more info, call (909)623-3111 or visit www.offroadexpo.com

OUR STAUN PRODUCTS BOOTH IS AT "6408 GOLDEN SPIKE TRAIL"

**Join our INDIAN ROCK ART ADVENTURE

Saturday, October 23

Hidden away in the desert near Barstow are scenic, ancient petroglyph sites and fascinating geological features. Highlights include colorful Rainbow Basin, mysterious pictograph and petroglyphs of Inscription Canyon, bedrock mortars and stone tool flaking areas. Let the Silver Coyote lead you on an exciting, clean and easy, one-day adventure into the Mojave Desert. Starts in Johannesburg; ends in Barstow, CA. *Rated: easy.*

FEE: \$60/driver + \$15/ea. passenger

This tour is offered as a "class" through Rancho Santiago College. Please call (714) 480-7390 to register.

SAFETY SEAL

NO RUBBER CEMENT!

The Safety Seal tire plugger kit is easy to use and makes a permanent repair!



PLUG TIRES IN MINUTES~ON OR OFF THE CAR~WITH LITTLE EFFORT!

Road heat completely vulcanizes the 21-ply plugs to the inner-tire butyl rubber through a U.S. patented repair process. Make a repair once with Safety Seal, and it will conform to the shape of the puncture and outlast the tire.

DON'T GET STRANDED BY A FLAT TIRE!

TRUCKAIR

12V HEAVY DUTY INFLATOR



Don't leave the pavement without a compressor!

- Built-in 2-1/4" diameter, 300-psi gauge
- 25" delivery hose with nozzle adapters
- Fan-cooled, heavy-duty motor runs non-stop for 8 hours
- Long, 13-1/2' power cord plugs into the cigarette lighter for 12VDC power
- Inflates even the biggest tires in minutes

This is the most cost effective compressor around. You can pay 300 or 400% more and only reduce air-up time by as little as 30%!

NO-LOSS Valve Caps

*No more searching for dropped caps!
No more storing filthy caps in your mouth!*



BUILT FOR NATO MILITARY VEHICLES!

Secure the polyethylene restraining straps over any valve stem threads for permanent storage and screw down caps to tighten. Simply unscrew the nickel plated brass caps to inflate/deflate and the straps will hold them safely just a fingertip away.

Caps hold air with or with a valve core!

STAUN ADJUSTABLE TYRE DEFLATORS

No backbreaking individual tire deflating!



Simply screw onto tire valve stem to automatically deflate to your desired/presettable pressure.

These all brass deflators have been designed for all tire deflation needs and can

be manually started at any pressure.

Standard units (6-30 PSI) are suitable for beach or bush pressures. **Light Duty** (0-10 PSI) units serve rock crawlers, quads and dune buggies. **Heavy Duty** (15-55 PSI) units are designed for light to heavy trucks and equipment.

Each set comes with 4 deflators and case.

MASTER-PULL SUPER YANKER

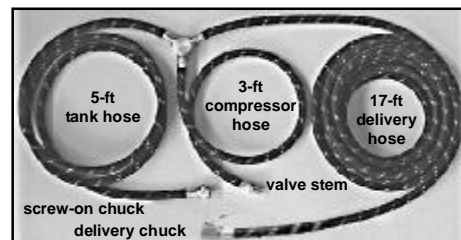
Don't risk getting stuck in the backcountry without a way to be yanked or towed!

At 28,500# strong, this 30'-long, 7/8"-dia. **double braid nylon rope** is more knot friendly and stretches 12.3% more than conventional flat, yellow yank straps. Professionally hand spliced eyes and heavy duty nylon chafe guards that all but eliminate sewn-in eye failure. (Vinyl bag optional)



Use with the Coyote Chain for more versatility.

COYOTE AIR ROBBER



With an Air Robber, you have emergency air with or without a compressor!

"Rob" air from nearby tires! Connect the screw-on valve stem chuck to any inflated tire and use the custom lock chuck at the other end to air up the low tire.

Improve air-up time! Connect to your spare and a compressor to the 3-port manifold, and continuously replenish the source tire while you fill others.

When your buddy is stuck and you are free, but you can't connect, you need a...

COYOTE CHAIN

Don't travel the backcountry without this versatile recovery tool! The Coyote Chain allows you to connect a towline to a disabled vehicle



Chain allows you to connect a towline to a disabled vehicle without frame-mounted tow hooks.

Attach the **slide hook** (left) directly to the 4X frame or use it as a choker to cinch up on anything, including the downed tree blocking your trail. Loop the **grab hook** (right) back and attach to any chain link. Both clevis hooks are easily removable, leading to **endless recovery and repair uses!**

Includes 3' of 5/16", heavy duty transport chain and "Recovery" newsletter reprint.

ClampTite

Hundreds of uses around the home, workshop, garage and in the field.

CLAMP ANYTHING

**ANY SIZE
ANY SHAPE
ANYWHERE!**



Stop leaky hoses on the spot or fix broken handles, tail pipes, sports equipment, fences and more with this handy tool.

Makes instant clamps from ordinary wire, or even clothes hangers!

From splicing starter wires to mending spewing radiator hoses in the field, this tool is a must for your "getchaback" box.

ORDER ON PAGE 10!

For more information on our backcountry books, products and services, see:

www.eco4wd.com/products

Request a copy of our Bonus Issue 2004 newsletter by email, fax or snail mail.



The ECO4WD newsletter presents 4WD-related product reviews and in-depth analysis, new backcountry books, trail tips from Shifting into 4WD, our class and tour schedule, and more. Back issues (\$3.00 each) and Reprints bring you up to speed on past matters and selected topics. Identify which reprints or back issues you want, calculate the total and enter on the last line of the order form at the bottom.

NEWSLETTER REPRINTS AND BACK ISSUES

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q Any three or more selections of reprints or back issues — Apply 20% discount and calculate total for below — (MAIL ORDER ONLY)

PRODUCTS

PRICES INCLUDE SHIPPING, INSURANCE AND TAX! ~ Please allow 2-4 weeks for delivery.
> See www.eco4wd.com/products/product_choice.htm for more product details. <

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q Coyote Air Robber—Air transferring scheme that provides air with or without a compressor\$39
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q Safety Seal Tire Plugging Kit—Repair tires on or off the car. Comes with 60 plugs, tools and plastic case\$55
q Truck Air Compressor HD300—Plugs into cigarette lighter for 12VDC power\$55
q Staun Standard Tire Deflators—4 easily adjustable automatic deflators (6-30 PSI)—Suits most deflation needs.\$64
q Staun Light Duty Tire Deflators—4 easily adjustable automatic deflators (0-10 PSI)—Rock crawling, quads/dune buggies \$64
q Staun Heavy Duty Tire Deflators—4 easily adjustable automatic deflators (15-55 PSI)—light/heavy trucks, equipment ...\$64
q Staun Massojet Under Body Buddy SA600—High pressure cleaning for hard to reach areas; connects to garden hose\$52
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