



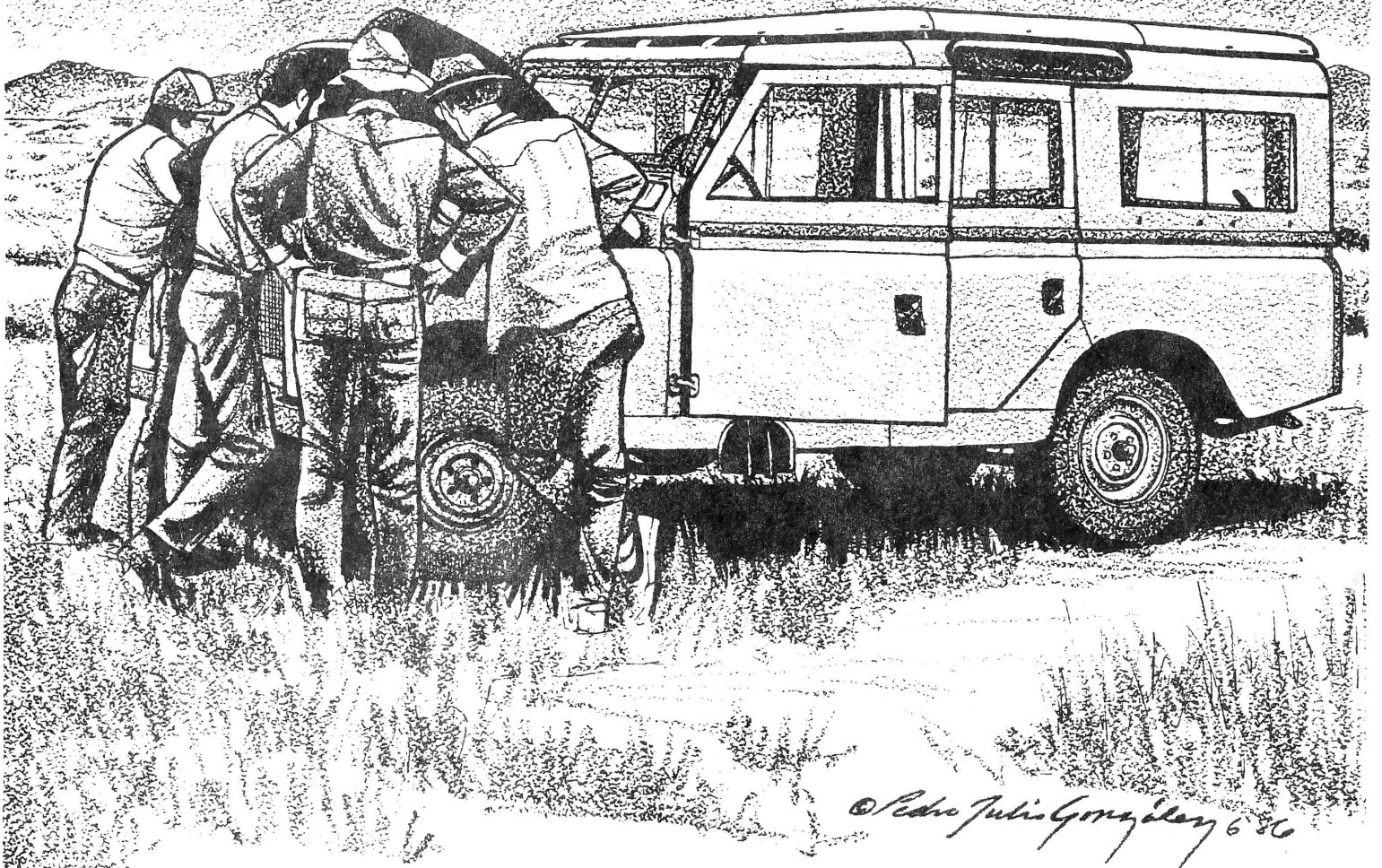
the
**ALUMINUM
WORKHORSE**



THE OFFICIAL PUBLICATION OF THE LAND ROVER OWNERS ASSOCIATION

SPECIAL ISSUE - SPRING 1987 - COPYRIGHT 1987 - ALL RIGHTS RESERVED

Special All-Tech Issue!!



LAND-ROVER OWNERS ASSOCIATION

SPECIAL ALL-TECH ISSUE

For those of you who missed some of the early tech articles, here they all are for your perusal. Those who have followed along from the beginning, here is your refresher course with one surprise. For the most part, these tech articles were written for and by people just like you; Land Rover owners who would rather do it themselves. Enjoy!

Jim Allen, Editor

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Land Rover Spares

Here is a list of parts and service establishments to aid you when you are searching for parts or service. This list is published on a non-partisan basis for your benefit. Please help us keep this list updated by letting us know of new businesses or ones that have gone out of business.

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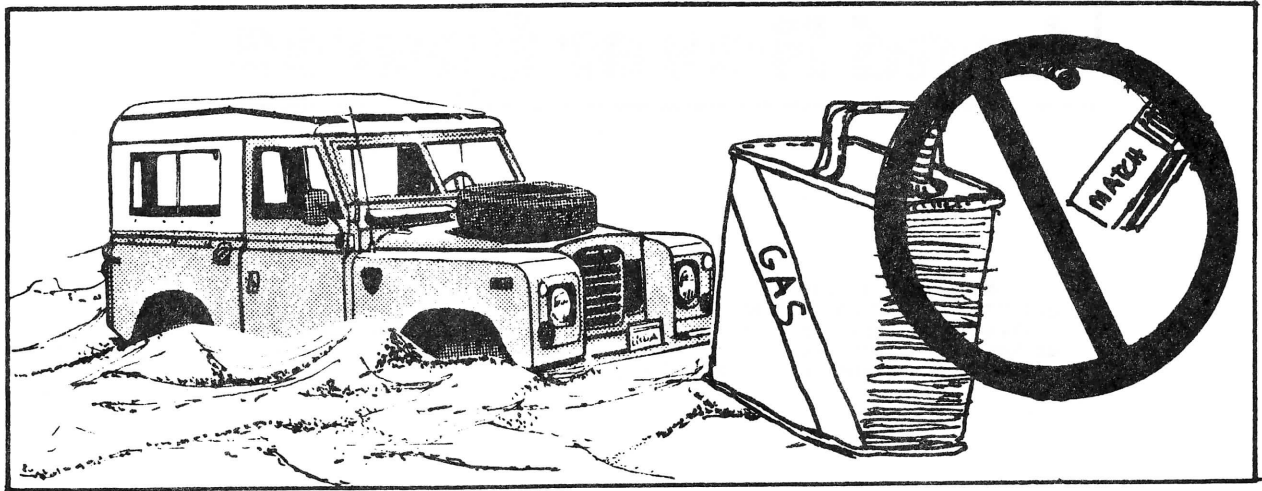
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KEY

P = NEW PARTS
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F = CUSTOM FABRICATOR
R = COMPONENT REBUILDER



WINTERIZE

by

Jim Allen

DON'T LET WINTER SPOIL YOUR OFF-ROAD FUN -

- GET READY FOR WINTER AND ENJOY IT FOR A CHANGE

The majority of us have to deal with adverse conditions of one sort or another when winter comes. These conditions vary from minor inconveniences to very real life threatening ordeals. In any case, you and your Land Rover need preparation to deal efficiently with whatever may occur in winter. This article will help you face those winter conditions safely wherever you live or travel.

Getting Your Rover Ready for Winter

Truth be told, most breakdowns are due to neglect of one form or another. This winter, when it's 10 degrees below zero and you've frozen your butt trying to get the Rover started, you might wish you'd taken the time for a little preventative maintenance. Take the time now to give the old workhorse a going over, before inclement weather.

Getting the Juice

The battery is the most important part of your electrical system. It is also, typically, the most neglected part. Did you know that an average battery at 32 degrees Farenheit produces

WINTER(continued)

only 65 percent of the power it does at 80 degrees? Add in corroded terminals, low water level and loose connections, you'll be lucky to get started at all! A little baking soda and water along with a good wire brushing of the terminals (inside and out) will go a long way towards getting you started. Don't forget the connections on your starter and starter solinoid; they need attention occasionally as well.

Another factor to consider is the age of your current battery. The onset of cold weather is the favored time for battery failures. If you do need a new battery, buy the most powerful one you can afford. Most good quality batteries show the cold cranking amps on them somewhere. This figure shows how many cranking amps the battery can deliver for 30 seconds at 0 degrees farenheit.

The alternator or generator should be checked for output before cold weather. During winter you use your accessories (heater, lights, wipers, etc.) much more. An anemic charging system will not keep your battery charged under a high load situation. Conversely, an overcharging system can, at least, cause excessive corrosion at the battery or, at worst, ruin it.

The Liquid End

The condition of your Rovers precious fluids is another prime candidate for inspection. When was the last time you changed your engine oil? Is the oil suitable for the temperatures it will face? Oil that is too heavy will turn into a goeey, honey-like mass at very low tempertures. A graphic example of the wrong oil to use in the winter took place 13 years ago on the East Coast when this writer put 50W racing oil in his MGA. When winter finally took hold one morning, the engine refused to turn over. It finally started after building a small charcoal fire under the oil pan to warm up the oil. This, of



course, is a worst-case scenario, but the correct grade of engine oil will go miles towards getting your engine started easily in the chilliest climate.

WINTER(continued)

When was the last time you changed your gearbox and differential oil? Did you know that the water you might have picked up this summer when you forded that creek will freeze in these components and could cause a catastrophic failure. That goes for your brake fluid as well. In some severe climates, it might be necessary to go to a winter grade of gear oil, say a 75W-90, for smooth operation of the geartrain.

Another all-important item is your antifreeze mixture. A 50/50 mixture is adequate for everywhere but the Yukon. Most auto parts stores sell inexpensive anti-freeze testers. It's a simple process to test your antifreeze and add however much is needed to bring it up to strength. While you are going over your cooling system, take a gander at your heater/defroster. We all know that the standard heaters on most Land Rovers need a little help. Help your heater (and you) out; look for kinked heater hoses, sticky water valves, leaking or disconnected duct hoses and don't forget to open the water shut off valve, if you have one.

Often overlooked is the windshield washer system. When road grit and scunge is covering your windshield one not-so-fine winter day, you will be glad you took the time to service this item. By adding a mixture of water and washer additive, you prevent the washer from freezing up and supply it with a cleaning agent for your windscreen. While you are at it, look at your wiper blades. It's a good idea to change them at the onset of winter for maximum visibility.

Tools of the Winter Trade

First on the list of winter tools is your set of chains. They can give you unequalled traction in the slipperiest conditions; don't forget or neglect them. It is important to try them on occasionally. If nothing else, it's good training for



when you install them for real. Remember also, the chains you bought five years ago may not fit the tires you purchased last summer. Ensure that all the clasps are in working order and that there are no broken links.

Other tools should include a shovel and a small container of sand, along with normal hand tools. The sand

Know that your chains fit before this point.

WINTER(continued)

will give you traction if you get stuck on ice. A tow strap or chain is valuable for helping stuck motorists (or maybe you!) out of the snow. A can of WD-40, or a similar water-displacing fluid, is good for drying out a wet ignition system. If water gets into the distributor, remove the cap and spray the fluid liberally inside and let the residue drip off. Reinstall the cap and fire the engine up.

Winter Survival

That's right, survival! Sudden, violent snowstorms can occur while you are on the road and leave you stranded in your Rover. Or, you might be out on that winter trek and break down ten miles from help, with a storm coming on. When you travel, you should carry a few items to ensure your safety if this should occur. To be safe, carry the items that follow throughout the winter season.

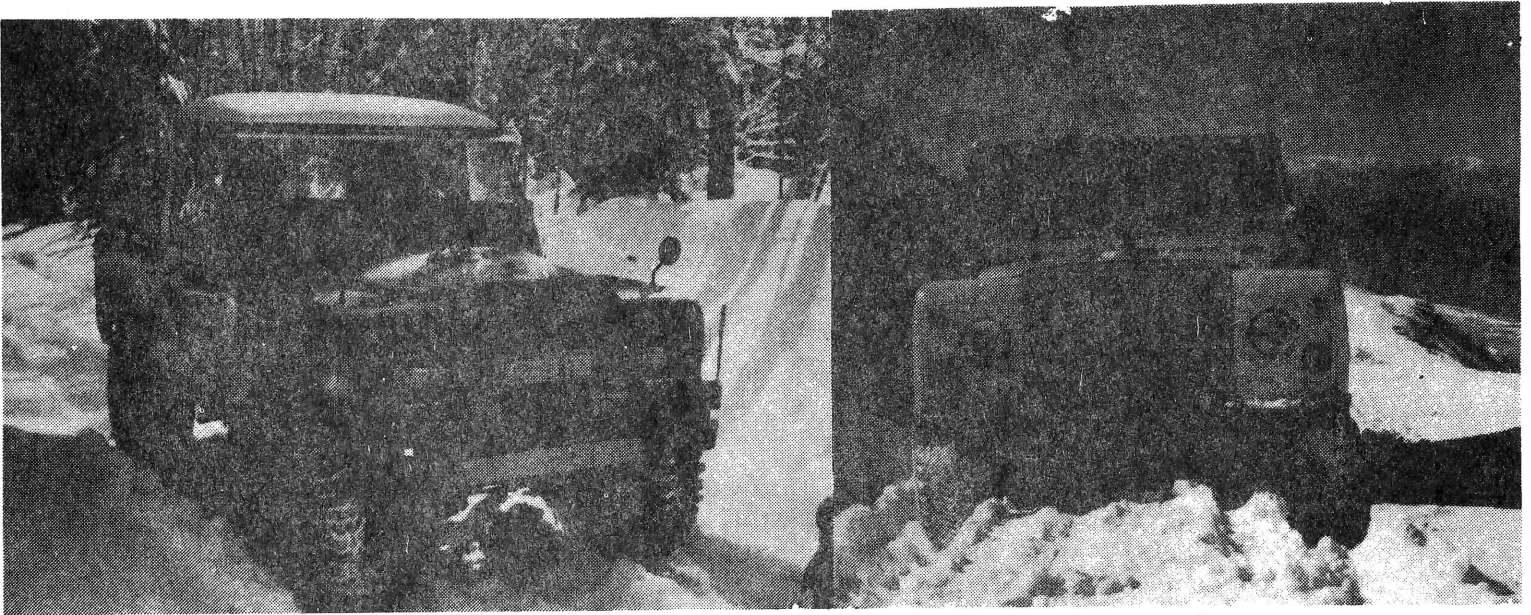
The most important item for your winter survival kit is a good sleeping bag. In cold weather the most important task is to conserve body heat. This is especially important for children or people in poor health. Carry a sleeping bag for everyone in your party. Next in importance is winter clothing. Most important is protection for your hands and feet. If you have ever tried to perform even the simplest task with very cold hands, you will realize the importance of keeping them warm. You will need your hands for many things, not the least of which is saving your life! The same goes for your feet. Stow a pair of winter boots somewhere in your rig for emergencies along with a good pair of winter gloves.

Other survival items might include a small supply of high energy food bars. You will burn up tremendous amounts of calories staying warm in cold weather and might need the extra energy. Since it isn't a good idea to run the engine (you may not even be able to) with snow piled around the vehicle, because of the risk of carbon monoxide poisoning, a couple of slow burning candles will take the edge off the cold. Be sure to crack the window slightly for fresh air when you use them, though.

Some more small items to carry along should include lighters, a blanket or two and sunglasses to protect you from the bright snow. The best idea would be to take all your survival items, pack them into a duffel bag and keep them in the back of your Rover. You never know whose life they might save.

Winter Driving Tips

People who live in the "snow-belt" get on-the-job snow driving training every year and some of them have been known to make foul utterances when viewing the antics of untrained drivers in the snow. Lets not give the pros reason to whisper, lets refresh our memories with some winter driving tips.



With its high ground clearance and large tires, the Land Rover at the left would have easily crossed the snow bank where the right Land Rover is stuck. The price, though, is a higher center of gravity and accelerated drivetrain wear.

On Pavement

Your Land Rover has a big advantage over the more mundane vehicles on the road; it has four-wheel drive. The ability to engage your front axle gives you superior traction and control in slippery conditions. One of the more common mistakes four-wheelers make is not engaging four-wheel drive soon enough. Don't hesitate to lock in your hubs and kick it into four-hi when there is snow or slush. When conditions get seriously slippery, use four-low for the added braking power.

Stopping in snow and ice can be tricky. Conventional 2wd cars tend to want to swap ends and under some conditions, 4wd can be worse. As much as possible, use your gearbox to slow down. This is when low range comes in very useful in bringing you to a safe, controlled stop. If you ever do go into a skid, do not hit the brakes. This will put you totally out of control. Steer into the skid until the Rover lines back up. Sometimes a light touch on the throttle will bring it back. Sometimes nothing will bring it back and you will simply have to hang on and ride it out! The key is to drive easy and use the four-wheel-drive for extra control and safety.

Off Pavement Snow Driving Tips

Most of the pavement rules apply when driving off road in snow. The most serious troubles can occur when cutting your own trail thru the snow. Snow will cover logs, rocks and debris. Running into this stuff could ruin your day. Remember that snow collects in the bottom of gullies or washes. What looks perfectly level could get you well and truly stuck in five or six feet of snow. Be extra careful by getting out and walking areas that look tricky. A stick is useful as a probe to test the depth and consistency of snow.

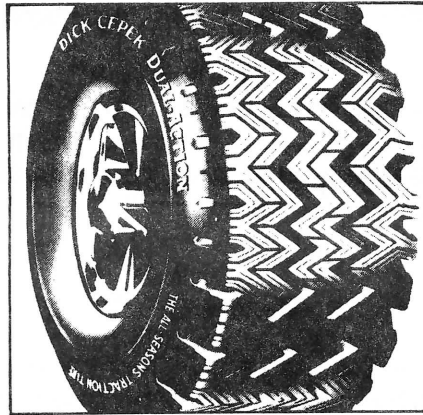
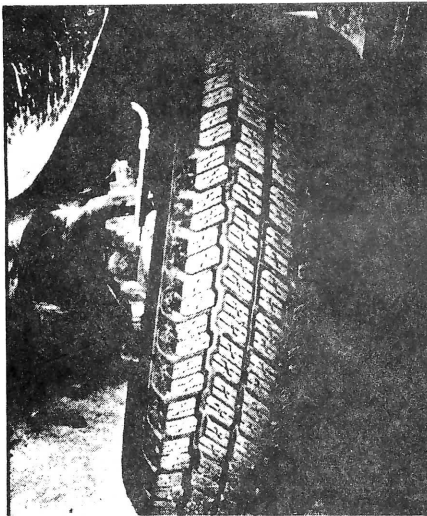
After thrashing thru deep snow, ice and snow can collect under your Land Rover and cause serious problems. It can pack in your wheel wells and cause steering problems. It can also pack

WINTER(continued)

in your wheel and freeze rock hard. You have never experienced an out of balance wheel until you have driven with a wheel packed with snow! When you get back on the highway, hop out for a sec and take a look underneath. Get rid of any snow or ice in vital areas before you get up to road speed.

Off Pavement Mud Driving Tips

Mud driving can be lots of fun, sometimes even when you get stuck. Generally, though, the idea is to get thru without actually going into the mud yourself. Tires play the most important role in slogging through mud. A open, aggressive tread pattern is needed to maintain traction and for self cleaning. Here is what it boils down to; tailor your mud driving to the type of tires you have. If you have nice, quiet running, closed tread tires, don't get carried away or you'll end up stuck with mud donuts where your tires used to be. Of course, with every type of tire, chaining up will aid traction in mud and sometimes this might be your only option.

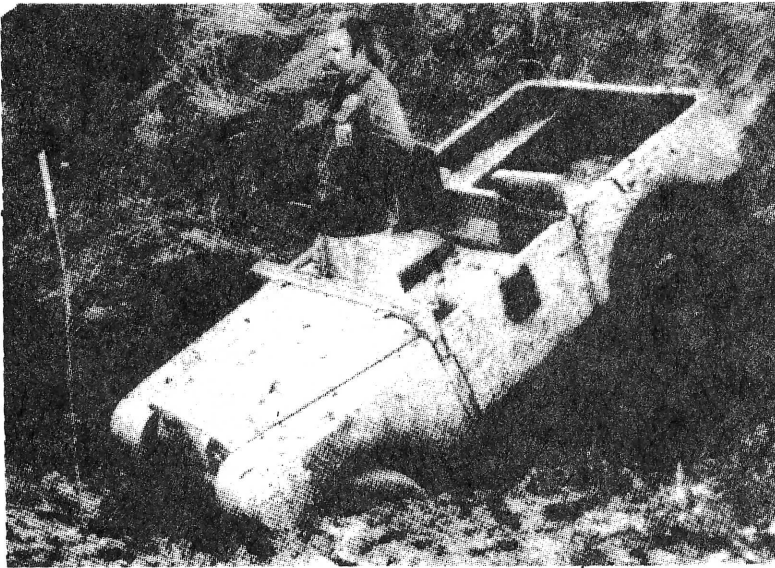


Though considered an "off road" tire, the tire at the left is best suited for light-duty four-wheeling. In mud, it would quickly ball up and be nearly useless but it would be a nice, quiet tire for less harsh conditions. The middle tire would be a good all around tire that's aggressive enough to get you through most anything while remaining relatively quiet. The tire at the right is an all out, howler-growler mud tire that will pull you across the pits of hell if need be, but after a few hours on the freeway, you will deaf and/or stark, raving mad from the noise.

Some basic tips for getting thru mud would start with getting out and looking before you charge thru a mud hole. You've seen plenty of pictures in Four Wheeler of 4X4s stuck up to their headlights, don't add to the number if you can help it. If you can find a way around the obstacle, take it. There's no law that says you must go thru every mud hole you come across. When you

WINTER(continued)

do cross, take it fairly slow. Usually, charging across like the Light Brigade will cause more problems than it will avoid. Choose a gear that will give you around 2500 rpms and go at a moderate speed, no more than, say, 10 mph. Apply power as necessary to



maintain movement and do not stop if you can help it; you may not be able to get going again. If the vehicle bogs down and stops, cut the power so you won't dig yourself deeper. Sometimes you can get out by using lots of throttle and spinning the tires fast enough to get some traction. Using this technique is a judgment call based on experience with different types

of mud. Many times, it can take you from mildly stuck to hopelessly stuck. Above all, remember that it is easy to lose control when blasting across mud too quickly. If you take it easy, the worst that will happen is that you get stuck and a little muddy.

Summing Up

Because of the extra risks involved, never go off-pavement snow four wheeling without company. Your Land Rover is capable of taking you a serious distance out in the boonies regardless of conditions, but it has limits. Being seriously stuck by yourself, miles from help is no laughing matter. Take at least one other vehicle along for safety and let someone back home know precisely where you will be and when to expect you back. If you cover all the bases, you can go out there and have a good time without any major worries.

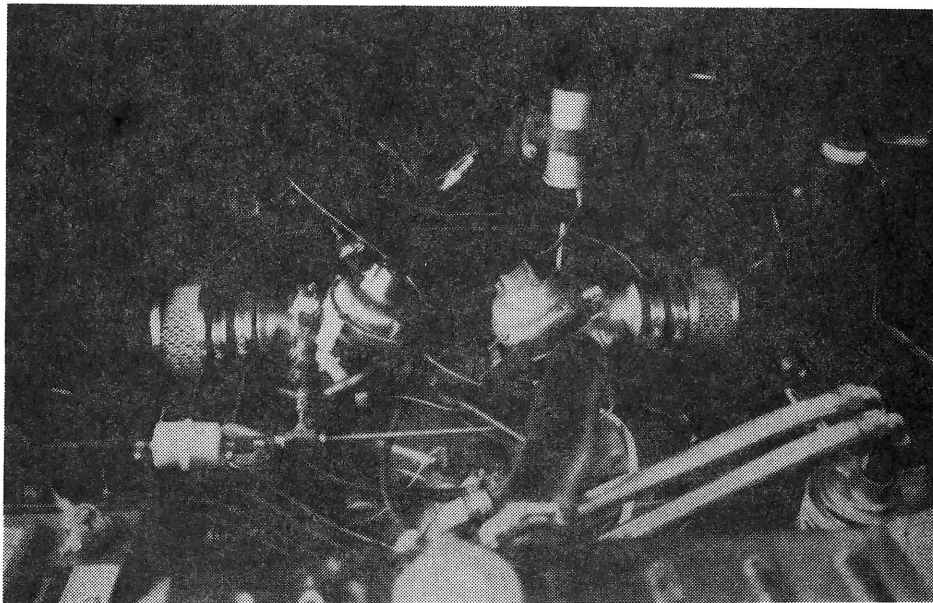
V-8 POWER

FOR AN EX-NATO ROVER

by Glen Foster

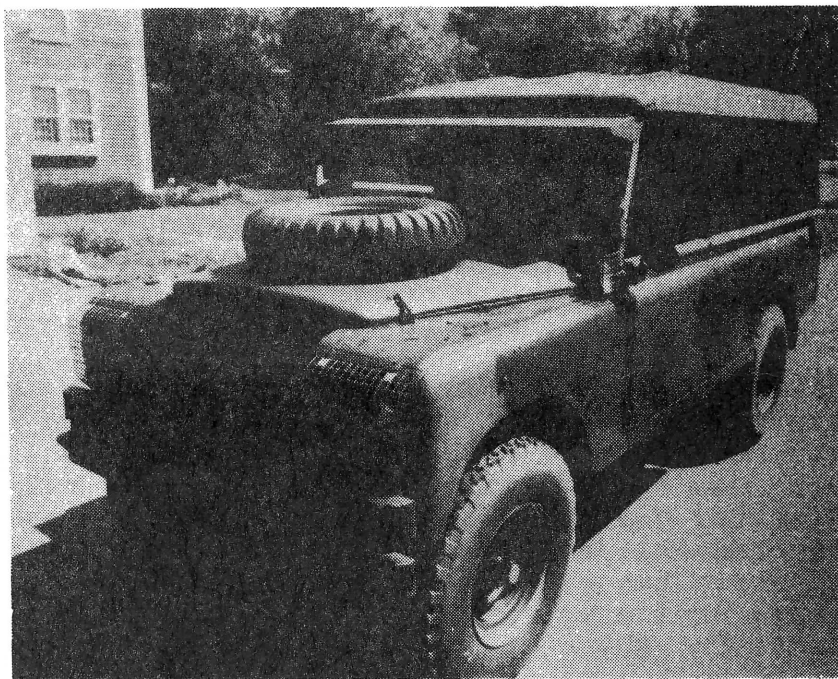
Last winter I made the decision to do an engine swap on my '71 ex-NATO 109". I had boosted the power on my four cylinder with a two-barrel and headers but was still not satisfied. I considered going the turbo-charged route but felt that since most of my off roading is done on very soft, sandy beaches, I would still not be getting the low-end torque I desperately needed. Also, with 16" wheels widened to 8", 255 BF Goodrich TAs, and a Bearmach overdrive, my Land Rover requires lots of power to get to a respectable highway speed. I want to get to the beach today, not next week.

The answer for me was a V-8 engine swap. All the work was done by D.A.P. Enterprises in Wareham, Massachusetts, who also supplied the Range Rover 215 cu.in. V-8 engine. From the month of March to the month of June, my 109" was a permanent fixture in their garage. The modifications to make the V-8 fit included remounting the transmission one inch to the side, relocating the steering column and relay box, and moving the brake and clutch pedal assemblies. The firewall was also modified to clear the exhaust manifolds. The exhaust system was done in stainless to resist the salt atmosphere on the beach and, of course, the road salt in the winter. The stock radiator was used with one modification; the top tank was refitted with a larger diameter pipe to match the V-8 radiator hose. Since there was limited clearance between the water pump pulley and radiator, an electric fan was mounted in front of the radiator instead of the usual engine driven fan. A remote oil filter set-up was used since the stock oil filter on the engine dangled dangerously close to the front diff. In order to keep a low profile under the hood, two small air filters were used in place of the stock unit.



All said and done, and despite minor problems, the new power plant is just what the doctor ordered. There is plenty of torque available for the sand and on the road there is wheel spinning power enough to turn heads at the traffic lights. My gas mileage went from 13 mpg (or worse) with the four cylinder, to 20-23 with the V8. That extra mileage comes in handy on long trips where gas will get devoured on the beach.

It wasn't all goodness and light. There have been problems to work out. It now takes a little more caution to manuver the steering wheel in haste. Since the steering column has been relocated more towards the outside of the vehicle, the door becomes a sure elbow-banger for the unknowing driver. The exhaust runs close to the floor in places, so it gets a little warm in places. Well, this winter it should be useful as a foot warmer. Come summer, well....

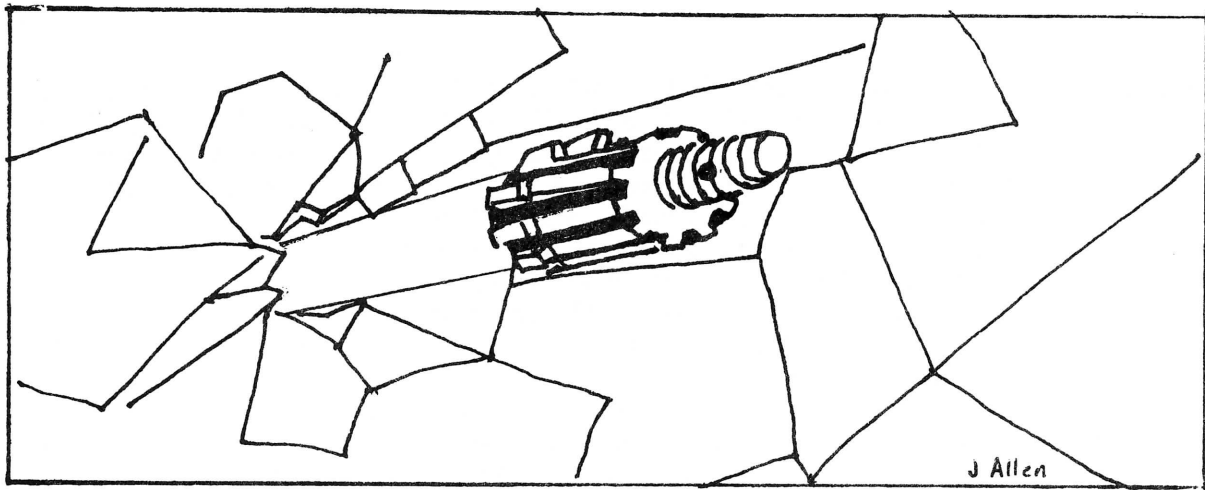


* ATTENTION WIERDOS *

If you have ever wanted to learn how the British military trains its personnel to destroy Land Rovers, send a self-addressed envelope with 22 cents postage and a photo of your Land Rover for the "Rover Revue" column and you will receive copies of this information excerpted from RAF manuals. Only a pervert would enjoy them!

* ATTENTION KOENIG WINCH OWNERS *

The Workhorse recently got hold of the installation, parts list and operators instructions for the Koenig "King" winches for Series IIa and Series III Land Rovers. These are the Koenigs that run from a PTO in the transfer case with a driveshaft that runs forward to the winch. We will be glad to send you photocopies if you send us a self-addressed, stamped 9x12 manila envelope with 39 cents postage and a picture of your Land Rover for the "Rover Revue" column. Also tell us if you have a Series IIa or Series III; there is a difference in the winch installation and parts lists.



PEOPLE WHO LIVE IN GLASS HOUSES SHOULDN'T BREAK AXLE SHAFTS

by Andrew McKane and Richard Gabatino

Picture yourself at a stop light waiting for the light to change. The light turns green, you slowly let out the clutch, the engine speeds up but you don't move forward. You double check to see that the shift lever is in first gear, which of course it is, and you try all over again as the horns begin to honk behind you.

You're on your way to work, running a few minutes late, and while backing out of the driveway, you hear a loud snap. You give the car more gas, the engine speed up and nothing happens. You start using all of the words that your parents never taught you.

What do these two unfortunate situations have in common? Have they ever happened to you? Do you drive a Land Rover? If you are one of the more fortunate Land Rover owners who has not experienced a broken axle shaft and all of the attendant frustrations, hang on to your Pith helmet because you probably will. You've known for years that Land Rovers are reliable vehicles, that they are closest to perfection this side of heaven. Could someone have been pulling your leg? It is a well known fact that the rear axle shafts are not as perfect as the rest of the vehicle and your Land Rover axle shafts will continue breaking as assuredly as the San Andreas fault.

Why then, do Land Rovers break axle shafts so readily? Could it be to protect the remainder of the drivetrain, to make a profit selling new shafts, or a fact of life for yesterdays' four wheel drive vehicle. The fact of the matter is that in its role as a heavy duty workhorse, the Land Rover is frequently subjected to grueling and arduous tasks beyond the sphere of most other four wheel drive vehicles. Axle shafts don't just break, they fatigue in time. Using the vehicle on high tractive surfaces will accelerate this fatigue. The problem arises from what is known as transmission windup.

Transmission windup is a term used to describe excessive torque buildup in the drivetrain of a motor vehicle. When the vehicle is used in four wheel drive in anything other than a

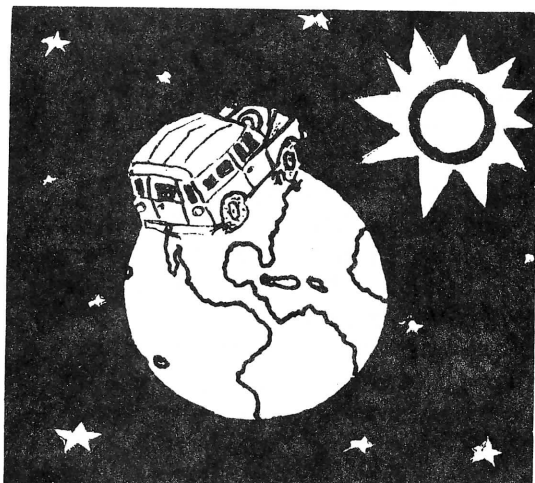
straight line, the rear wheels travel a greater distance than the front. Because the early Land Rover were not fitted with gearbox differentials, the rear wheels, going a greater distance, make the rear axles take most of the strain. If a vehicle is fitted with different diameter tires front and rear, the problem is compounded. The same is true for vehicles fitted with larger, more tractive tires. The heavier the wheel and tire combination, the greater the inertial forces which prompt the fatiguing of the axles. An out of balance or out of round wheel can also have a damaging effect.

Even the best Land Rover driver has been known to break an axle shaft but is there anything you can do to help the situation? Yes, and here are a few suggestions: first, don't use four wheel drive on high tractive surfaces; don't take on too much rough stuff in two wheel drive and don't lend your Land Rover to inexperienced drivers. Also, you might consider replacing your axles every 3 years or 36,000 miles as a precaution.

It can be a tribute to your sense of humor as to how you handle a broken axle shaft. Of course, the responsible person doesn't want to be late for work, but better on the way to work than in the outback. A Land Rover will always take you where you want to go, when you want to go there. The quality of the vehicle is such that broken axles will probably be the only problem you will encounter in a lifetime. Your lifetime! Sure, your Land Rover may leak a little oil now and then, but it keeps the undercarriage from rusting. After all, nothing really is perfect this side of heaven.

THE SUN NEVER SETS

by R.P. Allen



J. Allen

Once upon a time it was true; "The sun never sets on the British Empire." Alas, Anglophiles, this is no longer true. In 1946 when Maurice Wilks and his brother Spencer decided to improve on the wartime Jeep, the Land Rover was born. Since that time, over 1.3 million have been built and exported to 150 countries. Though it may be sad (to Anglophiles) that the sun does set on the British Empire, all Roverites may rejoice in knowing for certain that; "The sun never sets on Land Rover!"

FROM THE HUBS UP

The Land-Rover Axle

by Jeff Sparks

(excerpted from the December 1977 issue of " Review ", magazine of the Land-Rover Owners Club of Victoria)

" Last week I broke my axle - in the main street !"

How often have you heard this sort of statement from a Land-Rover owner? More than once, most likely. But do Land-Rovers and broken axles go hand in hand? Let's examine the situation more fully.

The Semi-Floating Rear Axle

When the first Land-Rovers appeared around 1948, they were fitted with a "semi-floating" type of rear axle arrangement, which continued to be used up until 1957. With this axle arrangement each of the two rear axles (half shafts) has a flange on its outer end which supports the wheel and hence the vehicle. One wheel bearing is used for each rear wheel. This is located in a carrier adjacent to the flange end.

The axle thus not only provides the turning motion (torque) to propel the vehicle but also supports the weight of the vehicle. This arrangement is still commonly used in motor vehicles. Up until a few years ago, in fact, the main competitor to the Land-Rover in Australia, the Toyota Land Cruiser, still uses this system.

The semi-floating axle system though has a number of disadvantages when used on a 4WD vehicle. Chief amongst these is that in the event of axle breakage, the vehicle can become completely immobilized (can't even be towed) and in the extreme case the axle may cause the corresponding wheel to actually leave the vehicle - not desirable, especially on steep tracks!

Standard Land-Rovers up until 1957 had either a 1.5 litre (11hp) or a 2.0 litre (15hp) engine. This combined with their lighter mass (unladen) compared with later models meant that axle breakage was rare (ie., axles not highly stressed). When axle breakage did happen, though, the situation was difficult and expensive to rectify.

In the relatively rare instance of Series I (1948-1957) axle breakage investigation usually shows that the breakage had been caused by external factors rather than major engineering design inadequacy. Typical contributing factors are:

- a) gross vehicle overloading
- b) poor driving habits
- c) replacement of original engine with one of more power
- d) axle fatigue due to old age.

The "Fully Floating" Rear Axle

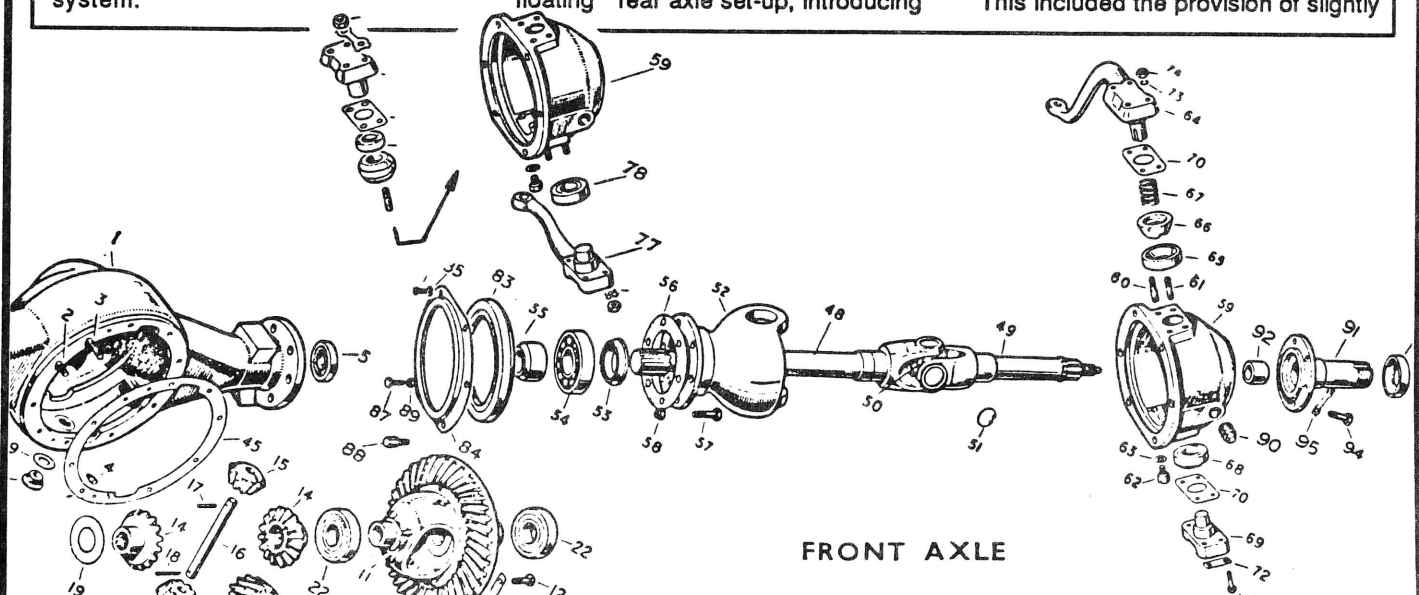
The Rover Company recognized the advantages offered by a " fully floating " rear axle set-up, introducing

this as standard from 1958. With this arrangement each of the two rear axles is used purely to transmit torque - the vehicle weight is supported by two separate bearings inside the wheel hub.

The "fully floating" axle used by Rover, however, had virtually the same torsional strength of the earlier "semi-floating" axles and because it is the torque and not the vehicle mass on the axle which causes failures, breakages still occurred. In fact the breakages became more common. The Series II had arrived - a heavier and more powerful vehicle. At least now, though, when an axle did break it was a relatively easy and cheap job to replace it, and the wheel couldn't fall off !

The strength of the axles in normal use fitted as standard was adequate, although barely so, on the LWB 109. Through the sixties, Land-Rovers gained a reputation for weak back axles. Many causes of breakages though can be traced to vehicle abuse, overloading, poor driving habits, etc., but the safety margin wasn't great.

The year 1967 saw a few changes to the models available and the rear axle set-up. A 6cyl (2.6 litre) LWB was introduced. As well, the transmission was generally strengthened in all models ("plus 35"). This included the provision of slightly



FROM THE HUB UP

stronger back axles. These were of the same physical size as the previous ones but used a supposedly stronger material.

Axle failures in LWBs increased. The heavier and more powerful 6cyl placed more stress on the axles. As well, drivers tended to load the new vehicle more and drive it harder. Land Rover's axles-breaking reputation consolidated and the market percentage slipped (not due entirely of course to the rear axle problem).

In 1972 the problem was finally recognized and solved - in the LWB at least. The introduction of a completely new and much heavier rear end ("Salisbury diff") cured the problem. Meanwhile, SWBs continue to be produced with the same rear end virtually as in 1958. Their generally lighter all-up weight, 4cyl motor and different performance characteristics mean however that axle breakages in SWBs are fairly rare although vehicle abuse will hasten the axles' demise.

Description of Land-Rover rear axle arrangements would not be complete without mentioning the "ENV" differential. Like the later "Salisbury, the "ENV" is a heavier rear end of different design to the standard Land-Rover set-up. The optional "ENV" differential appeared around the mid-sixties; however, production ceased a few years later. There are however a number around, especially in Forward Control models.

Mode of Failure

The normal mode of failure of Land-Rover axles is spline failure. Repeated stress application at , or

above, the yield point of the material opens fatigue cracks at the base of each spline. Associated with this failure can also be torsional failure of the axle evidenced by noticeable twisting of the splines. The failure in the vast majority of cases is one or a combination of both the above modes affecting the inner splines of the axle. Once failure has occurred the end of the axle usually remains in the diff, while the main part of the axle can be withdrawn. Subsequent removal of the diff to recover the spline end and fragments may then be required.

Minimizing The Chance of Axle Breakage

If your Land-Rover has a standard Rover rear axle (not Salisbury or ENV and most likely a SWB or a pre-1972 LWB), you could someday break a rear axle especially if you use your vehicle extensively in the rough - if you haven't already done so - , but there are ways of minimizing the risk.

Ensure the axles are in good condition. Axles do not last indefinitely - they eventually fatigue. A life of 100,00 miles appears to be a reasonable figure. This could be much shorter or longer depending on the type of driving undertaken. If the axles are approaching this mileage, or show signs of excessive wear, or have a slightly twisted inner spline, it should be replaced before a breakage occurs. New axles are relatively cheap and are easy to fit if the old axles are intact. A broken axle is harder to replace and is usually inconvenient. It could also lead to diff damage. Check the axles regularly, especially after rough trips.

Do not overload the vehicle. This applies especially if you're tackling rough rocky terrain. Refer to the handbook for recommended loading. You could be surprised how much your vehicle weighs when loaded and put on the local weighbridge.

Driving With a Broken Rear Axle or Rear Differential

With a Series II-and-onwards Land-Rover, if it is inconvenient to repair the damage immediately or the required parts are unavailable, the vehicle can still be driven (2WD only!) without any major worries, but unless the following points are observed, you may cause further damage or alternatively not get home at all !

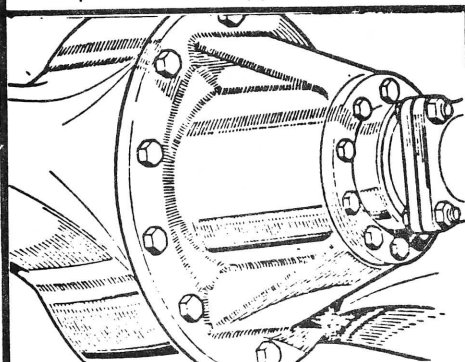
- a) establish problems and if anywhere in the back axle assembly (ie., axles or diff) remove both axles and rear propeller shaft.
- b) refit drive flanges minus axles and ensure there is adequate hub bearing lubrication (grease if necessary) and also ensure that the lubricant will not escape or become contaminated, eg., via dust entering under the hub cap.
- c) engage free wheeling hubs (if fitted) and select 4WD (yellow knob). Avoid low range.
- d) drive off normally but be aware of changed handling on account of front wheel drive only. Traction will also become less than rear wheel drive.

Axle Repairs in the Bush Rover-type Differential

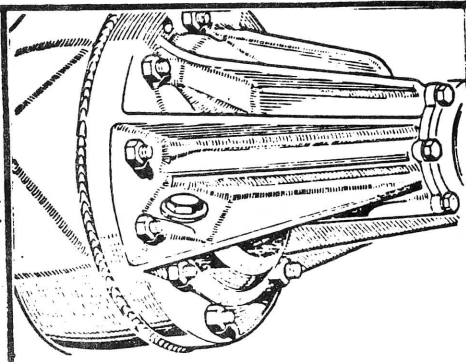
These can be - and have been many times - undertaken in all sorts of places in the bush. As well as some mechanical knowledge and perseverance you require:

spare axles (1 short or 1 long); diff bajo housing gasket; cleaning fluid (petrol will do); replacement diff oil; various hand tools (normal tool kit). All these items are easily carried in your vehicle "just in case". This applies even if you have no mechanical aptitude as there may be someone else around who has.

From past experience, owners of Salisbury and ENV diffs need not bother carrying spare axles etc., as



ENV type differential



Rover-type differential

FROM THE HUB UP

these rear axles virtually never wear out unless the oil runs out!

Before concluding, it is worth mentioning another couple of points : **Drive Carefully**

This applies especially when ascending steep rocky hills. It is under these conditions that most axle damage occurs although the axle might not actually break for sometime afterwards (eg., at home in the main street!). One of the most common axle damaging situations is where the vehicle is bouncing up a rocky track with wheels intermittently spinning clear of the ground and then suddenly connecting with a solid surface - for instance a rock.

Sensible use of the engines torque (especially if a larger-than-standard engine is fitted) along with smooth clutch operation is required if maximum axle life is to be achieved.

Replacement of Axles (Not Salisbury or ENV)

Axle inspection or the replacement of a worn or twisted axle is simple. The vehicle does not even have to be jacked up. The procedure is:

i) remove the six bolts with washers holding the hub drive-flange to the hub. These are 3/8" BSF. (Ensure that the handbrake is off and vehicle is out of gear with wheels chocked before starting)

ii) prise the hub drive-flange off the hub with screw driver or other suitable tool.

iii) remove the drive-flange complete with axle, axle nut, split pin, washer and hub cap.

iv) inspect and/or replace axle and reassemble axle nut, split pin, etc., if hub flange removed from axle.

v) refit axle to housing engaging splines and aligning holes. Ensure the mating surfaces are oil-tight (gasket cement and/or paper gasket) then install and tighten bolts. Note that while the hub drive-flange is removed from the hub, some oil may escape. This is normal and will be replenished from the main diff as soon as the vehicle is driven. Diff oil should of course be checked.

When a broken axle is being replaced, all of the above still applies except that the differential centre usually has to be removed to recover the end of the broken axle. This necessitates removal of both axles and the tailshaft and, although a formidable job, it can be completed in the field in less than two hours. Remember to thoroughly clean the diff and refill with clean oil.

Low Range 2WD

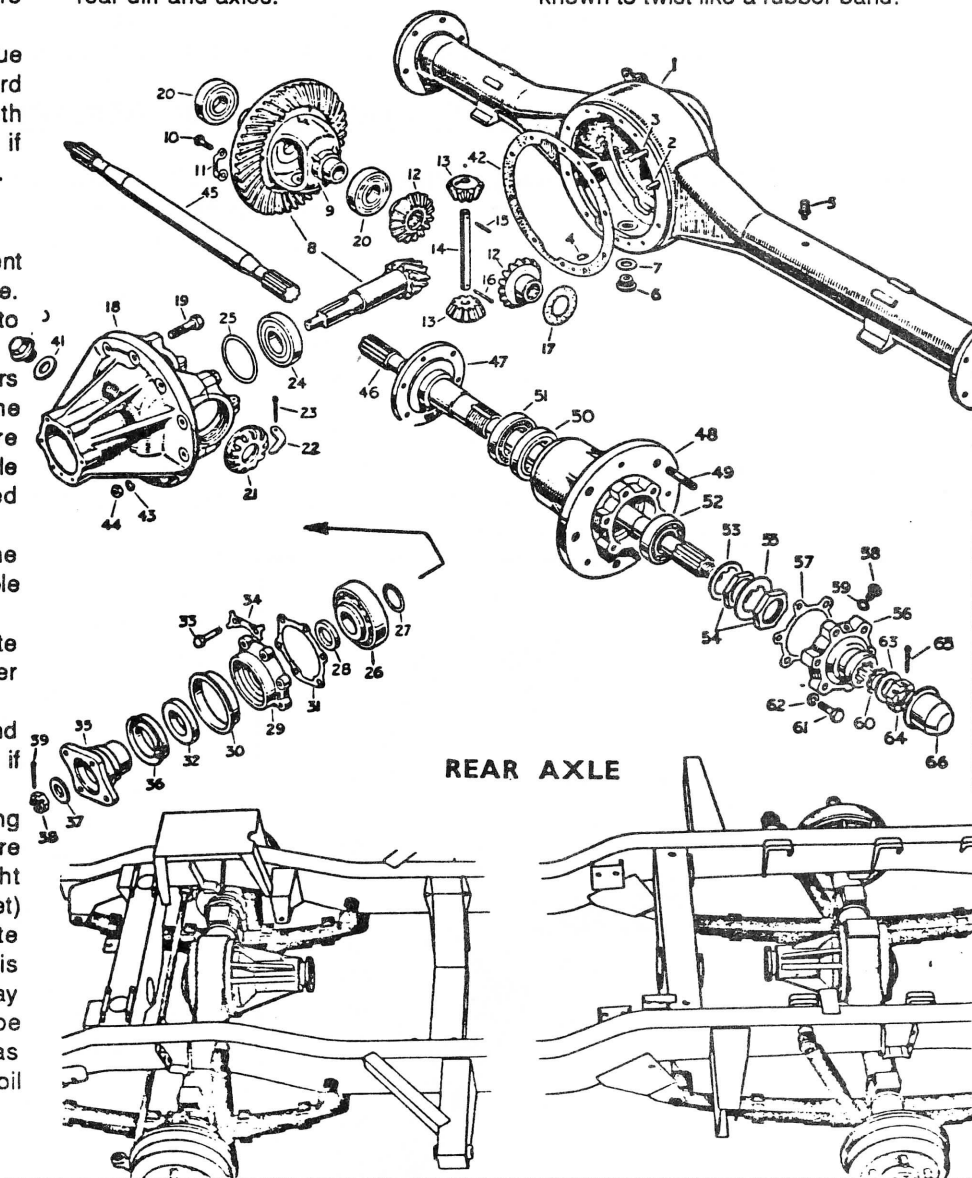
Avoid low range 1st and 2nd without first engaging the free wheeling hubs, if fitted - otherwise excessive torque can be fed to the rear diff and axles.

Free Wheeling Hubs

These can fail - especially the early "MAP" hubs - and effectively negate the front wheel drive. This has the same effect as low range 2WD above and can lead rapidly to axle breakage.

Types of Replacement Axles

Stick to genuine Leyland "plus 35" rear axles. These aren't very much more expensive than some of the non-genuine axles around. While some of the non-genuine axles are quite good (even better perhaps than the genuine Leyland unit) some of the others are rubbish. Some have been known to twist like a rubber band!



REAR AXLE

Land - Rolling

THE ART OF STAYING IN ONE PIECE

by Jim Allen

There is no such thing as a good roll over, but if you can walk away from one you might say, "Thank goodness I took the time to prepare." Yes, you can (and should) prepare for the worst. By now some of you are scoffing, saying, "Heck, I bin drivin' off-road fer twinny yers 'n never had a problem." Well, good for you! Maybe you are an exceptional driver or have been lucky (maybe a little of both). The fact is, off-road driving can be a hazardous business and sometimes despite every precaution, accidents occur. Don't forget the human factor either; we all make mistakes. Another myth concerns the strength of the Land Rover top. While it offers good protection from the elements, it can hardly be considered the ultimate safeguard. In relatively mild situations, it will hold up enough to protect the occupants. In a serious multiple roll, it is highly likely to be torn off (there really isn't much holding it to the rest of the LR is there?) Read on and learn more about protecting you and your passengers from injury in rollovers and other accidents.

YOUR FIRST LINE OF DEFENCE

"Okay," you ask, "what can I do?" The answer to that lies partly with your pocketbook and partly with your conscience. When it comes to buying that Weber 2-barrel or a good set of safety belts, what are you going to do? Seat belts should be considered your first line of defense against injury in a roll or any other kind of accident. The bare minimum is a set of lap belts which will keep you within the vehicle, but will not prevent your upper body from thrashing around the interior of the Rover or hanging out that shattered drivers side window. The factory shoulder belts are only a little more protection, as they still allow too much movement side to side. Your best protection lies with a four way racing harness.



This setup will keep you well secured from all angles. Most manufacturers offer a quick-release feature that will allow for a hasty exit from your rolled Rover if that becomes necessary. Did you know that almost every OEM seat belt will not release with a strain on the latch? Imagine hanging upside down and not being able to release the belt! The illustration shows the PYOTECH racing harness. Another factor to consider is the age of your

LAND ROLLING (continued)

current set of belts, whatever the type. Age, stress and ultraviolet light has taken a toll on these belts. They may be reduced to a mere 50% of their original strength by these effects. Look closely at the way your belts are mounted. A belt looped through a slot in a flat piece of steel may be cut if sufficient force is supplied. Properly mounted belts have plastic buffers between them and their mount. Eye bolts are the best way to mount seatbelts. They allow for movement and retain 100% of the belt strength at any angle.

YOUR SECOND LINE OF DEFENCE

Next to a good set of belts, a good roll bar, better yet a full roll cage is your best bet to survive the unspeakable. They will provide protection from a roll and in some cases from a collision. The most commonly seen roll protection for Land Rovers is the single tube roll bar. This type of roll bar (see illustration below) offers good protection in all but the most severe situations. In conjunction with the factory hardtop, you could consider yourself adequately protected. The weak point is the windshield frame and firewall area. With your top off, the windshield frame loses much of its structural integrity. For hardcore off-roaders who often go "topless", a full cage is the safest bet (see illustration below). The one hitch to



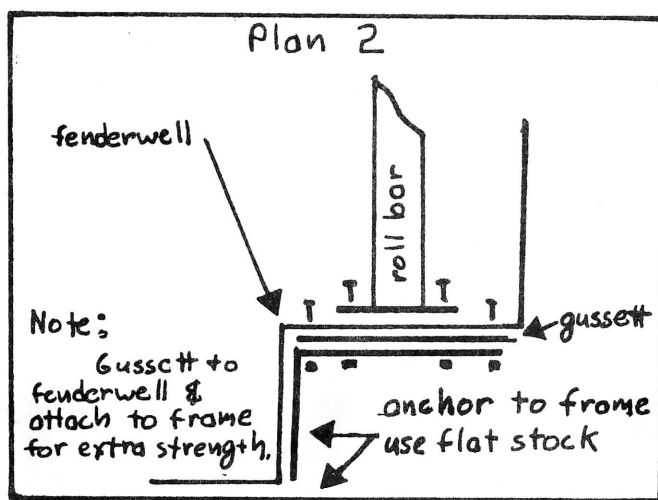
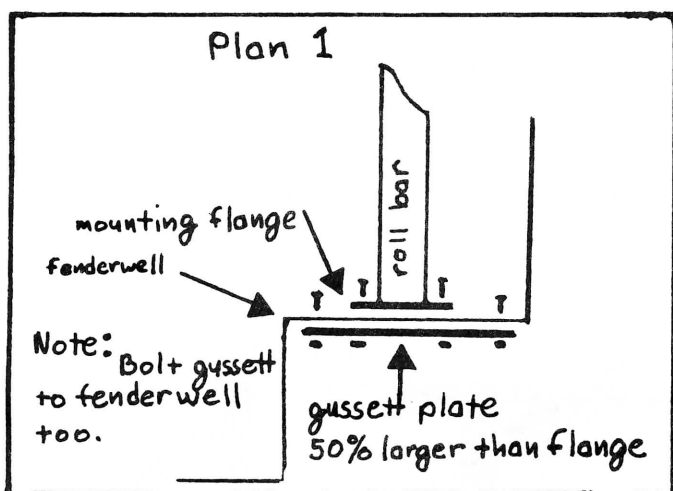
obtaining a roll bar is that there is no one in the U.S. currently producing them other than on a custom built basis. Smittybilt, a large producer of roll bars and off road equipment, built bars for Rovers some years ago. A phone call to them yielded a small hope. They stated that if sufficient interest were generated, they could produce them again. All they would need is a minimum of ten orders and a vehicle to take measurements from. Interested, write to: SMITTYBILT, Inc., 2124 N. Lee, South El Monte, CA 91733 or call them at (818) 442-1788.

Some owners have modified bars from other vehicles to fit Land Rovers. Richard Brengeman, #43, ordered a Toyota Land Cruiser rollbar narrowed by 4 inches. He reports that it fits

LAND ROLLING (continued)

well on a stripped out interior but might need to be narrower if used with a Deluxe Interior. Of course, custom bars can be built by welding specialty shops with heavy pipe bending capability. Beware of "show bars" or "light bars". They are merely exhaust tubing bent to look like roll bars and only good for show. Also, watch out for chrome roll bars: they are not as strong as the painted type due to being made brittle by the chroming process.

When installing a roll bar, always use hardened bolts (grade 8 or better, and be sure to gusset where it is mounted. This prevents it from tearing away from the fenderwell where it is mounted (see the illustration below for some ideas on how to do this). Once your bar is installed, buy a padding kit and pad that sucker. If annoying bumps on the head during everyday use doesn't cause brain damage, slamming your head into it in a serious situation will.



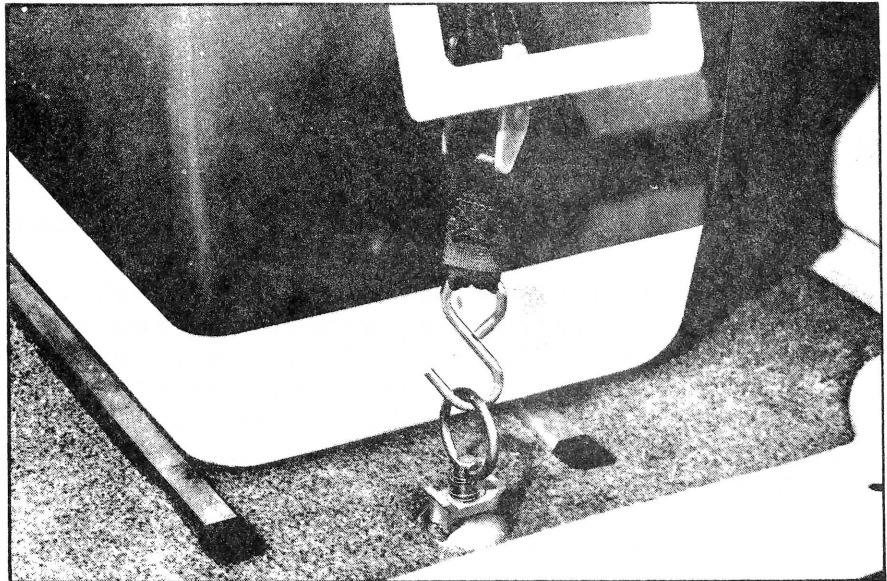
YOUR THIRD LINE OF DEFENSE

Massive head injuries can develop from loose gear careening around the inside of your Rover as it rolls. Secure all your equipment as if you expected your Rover to be parachuted from a C-130. If loose equipment rattling around the back of your rig isn't annoying in itself, the safety aspect alone is reason enough. The picture on the following page shows one rather slick method of securing gear. All loose gear too small to be secured by itself should be put into another container, such as a plastic milk case, and tied down.

SUMMING UP

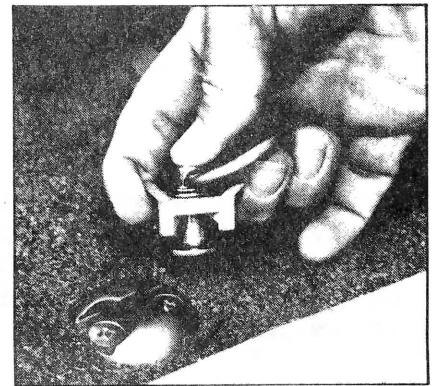
If you follow the guidelines in this article, you will better your chances of surviving a serious rollover and make a minor one something you'll be able to yarn about sitting round the campfire. Just remember, all the preparation in the world can't protect you from careless driving! Use your head or lose your head!

LAND ROLLING (continued)



Ancra tie-downs and anchors help keep the gear cinched down inside the vehicle while off-roading.

The spring-loaded anchors can be removed from the base, keeping the cargo space open. The aircraft grade hardware is more than tough enough for off-roading.



APPENDIX

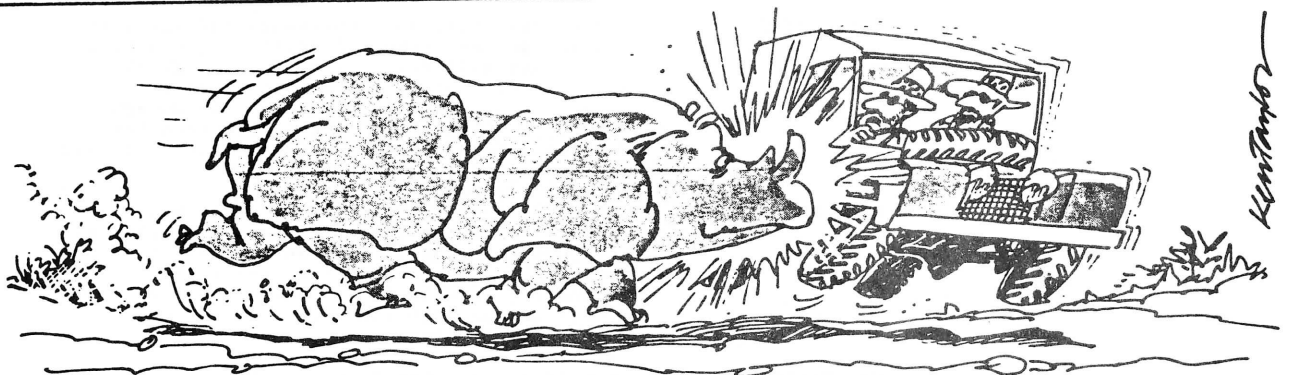
ANCRA TIE DOWNS
Motorsport Accessories
2233 E. Grand Ave.
El Segundo, CA 90245
(213) 322-7365

ROLL BARS & CAGES
Smittybilt Inc.
2124 N. Lee
South El Monte, CA 91733
(818) 442-1788

COMPETITION SEAT BELTS
Pyroprotect Racing Safety Equipment
3400 East 42nd Street
Minneapolis, MN 55406

or

Sears Roebuck & Co.
Look for current
RV Catalog



ENGINE TUNE-UPS (Part I)

A Professional Approach

A professional mechanic works against the clock. He must complete his work in a reasonable amount of time and go on to his next job. At the same time, he must do the work correctly, the first time. To achieve this, the true professional never loses his cool and is always thinking a step or two ahead. Before he picks up a wrench, he has thought out the job and devised an order so that one operation leads to another until the job is done.

Anyone who works on his own Land Rover, or wants to start, can benefit by adopting a professional approach. The rewards can be many, not the least of which is the elimination of much of the "aggravation factor" when working on your vehicle. Granted, problems will come up but with the right attitude towards working on your Land Rover, any problem can be overcome with a minimum of irritation.

Keep It Safe

Working around running engines is more than sufficient cause to always know where your hands are going. Keep loose tools around the engine compartment to a minimum. Knocked into the fan, they can become formidable projectiles. Before starting, always be sure the vehicle is in neutral and the parking brake applied. Any spilled fuel should be immediately cleaned up and the area ventilated. These are all common sense items that you probably already know, but bear repeating. There are quite a lot of mechanics (and ex-mechanics) missing fingers, toes, and eyes who too knew the rules, but in an instant of forgetfulness, had an accident.

Operation #1 Remove the Spark Plugs

This is a simple operation. Take a look at those plugs as you pull them out. They can tell an important story about your engine's operating condition.

Use this chart
to "read"
your spark plugs

NORMAL:	Grey-brown in color. On plugs nearing the end of useful life, electrodes may be worn and appear rounded. Gap will increase approximately .001 per 1000 miles. Some deposits OK after lots of miles on the plugs, especially on older engines.
OVERHEATED:	Due to lean mixtures, over-advanced ignition timing, or heat range of spark plug too hot. Electrodes will have a blistered or glazed appearance. Porcelain core nose may be extremely white in color and may be damaged due to pinging in the case of advanced timing. Plugs in the conditions described above should not be reused.
RICH CONDITION:	Plug may be sooty black or wet with gas. Usually caused by over rich fuel mixtures but may look the same if some sort of ignition failure has occurred on that particular cylinder. In mild cases, the electrodes may appear normal, but the core nose and outer edges will be black.
OIL FOULED:	In mild cases, this is apparent by brown deposits covering the electrodes. In more severe cases, the plug may be wet and oily.

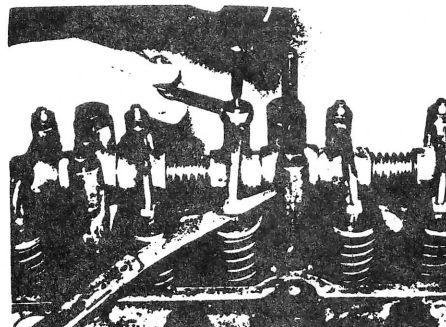
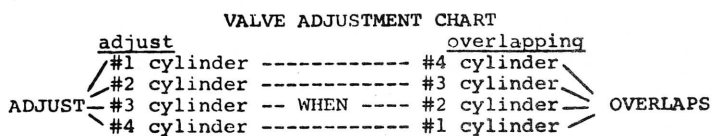
Operation #2 Valve Adjustment and Compression Test

This sounds more difficult than it really is. If you've had problems using the methods most commonly printed, pay special attention to this section.

The primary reason to run the valve clearances at this particular time is to make the compression test as accurate as possible. A valve with too little clearance can lower the compression readings. Also, with the spark plugs removed, the engine is much easier to turn by hand. To turn the engine, use your hand crank; using the cooling fan works just as well. If you use the fan, you may have to push down on the belt if the fan pulley slips. Another method for turning an engine over (also the least convenient) is to slip the vehicle into third or fourth gear, release the brake and move the whole vehicle. The engine will turn according to how far you move the vehicle.

The first step in adjusting valve clearances is to remove the valve cover. This is a simple operation, though a few words on gaskets are in order. DO NOT reuse an old, cork gasket. Cork deteriorates rapidly and is not a safe bet the second time around - even if it looks decent. If you can, buy the neoprene type. They can be reused many times, and are less likely to be a problem. After scraping the old gasket from the cover, glue the new one to the valve cover. Do this before you adjust the valves to allow the glue time to dry. Use contact cement. (Both Fel Pro and 3M make a gasket adhesive that works well). Don't leave any pieces of the old gasket in the valve cover or on the head. They could cause severe engine problems if they found their way into the wrong places. Don't forget to take a look at the rubber grommets at the top of the cover. They may weep oil if badly deteriorated. A little silicone sealer on them will assure no leaks.

Probably the toughest part of this operation is getting the engine in the right position to adjust them. The idea is to get each cylinder at TOP DEAD CENTER on the compression stroke, and then make the adjustments. The easiest way to do this is by watching the movements of the rocker arms. Say you want to adjust the valves on #1 cylinder. To get #1 on TDC (top dead center) you need to watch the rockers on #4 cylinder as you rotate the engine clockwise. #4 is opposite #1 in the firing order (1-3-4-2). When you notice the exhaust valve on #4 coming up, watch closely. Just before the rocker on the #4 exhaust valve comes fully up, you will notice the intake begin to go down. STOP. Where the two meet in their travel is where you want to stop and adjust the valves on the opposite cylinder. To continue, move the engine one complete turn clockwise and you'll notice the valves on #2 cyl "overlapping". Stop and adjust the valves on #3 cyl. Simply carry on according to the firing order (above) until the operation is complete. Once you get the hang of it, it won't be necessary to start on #1. You will be able to pick up the right valves just by watching for the overlap.



Sometimes getting the clearance correct can be a problem, so a short discussion might be in order on this topic. Once you are set up to make the adjustments, run a .010 feeler gauge between the tip of the valve and the rocker arm. It should just slide through with some resistance. If the clearance is too small, it will be difficult or impossible to get the gauge between the valve and the rocker. If the clearance is too great, of course, the gauge will slide around easily. One wasy way to tell if the clearance is correct, is to insert the gauge and try to move the rocker. If any movement is felt, the clearance will have to be adjusted.

Operation #3 Running the Compression Test

This test gives an indication of your engine's overall condition and should be done regularly. As stated earlier, the valves should already be adjusted prior to running this test.

There are two types of compression gauges commonly available. One is a screw-in type and one a push-on type. The first type is generally more accurate, but more expensive. The push-in type is a little more difficult to use as it must be held tight in the spark plug hole while the engine is cranked.

To actually perform the test, make sure the Rover is in neutral, then insert the gauge (in the spark plug hole) and crank the engine over with the starter until the gauge has stopped climbing. Record the reading and proceed to the next cylinder. Generally, if the readings are within ten pounds of each other, they are considered "perfect". Any cylinder that reads greatly different from the rest should be suspected of trouble. Service manuals show that 145 psi is a normal reading for a Land Rover engine with the 7.1 compression ratio. Readings lower than this, as long as they are fairly even, aren't necessarily cause for concern as long as it runs well and oil consumption is reasonable. "Reasonable" oil consumption is difficult to define and is subject to many differing opinions. Based on the author's experience, a Land Rover engine that uses more than a quart of oil per 600 miles should be looked at suspiciously. If compression is good, but oil consumption is high, valve guides or valve stem seals are a likely cause.

Operation #4 Distributor Service & Inspection

This can generally be done with the distributor installed. There are some problems that might necessitate removing the distributor to correct. We will discuss service procedure with the distributor still in the vehicle first, then proceed to the out-of-the-vehicle repairs.

Plug Wires

Before removing the cap, look at your spark plug wires. Are the wires in good condition externally? Do the plug boots fit tightly on the plugs? Are the distributor end boots in good condition and tightly fitting? If not, this is a good indication that it is past time for replacement. For further checking, you must determine whether the wires are carbon core or wire core. Wire core wires, as the name implies, have metal wire through the center to conduct the electricity. Carbon core have a black string of carbon running through

the center. Pull back the boots on either end of the wire and look near the metal connector to determine which type you have.

To check carbon core, you must use an ohm meter set on the 1000 ohm scale. Connect the leads of the ohm meter to each end of the wire and measure the resistance on the 1000 ohm scale. A rule of thumb when measuring carbon core is that they should measure close to 2000 ohms per foot. An infinity reading usually means the wire is broken somewhere inside the insulation. A very high reading means that the core is breaking down and causing high resistance.

Wire core wires are much easier to check. The wire in the core almost never breaks, Usually, the insulation rots away from the wire. If there is some doubt, they can be checked with an ohm meter, and will show a "zero" or close to zero reading on the 1000 ohm scale. The most important thing to remember about wire core wires is to ALWAYS USE RESISTOR SPARK PLUGS. For ignition system efficiency there must be some resistance in the secondary wiring. (Secondary wiring is the plug and coil wires; Primary is the small wire to the points from the coil). A good analogy to explain why secondary resistance is necessary is to use a water hose as an example. With no obstruction at the end of a hose the water flows with little velocity. If you put your thumb over the end, you'll notice a remarkable increase in velocity. Resistance in the plug wires (or in the plugs themselves) forces the coil to produce much greater voltage to overcome it. This results in a much hotter spark at the plug.

ROTOR AND CAP

These can be checked visually and with an ohm meter. First, look inside the cap and check for any cracks. If any are evident, toss that cap in the trash! Any dust or foreign matter should be cleaned out with electrical cleaner or blown out with air. Hot soapy water works well if the cap is carefully dried afterwards.

Look at the center electrode. If it is chipped or eroded, replace the cap. Also take a gander at the other four electrodes. They will look corroded to a degree and this is natural. This occurs because the spark has to jump from the rotor tip to the electrodes; they don't actually touch each other. When they look badly eroded and caked with white powder, it is time for a new cap. Under NO circumstances should you scrape the electrodes. All you will succeed in doing is to increase the rotar gap and cause more arcing to occur, usually with destructive results to the cap & rotor.

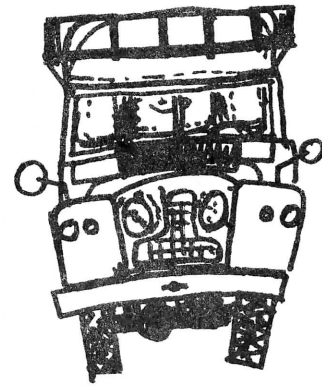
Sometimes a cap will have a break between the contact inside the cap and the one outside. To check, use your ohm meter, on the 10 ohm scale, and connect one end to the inside contact, and one to the outside contact (using a probe). There should be almost no resistance. If there is high resistance or an infinity reading, replace the cap.

Checking rotors is easy. Look for cracks, and at the rotor tip. The rotor tip will look somewhat pitted normally, but again, if it is badly eroded, replace it. The same rules apply with regard to scraping as with the cap. Check the top contact of the rotor (where the carbon button in the cap touches it) for abnormal wear or pitting.

Here's a little trick to remember when troubleshooting a no spark condition. If you have spark from the coil wire, but none from the plug wire, be sure to check the rotor for cracks. Sometimes, the rotor will crack inside and will ground to the shaft of the distributor. It's usually very easy to see by pulling the rotor and looking inside.

continued next issue

Land-Rover



TUNE UP

PART TWO

To get the most from your Land Rover tune-up, a careful check of the distributor is in order. This can be done with the dist. in the vehicle but a much better job can be done with it removed. It is also much easier to work on the bench than hanging over a fender.

REMOVING AND INSTALLING THE DISTRIBUTOR

Land Rover engineers made this task an easy one. The drive cog at the bottom of the distributor shaft will engage only one way. Before loosening the clamp bolt at the bottom of the dist. housing, take note of where the vacuum advance unit is pointing. Make a mark if you like. It will be much easier to get the engine started if the timing is close to where it was. Also, mark the dist. housing so you will know where the rotor was pointing when you removed it. Once you've done these two things, the rest is a simple remove and replace (R&R) operation.

Two tips to be aware of are; leave the clamp bolt a little loose so that you can adjust the timing once the engine is running without fussing with a wrench; you may have to twist the rotor a bit, one way or another, to get the cog to engage with the slot.

CHECKING THE TIMING ADVANCE MECHANISMS

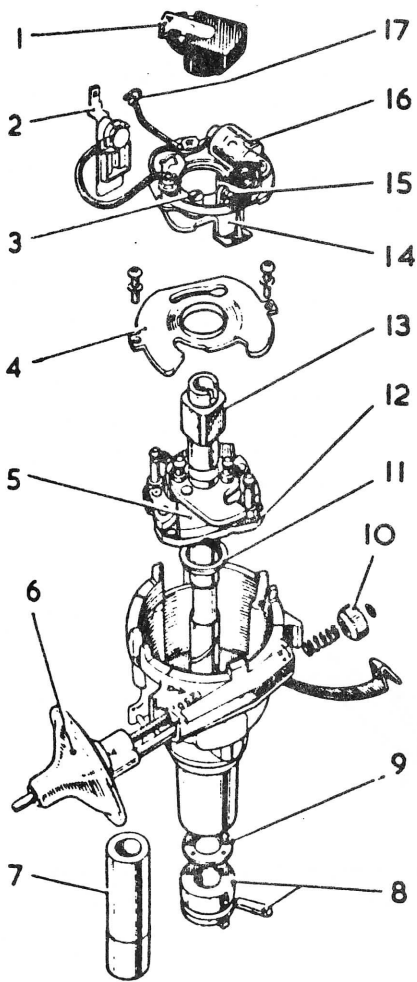
There are two timing advance mechanisms built into the LR distributor. One is a mechanical device that works by the centrifugal force of the distributor shaft as it spins. The other is a vacuum operated setup that advances as the throttle is opened. The later emission controlled Series III LRs had a variation of this. They used a vacuum retard device that retarded the timing at idle. Most of the vehicles so equipped have, no doubt, been converted to the advance type dist. by now. The emission related parts for those later Series IIIs are no longer available, so discussion of their workings is pointless.

Since most of you don't keep distributor testing machines in your garages, we'll discuss the methods of checking a dist. that the home mechanic can use.

To check the mechanical advance, hold the drive cog securely (a vice works well) and twist the rotor clockwise and release. It should operate freely and snap back when released. For continued free operation, a few drops of light oil down the center of the shaft will lubricate the inside parts.

The most common problems are with rust or old, dried lubricant jamming the works. This can be remedied by removing the breaker

ADVANCE MECHANISMS (cont.)



- | | |
|---|---------------------------------|
| 1 Rotor arm | 9 Thrust washer |
| 2 LT terminal | 10 Vernier adjustment nut |
| 3 Fixed contact plate securing screw | 11 Distance collar |
| 4 Contact breaker baseplate | 12 Baseplate |
| 5 Centrifugal advance control weights and mechanism | 13 Cam |
| 6 Vacuum advance control unit | 14 Contact breaker moving plate |
| 7 Bearing bush | 15 Contacts |
| 8 Driving dog and pin | 16 Condenser |
| | 17 CB earth connector |

FIG 1

The primary wiring (primary denotes the low tension wiring; the small stuff) should be looked at for frayed insulation and bad connections. The harness attached to the plastic insulator that slips into the side of the distributor is a common source of trouble when it is allowed to get frayed. A bare wire could kill the engine at a critical moment if it grounds out. This little harness and insulator assembly is replaceable and is commonly available. Remember, the Land Rover distributor is virtually the same unit that is found in non-electronic ignitioned MGBs so parts aren't a real problem.

There is a ground wire that attaches to the breaker plate and grounds to the distributor body (see figure 1). This is an often forgotten item. It ensures a good ground for the points. If yours is missing, you can make one out of 18 gauge wire and solder one end onto the breaker plate and use a crimp on eye fitting for the other end at the distributor body.

plate assembly and liberally dousing the advance assembly with a WD-40 type penetrating oil. You may also be required to work the mechanism by hand until it does loosen up. In the case of broken, missing or worn out parts, distributor replacement might be the only way out.

The vacuum advance is easier to check out. Simply suck on the open end of the chamber. It should hold vacuum and the breaker plate should rotate towards the chamber. Simple enough, eh? The most commonly overlooked problems concerning the vacuum advance are not with the unit itself, but with the hoses or lines from the carburetor. Check them well.

The breaker plate itself is also subject to wear. This is usually easy to detect by trying to move the top plate at right angles to the bottom. A little movement, maybe three or four thousandths of an inch, is acceptable. Too much play will cause a dwell variation; i.e. the points will open a different amount each time. Variation can also be caused by wear in the shaft bushing (see fig. 1). Side to side movement of the shaft in the housing, more than a few thousandths of an inch, will cause variation. Some distributors have replaceable bushings and others may not.

OTHER CHECKS

In this realm, we will look at cam lobes, wiring harnesses and ground straps.

Without proper lubrication, the rubbing block on the points can eventually wear out the cam lobes. It will result in a dwell variation and it is usually very noticeable scoring on the lobes themselves.

INSTALLING POINTS AND CONDENSER

There are two methods of adjusting points. The old "standby" method uses feeler gauges and is accurate according to the skill of the user. The other method uses a dwell meter and is nearly fool-proof. There are some general rules to keep in mind when replacing points. The first is; avoid getting grease or oil on them. Any foreign matter that gets between them can cause arcing and point failure. A clean piece of white paper works well to clean the contacts. Just run it thru until it comes out clean. Another little item to remember is to make sure your feeler gauge is clean before you run it between the contacts.

Installing the points and condenser is pretty much an R&R job. The only tricky part comes when you attach the wiring and condenser to the points. It's easy to accidentally ground out the system when hooking up the wires. Look at figure 2 for the correct way of doing this.

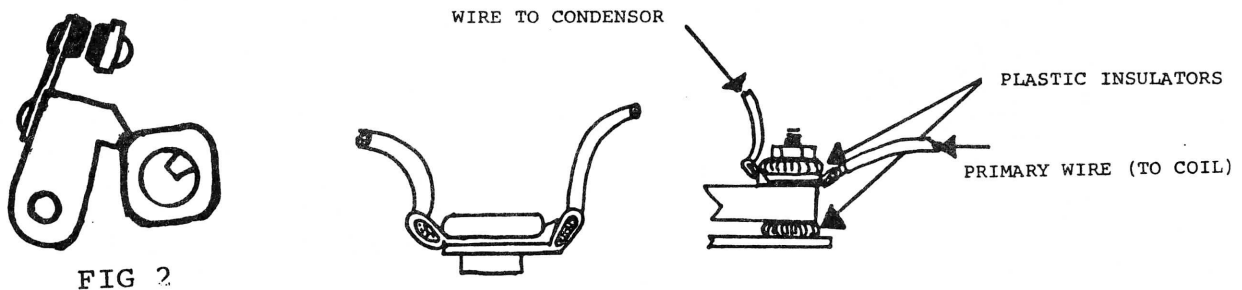


FIG 2

Your first step in setting the points with your feeler gauges is to bring them up onto a lobe (see fig. 2). Once accomplished, use a screwdriver in the slot on the base plate to open or close the gap to match the specification. Always use the wider of the specifications given. If only one spec. is given, use a two thousandths (.002) larger feeler gauge. This procedure will allow for the closing of the points as the rubbing block wears. Apply a small amount of distributor lube onto the cam. Axle grease won't do. Cam lube can be purchased at any auto parts store and one tube will last for years.

Adjusting the points with a dwell meter requires turning the engine over with the starter as you do it. Make sure the Rover is in neutral before you start. Hook up the meter with the red lead attached to the + side of the coil and the black lead grounded on the engine (the acorn nuts on the valve cover are a good spot). Have an assistant crank the engine while you watch the meter. Since the cap is off at this time, the engine won't start. Just watch your hands. If they get to close to the cap, you may get ZAPPED while the engine is cranking. Anyway, note the reading on the meter and adjust the points accordingly. Remember, the higher the dwell reading, the narrower the point gap. The wider the point gap the less the dwell reading. After you have correctly adjusted and locked down the points with the set screw, double check the reading. Sometimes, as you tighten the screw down, you will change the adjustment slightly.

FINE TUNING

It's time to install your freshly gapped spark plugs. Now is also the time to tie up any loose ends. Double check mentally and visually all the work you have done up to this point. This

FINE TUNING (cont.)

can really pay off if you catch a boo-boo. Even pros make mistakes. The trick is to catch them before they lead you down a merry path.

Start the engine and let it warm up. As you wait, you may hook up your timing light according to its instructions. If you don't have one, try and figure out how to get one. This is a necessary item for tune ups.

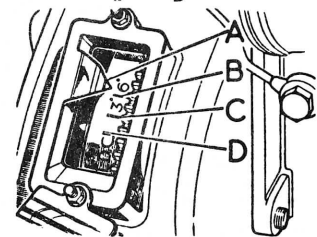
With the engine "ticking over", disconnect the vacuum advance and check the timing with the light. See figure 3 for details on the timing marks. If you find it hard to see the mark, a little nail polish (cherry red is "in" these days) on the pulley notch will make it easier to see. Once you've turned the dist. whatever way needed and have the timing spot on, tighten the clamp down and recheck.

Due to the design of the Land Rover combustion chamber, the timing can be advanced considerably without an audible "ping" or "spark knock". Just because you can't hear it, that doesn't mean harmful things aren't going on in there. With the fuel commonly available as "regular" in the U.S., the timing can be advanced to about 6 degrees with no trouble. The octane readings on figure 3 are not accurate for today's gasoline. In the seventies, the method for determining octane ratings was changed and the new reading come out slightly lower than the old. The 90 octane is comparable to the 88 octane of today. For the sake of your pistons and valves, don't get carried away with advancing your timing unless you plan to use premium fuel.

Carburetor adjustments are the next order of business. The air filter should be hooked up (when was the last time you cleaned it?) to make the adjustments. If you have a dwell meter that has a tachometer, set it for the 1000 rpm scale. Idle speed is largely a matter of personal preference or necessity. Many prefer the engine to idle higher to avoid stalling in ticklish off road situations or for winching purposes. Anything in the range of 600 to 950 is OK. So, set your idle speed according to taste. Mixture adjustments come next and this is where a tachometer is really useful. Screw the mixture adjustment in (clockwise) until the idle speed starts to drop and the engine begins to get rough. Then, turn the screw back out (counter-clockwise) and watch the tach. Do it slowly and when the idle speed settles down at the highest steady point, stop. Generally, from the lean roll point (rough idle) it's about $1\frac{1}{4}$ turns back out to the correct idle mixture. This can vary from engine to engine so go ahead and run the screw out a little if the idle doesn't feel right. Repeat the idle adjusting process if you have doubts about something. Keep working till the LR is purring like a kitten.

THE TEST DRIVE

This is the time when you find out if you did a good job. If you notice any drivability problems, recheck what you did.



4.5 Timing pointer on flywheel housing (earlier engines)

- A Timing pointer
- B 6° mark, align when using 90 - 96 octane fuel
- C 3° mark, align when using 80 - 85 octane fuel
- D TDC mark, align when using 74 - 76 octane fuel

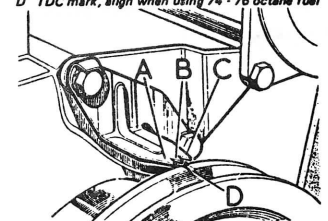


Fig. 4.6. Timing pointer on front timing chain cover (later engines)

- A 6° tongue, align when using 90 - 96 octane fuel
- B 3° tongue, align when using 80 - 85 octane fuel
- C TDC tongue, align when using 74 - 76 octane fuel
- D Mark on crankshaft pulley, align with appropriate mark

TEST DRIVE (cont.)

If it all checks out then you may have some problems that you haven't bargained for. Watch next issue of THE ALUMINUM WORKHORSE for a troubleshooting chart to help you over any unexpected problems.

TOOLS

Have you ever tried fixing your Land Rover with no more than a crescent wrench, pliers and a screwdriver? If you have, it was probably in some last ditch, gotta get home, breakdown situation where you had no choice. Well, at home, you do have a choice. Proper tools can take a lot of the aggravation out of doing your own repairs. Tools can be purchased a few at a time and, taken care of, can be passed on to heirs. Service manuals should be considered as tools of the utmost importance. If you can, buy the factory manuals for a "clean set" to keep inside to study in a clean environment. For outside use, buy the HAYNES Land Rover workshop manual. At only about \$12, it's a fantastic bargain. It has almost all the information contained in the factory manual and is written for the home repairman. Look at the list below and check how many of the tools you have.

WORKSHOP MANUAL(S)
RATCHET, EXTENSIONS, SOCKET SET
SPARK PLUG SOCKET
COMPRESSION TESTER
OPEN AND BOX END WRENCHES
IGNITION WRENCHES
FEELER GAUGES (.002-.030)
SPARK PLUG GAPPING TOOL
GASKET SCRAPER
TIMING LIGHT
DWELL, TACH, VOLT, OHM METER

COMMON AND PHILLIPS-
SCREWDRIVERS
PLIERS
REMOTE STARTER SWITCH

A FINAL WORD

This article was written to clear up some details to those of you who have had bad luck with tune-ups. The article was designed to be used in conjunction with a service manual. It can answer any little procedural questions that might come up that are not covered in this text. Good luck on your next tune-up!

WORKHORSE STAFF

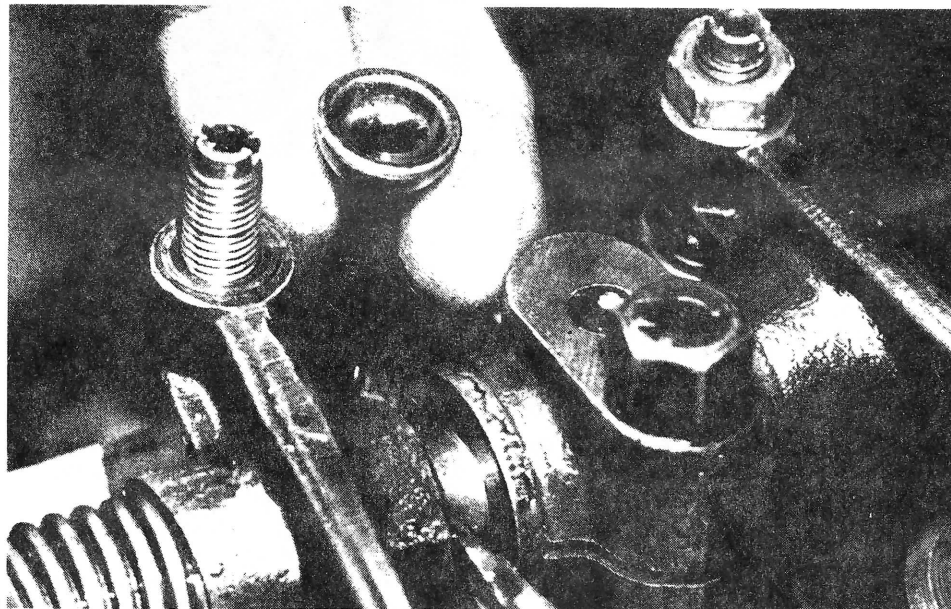
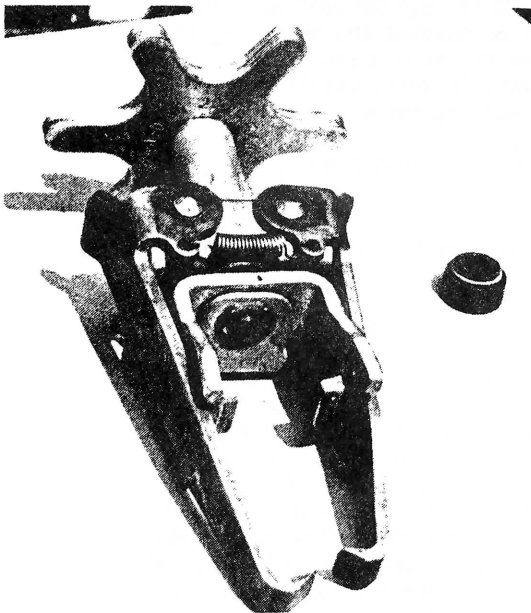
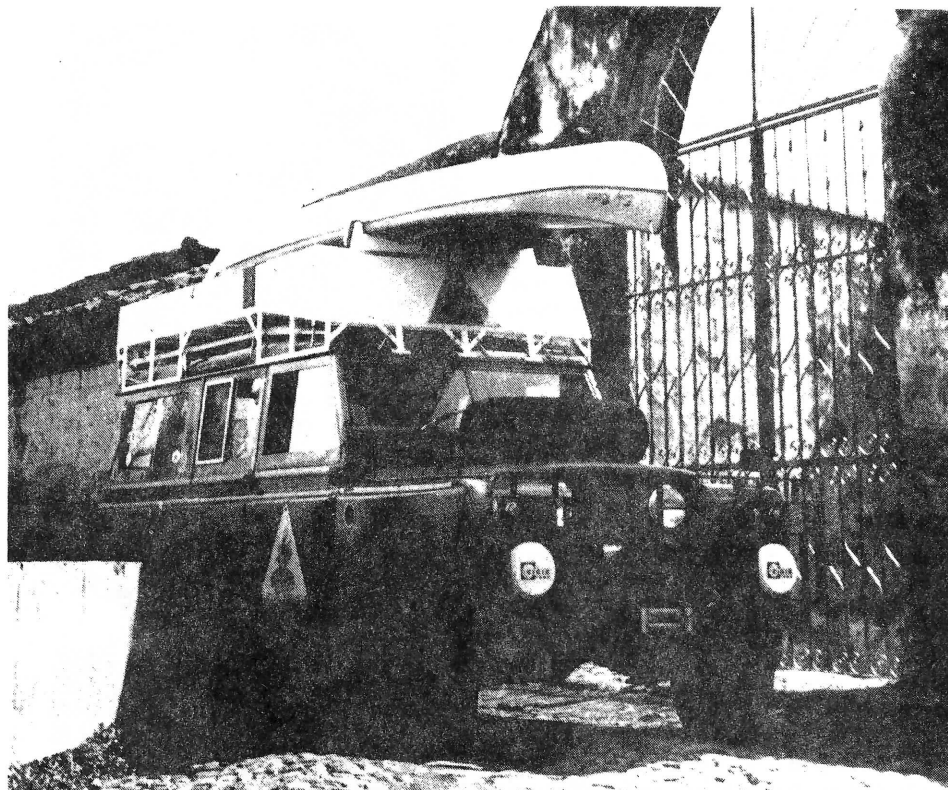
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DON'T JUNK IT—FIX IT!

By Gerald T. Ahnert

LAND ROVER PUFFING OIL?



A

Keeping that Land Rover alive is becoming more and more of a problem. British Leyland stopped importing the Rover car in the late '60s, then the 109 Land Rover, and finally the 88 Land Rover in late 1974. Although rumors persist of the Land Rover being imported again, and perhaps even the Range Rover hitting the American market, the trend is still downhill. Some garages have stopped servicing Land Rovers and will only order parts for you. British Leyland in New Jersey is still importing parts for Land Rovers and there is still the ace-in-the-hole Atlantic British Parts.

One way to keep your Land Rover alive is to diagnose problems when they begin.

B

After 100,000 miles, up-and-down and around four continents, into the Sahara desert twice and across it once, zig zagging across the North America and up the Alcan highway to Alaska, my 1969 Land Rover started using a little oil. On starting the engine, a blue cloud of smoke blossomed from the tailpipe and quickly stopped—characteristic of oil running down the valve guides into the cylinders when the engine is shut off. The action of the valve stems in the valve guides prevents very little oil from leaking during engine operation (unless the valve guides are badly worn) so the oil is burned off in the first few seconds of the engine starting.

If this happens to your Land Rover don't panic and think about doing an engine job and shorten your engine's total life, or pulling the head and replacing the valve guides. This may not be the problem. It may be nothing more than worn or damaged valve stem oil seals. If you have a "K" series or newer Land Rover, replacing the seals is easy and inexpensive. You lose nothing if this doesn't solve the problem as you will need new seals anyway if you have to replace the valve guides. Learning to do this simple operation is also a dry run for doing emergency repairs in the boondocks.

The biggest expense is the cost of an

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overhead valve spring compressor. With the valve spring compressor you can replace the worn valve stem oil seals without removing the head. This handy tool will also enable you to replace broken or weak valve springs. The Universal Overhead Valve Spring Compressor number 2078 (\$9.85) can be found on the K-D Tool rack in automotive stores.

If your Land Rover uses external valve stem oil seals and you can't get them from your British Leyland dealer, order Lip Seal for Inlet Valve number 5596 and Lip Seal for Exhaust Valve number 5597 (for each cylinder) from Atlantic British Parts, Ltd., Box 109, Mechanicville, New York or Box 756, San Marcos, CA 92069. They cost 25 cents each from Atlantic British Parts and it would be wise to order a few extras as spares.

This same operation can be done on most engines that have overhead valve stem oil seals using the required seals. If you have a suffix "J" Land Rover or older, check to see if the valve guides have been replaced with the newer type that take external valve guide oil seals (as shown in photo B). The older type takes an internal mounted oil seal, called an

A. The two main items for doing this simple job: a valve spring compressor and valve stem oil seals.

B. Removing the push rod so the tappet can be flopped back to facilitate the valve spring compressor.

C. The valve spring compressor in place on a valve spring. Note that this can be done without removing the head.

D. The arrow points to the culprit. This type oil seal is used only on Land Rover valve guides with external grooves for seating the oil seals. Older models have internal seals.

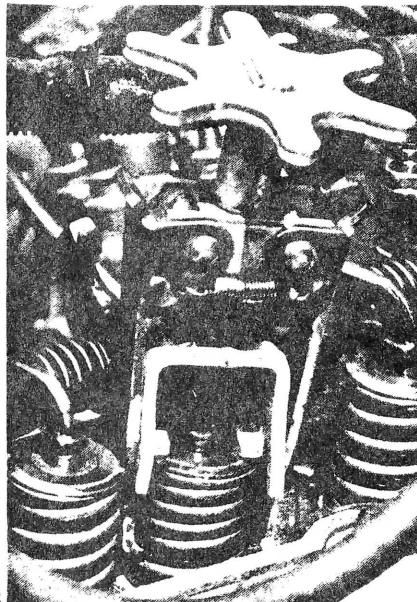
E. The arrow points to the spring that identifies an inlet valve oil seal. The seal on the right without the spring is for the exhaust valve. The external valve guide oil seal is used on Land Rovers suffix "K" and newer, and on suffix "J" and older if the valve guides have been replaced with the newer type.

O-ring, and can't be mounted without first removing the head.

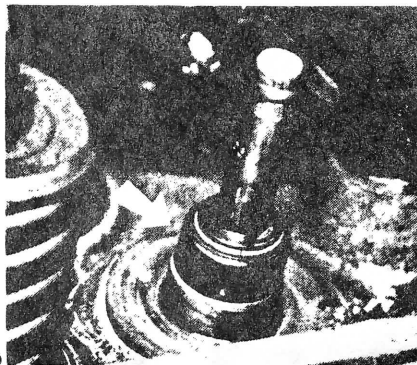
If you break the old valve cover gasket, and have the standard four-cylinder 2½ litre petrol engine, Valve Cover Gasket number 344 is available for 50 cents from Atlantic British Parts if you can't get it from British Leyland.

The total cost of this operation is \$12.35 and you will have the bonus of a very useful tool added to your toolbox.

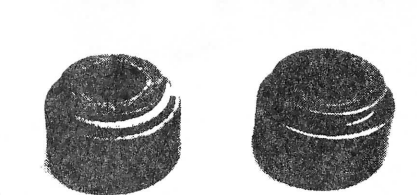
Another tool needed is one you can make yourself. It is a metal rod about 10 inches long with about ¾-inch of one end bent at about a 30-degree angle. The diameter of the rod can be from 1/8 to 3/8-inch. Make sure there are no loose



C



D



E

metal filings or chips ready to break or fall off the rod as it will be used inside the combustion chamber.

Now that you have these parts, your toolbox, and put on your wife saver (overalls), you are ready to begin. The design of a Land Rover makes it easy to work on. Remove the hood by taking out the cotter pins from the hood hinges and the pin from the hood prop. The lightweight aluminum hood can be slid off easily—that is if you have removed the spare tire from the hood mount first.

Remove the valve cover by taking off the three nuts. Do this gently and you may be able to save the valve cover gasket. Make sure the piston for the exhaust and intake valve you are working on is at the top of the cylinder. This can be done by removing the spark plug and checking through the spark plug hole with a flashlight or by feeling the piston top with a screwdriver blade. When the valve spring is removed the valve will drop a few inches and rest on the piston

top leaving the valve stem exposed above the cylinder head.

Loosen the valve adjustment screw for the valve you are going to work on. Turn the adjusting screw all the way out so the tappet is loose. Photo B shows how to remove the push rod. Force the tappet to one side against the rocker shaft spring with a screwdriver blade. This will slide the tappet along the rocker shaft enough to remove the push rod with your fingers as shown.

Next flop the tappet out of the way so that the valve spring compressor can be utilized as shown in photo C. When the valve spring is compressed, the valve will have some free play. Slide the homemade rod with the bent end through the spark plug opening. Move the valve up and down with compressor until you can feel the rod against the bottom of the valve. Hold the rod end tightly against the bottom of the valve forcing it to stay up. This may be a little awkward at first, but it is easier and cheaper than removing the head and is also good to learn to do for emergency purposes. Holding the valve up with one hand on the bent rod, place your other hand on top of the valve spring compressor and push down. This should dislodge the split cones so they can be removed and the spring lifted from the valve stem. If you cannot dislodge the split cones this way give the retaining spring cap a few light, but sharp, whacks with a small hammer to dislodge them.

There is a tool that screws into the spark plug opening that hooks onto an air pressure hose to force air pressure into the cylinder to hold up the valves. If this is available it will make the job easier, but this is an added expense and carrying an air compressor in the Sahara or Mojave desert isn't practical.

Photo D shows the valve spring removed from the valve stem. The arrow points to the valve stem oil seal. This style seal is for suffix "K" and newer Land Rovers or for suffix "J" Land Rovers and earlier if they have the new type valve guides. If the valve stem oil seal is worn the valve will fall freely from its own weight. A new seal will hold the valve up and the inner edge of the seal that contacts the valve stem will dimple up and down when you move the valve. If the old valve seal isn't doing its job you will notice oil on the inside surfaces of the oil seal when you remove it. The seal shown in photo D is for an inlet valve. The difference being the little spring (arrow, photo E) in the groove of the inlet valve oil seal and no spring in the groove of the exhaust valve oil seal. Another reason the inlet valve seal may not be doing its job is if the little spring is damaged or missing. Exhaust and inlet valve oil seals are shown in photo E.

PUFFING OIL?

When you pry off the old oil seal you can let the valve rest against the piston. Slide a new seal down over the valve stem and make sure it is seated in the groove on the valve guide. Again, make sure the correct seal is used for the correct valve. Hold the valve up with the homemade bent rod tool and place the valve spring in position compressed with the valve spring compressor tool. Put the split cones in place and make sure they are seated by giving the top of the valve stem a few whacks with a hide or hard rubber hammer. Next flop the tappet back in place and install the push rod back in place by using the same method in photo B. Do one complete valve at a time to insure that the same push rod and other parts are used for the same valve they were removed from.

After the valve stem seals are renewed and the tappets in place, the tappet clearances must be set. The manual recommends all valves, hot or cold, be set at .010 (0.25mm). Of course, there is a tolerance change as the engine heats up and it isn't good if this gap goes below .010. A loose "magnetic" fit instead of a tight "magnetic" fit will make up for this difference in tolerance change when the engine heats up. The order of setting valve clearances with number one tappet being at the front of the engine is:

Set #1 tappet with #8 valve fully open.
Set #3 tappet with #6 valve fully open.
Set #5 tappet with #4 valve fully open.
Set #2 tappet with #7 valve fully open.
Set #8 tappet with #1 valve fully open.
Set #6 tappet with #3 valve fully open.
Set #4 tappet with #5 valve fully open.
Set #7 tappet with #2 valve fully open.

Make sure all locknuts are tight. An emergency setting of tappet clearances can be made without a feeler gauge and is good to practice during this operation. The Land Rover valve adjustment screws have 24 threads per inch. This means that one complete turn of the screw will change the clearance by .0416 inch. Turning the adjustment screw by 1/4-turn will give 1/4 of .0416 inch or .0104 inch. Make this setting by first turning the adjustment screw until it just contacts the valve stem and then back off by 1/4-turn. The slotted top of the adjustment screw makes eyeballing a quarter-turn easy. Of course, this will give you only *approximately* .010-inch clearance and should be checked as soon as possible with a feeler gauge.

After the valves are set replace the valve cover and you're ready to go. The Land Rover this operation was done on has no noticeable oil burning after 5000 miles of operation. As was mentioned before, this may not be an absolute cure for your oil burning problem, but, for a few dollars and a few hours work it's worth the try.

Phlogiston Electronics

A sheet of paper crossed my desk the other day, and as I read it, realization of a Basic Truth came over me. So simple! So obvious we couldn't see it. John Kuivinen, Chairman of the Palomar Repeater Committee, has discovered what makes integrated circuits work. He says that smoke is the thing that makes IC's work because every time you let the smoke out of an IC, it stops working. He claims to have verified this through thorough testing.

I was flabbergasted. Of course! Smoke makes all things electrical work. Remember the last time the smoke escaped from your Lucas voltage regulator? Didn't it quit working? I sat and smiled like an idiot as more of the truth dawned. It's the wiring harness that

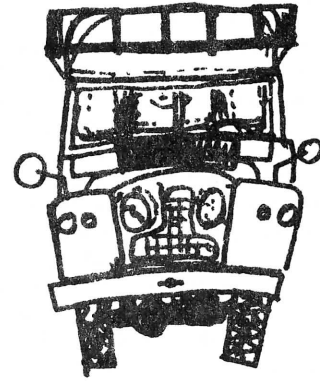
carries smoke from one device to another in your car, and when the harness springs a leak, it lets the smoke out of everything all at once and then nothing works. The starter motor requires large quantities of smoke to operate properly; that's why the wire going to it is so big.

Feeling very smug, I continued to expand my hypothesis. Why are Lucas electrics more likely to leak smoke than, say, Bosch? Hmmm. Aha! Lucas is British. Things British always leak! British convertible tops leak water. British engines leak oil. British displacer units leak hydroelastic fluid. Naturally, British electrics leak smoke.

Thanks to Fred Kenfield for passing this on; he credits Robert Campbell of Poway, CA.

Land-Rover

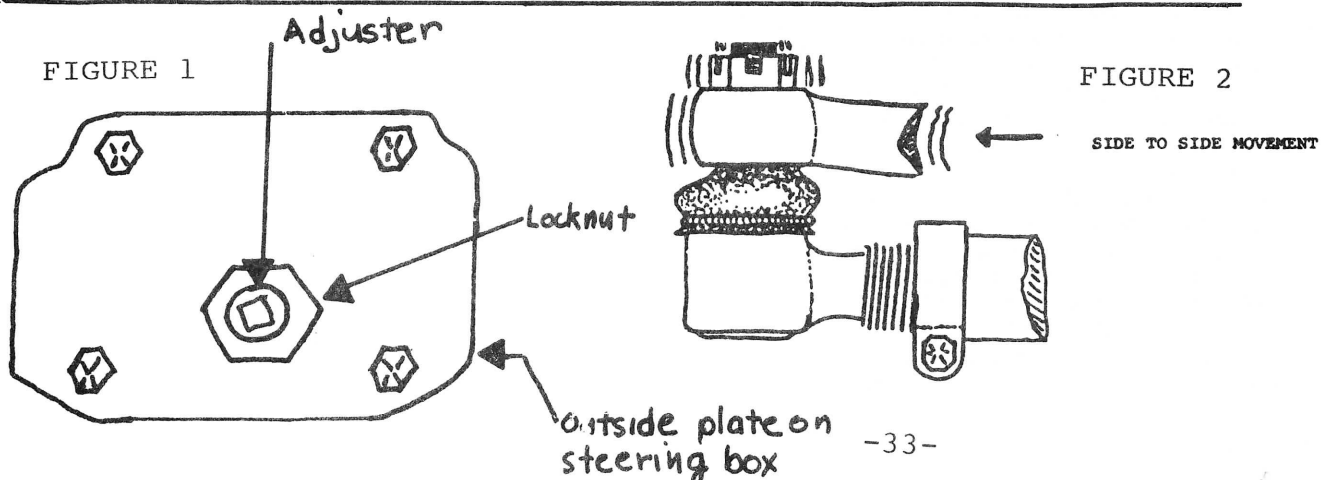
WHEEL ALIGNMENT



Are your front tires wearing abnormally? Does your Land Rover wander all over the road and fairly dance when you encounter bumps in the road at anything more than a crawl? Don't chalk it up to being "normal" for a four wheel drive. You can do something about it yourself, in most cases.

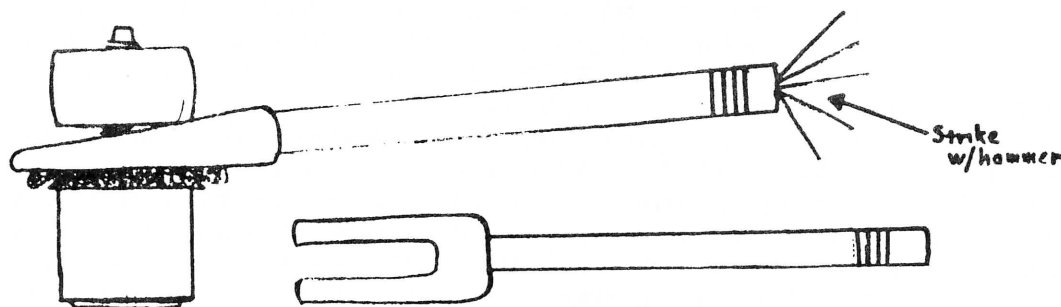
The first step is to determine what your problem actually is. With the Land Rover stationary, turn the steering wheel a little from side to side, while watching a front wheel. There should be only a little slack in the steering and you should be able to see the front wheels move with very little movement of the steering wheel. If you have a lot of steering play and/or a clunk in the steering then you have a mechanical problem in your steering. Slack in your steering can come from three places, the tie rod ends, the steering box, and from components whose bolts have worked loose. A common problem with Land Rovers is the steering box mounting bolts working loose. Usually this problem is accompanied by a clunk. Another problem is the steering lever on the bottom of the swivel pin housings coming adrift. This will also cause oil to leak from the housings and is easy to see. With an assistant working the steering wheel, watch the tie rod that comes off the steering box. This should move with each small movement of the steering wheel. If it doesn't, you need a steering box adjustment.

Adjusting the steering box is easy. If your LR has a cover over the steering box, remove it. On the outside of the steering box, you will see a lock nut and adjuster (see figure 1). Loosen the lock nut and turn the adjuster in until you feel resistance. Usually, it won't take more than 1/4 of a turn to take any slack out. Don't overtighten the adjuster. If you do, you will notice the steering get very hard to turn. If you can stand to drive it that way, you will eventually ruin your steering box. If you simply cannot get the slack out, or have noise or slackness at different positions, you have steering box problems. Consult your manual for steering box overhaul procedures.



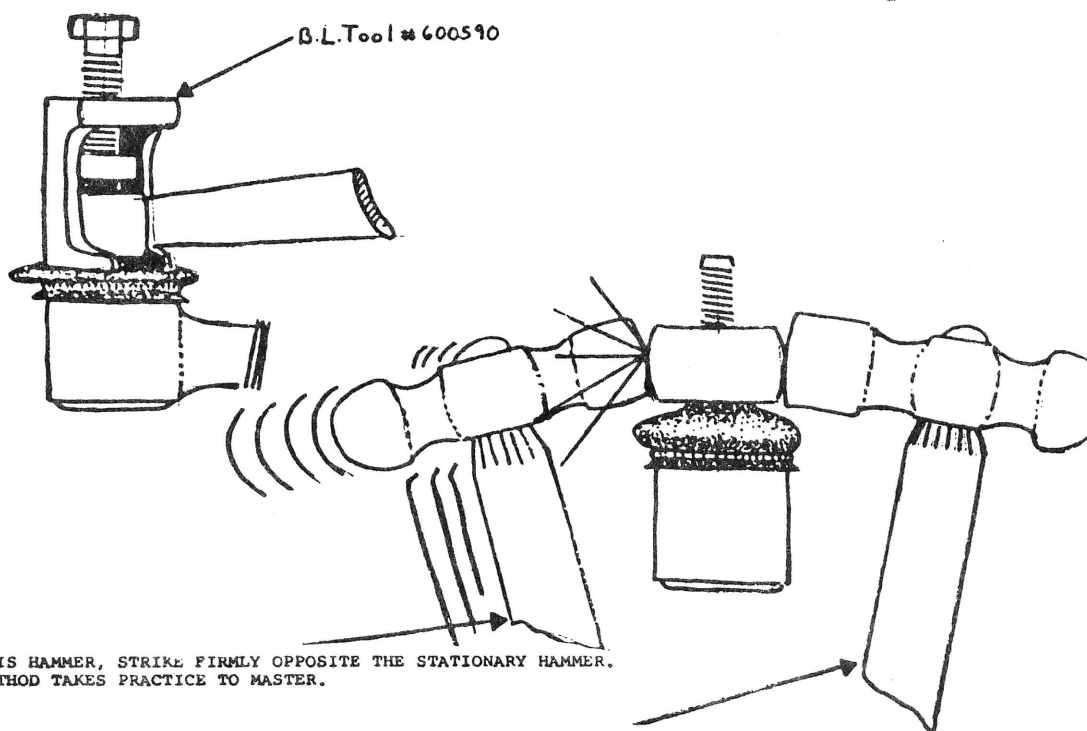
The final check is of the tie rod ends themselves. Your assistant will be needed again at the steering wheel. As he moves it, watch the tie rods. If there is any side to side movement, the tie rod must be replaced (see figure 2). If the protective boots are torn, they can be replaced. If the boots have been torn for a long time, dirt will have worked its way into the tie rod and you are better off replacing it. Figure 3 shows three ways to remove tie rod ends. When you screw them out of the tie rods, make sure you count the number of threads so you can put it back in the same relative position. This will make the alignment portion easier.

Now that you have ensured that your steering system is in acceptable condition, you come to the alignment portion of the job. The only adjustment that you can make at home is toe in. Caster and camber (see figure 4) are not adjustable and will not change unless your front axle housing is bent. If you have any doubts, an alignment shop can check caster and camber for you.



THIS IS A TIE ROD SEPARATOR OR "PICKLE FORK". THIS TOOL WILL SOMETIMES TEAR THE PROTECTIVE BOOT IF IT IS DETERIORATED.

FIGURE 3



WITH THIS HAMMER, STRIKE FIRMLY OPPOSITE THE STATIONARY HAMMER. THIS METHOD TAKES PRACTICE TO MASTER.

HOLD THIS HAMMER TIGHTLY AGAINST ARM

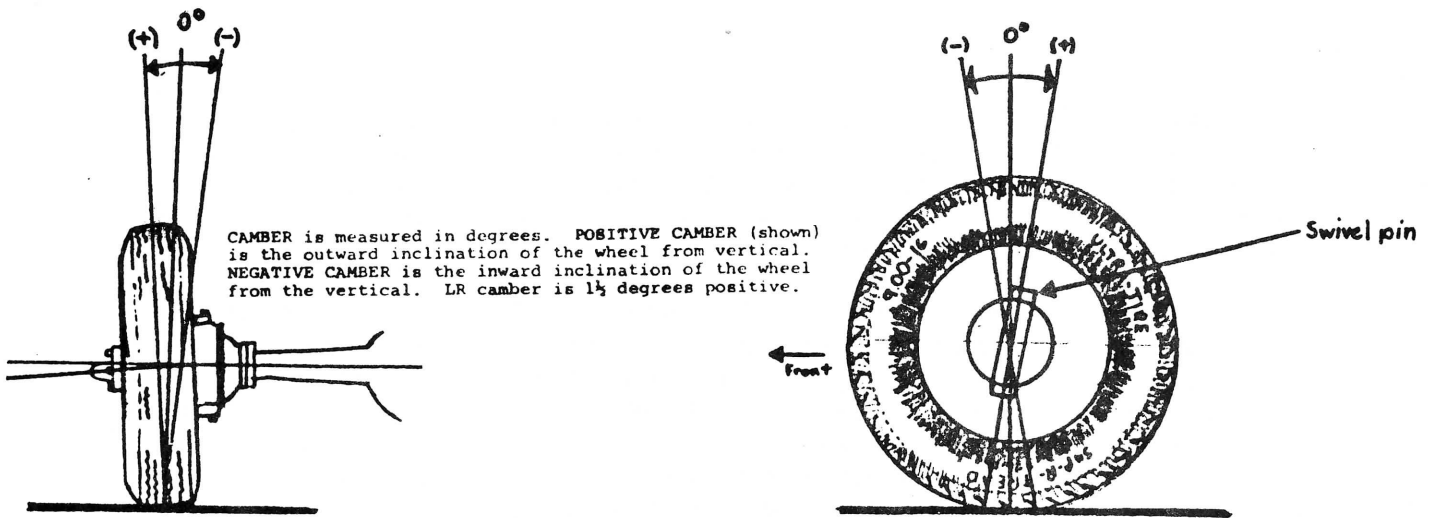


FIGURE 4

You will need to make yourself a couple of tools. Figure 5 shows some examples of these and how they are used. Once made, they can be used again and again, not only on the Land Rover, but on any other vehicle.

One at a time, jack the front wheels up, and spray a line of white or silver paint around the tire near the middle of the tread. While spraying the paint, spin the tire until you have a strip of paint around the circumference of the tire (see figure 5). Don't worry, the paint will wear off as soon as you drive the Land Rover. With your marking tool held stationary, and the nail point held lightly against the tire, spin the tire until you have a line scraped in the paint all around the tire (see figure 5).

Next, lower the LR and point the wheels as close to straight as you can. An easy way to do this is to line them up using the rear tire as a reference point (see 6). Do not use the steering wheel as a guide. It is often not centered correctly. When the wheels are pointed ahead, measure from line to line at the front of the tires using your alignment gauge (a tape measure will suffice). Do this as far above the ground as space allows. Then, measure at the rear of the tires, line to line, at the same distance from the ground as you did at the front. Compare the readings. If the front measurement was larger than the rear, then the wheels are toed out. If the front reading was smaller than the rear, then they are toed in. You want the front wheels to be toed in from $\frac{3}{64}$ to $\frac{3}{32}$ of an inch.

To adjust the toe-in, loosen the clamps at either end of the tie rod (the one farthest back), and using pliers, twist the rod clockwise to increase the toe-in, or counter-clockwise decreases the toe in. Once you have made the adjustments, tighten the clamps and double check the readings. If they are OK, double check that you have tightened the clamps.

The last step is to center the steering wheel. Do not remove the steering wheel to do this, except as a last resort. The proper method is to loosen the clamps on the tie rod farthest forward and twist it whichever way required to center the steering wheel. If you cannot center it in this manner, then you can remove the steering wheel to center it.

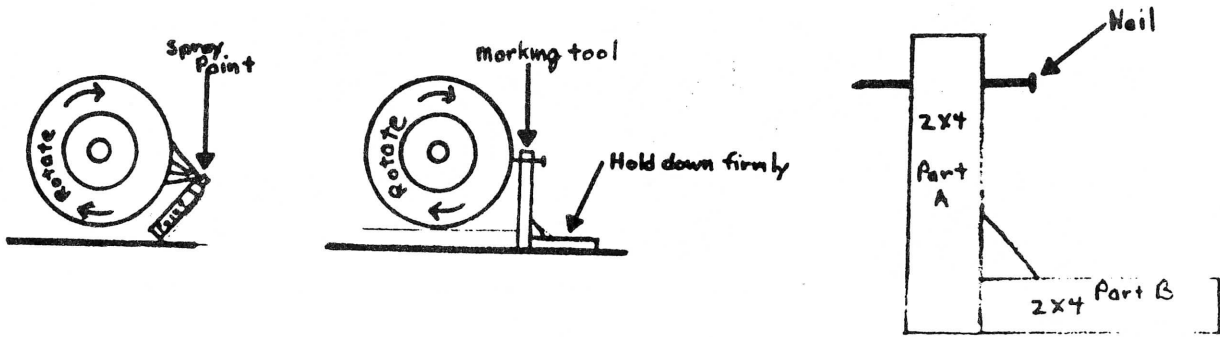


FIGURE 5

DETAIL OF MARKING TOOL. PART A SHOULD BE LONG ENOUGH TO REACH MIDDLE OF TIRE. PART B SHOULD BE LONG ENOUGH TO GET GOOD LEVERAGE FOR HOLDING.

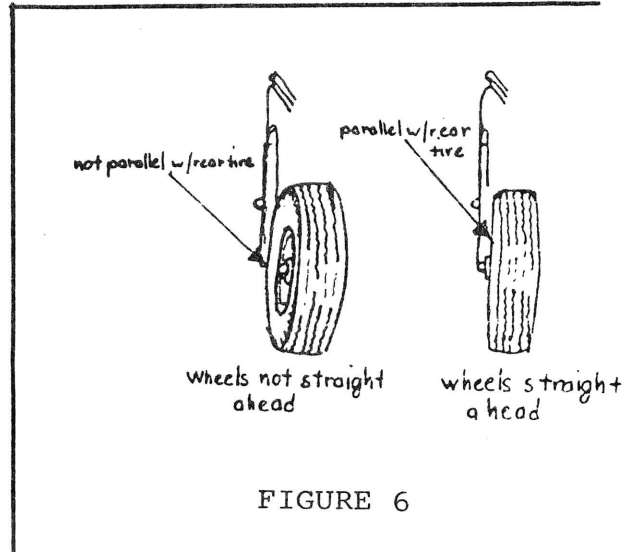
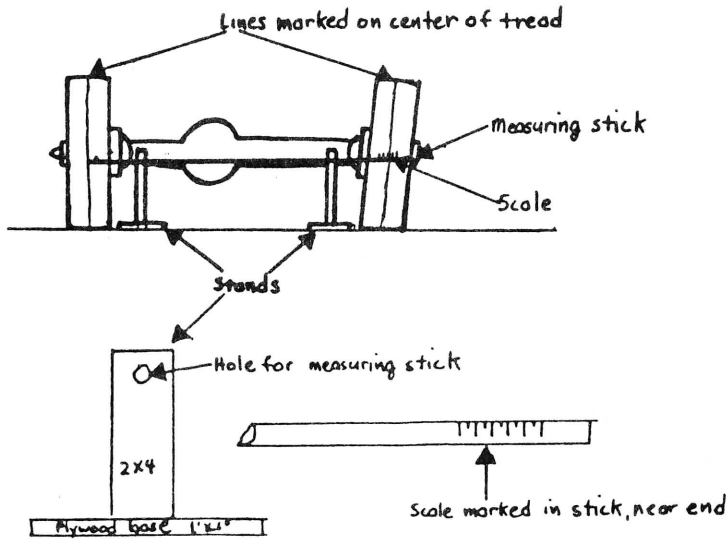


FIGURE 6

Remember that you are dealing with a potentially life threatening situation when dealing with the front end of your Land Rover, so take care with what you do, and double-check everything. Here are some extra tips to aid in getting the wander out of your Land Rover steering:

- *ROTATE YOUR TIRES REGULARLY TO AVOID CUPPING THEM
- *WHEN ALIGNING, PUT YOUR BEST TIRES UP FRONT
- *BAD SPRING-EYE BUSHINGS CAN CAUSE WANDERING AND CLUNKING
- *A STEERING DAMPENER WILL HELP TO SMOOTH STEERING VIBRATIONS
- *GOOD SHOCK ABSORBERS HELP WITH STEERING CONTROL
- *FOR SIDE TO SIDE PULLS, CROSS ROTATE FRONT TIRES TO SEE IF PULL CHANGES SIDES



TECH TIPS-by the numbers

WEBER CARB DATA

In June 1985 I installed a 2-barrel Weber carburetor, purchased as a kit from West Coast British, on my 1969 Series IIA 88. The new carburetor has produced increased power and improved highway gas mileage over the Rochester with which I replaced the original Zenith. I never kept detailed mileage records for the Rochester or the Zenith but typically I would get 11-12 mpg in the city with each. The Zenith would, at best, get 14 mpg on highway and the Rochester about 15 (under ideal conditions it could give 16-17 mpg). Since installing the Weber, I have driven over 2000 miles and have kept detailed records of gas consumption. The table below summarizes my records.

	TOTAL	HIGHWAY	CITY	COMBINED*	TOWING**
MILES	2148.6	1080.2	652.5	222.5	193.1
% TOTAL MILES	----	50.3	30.4	10.3	9.0
GALLONS USED	146.9	61.9	51.3	14.9	18.8
AVG. MPG	14.6	17.4	12.7	14.9	10.3
RANGE MPG	23.2-9.4	23.2-15.1	14.2-10.3	15.1-14.8	11.2-9.4

* Includes highway, city and mountain driving.

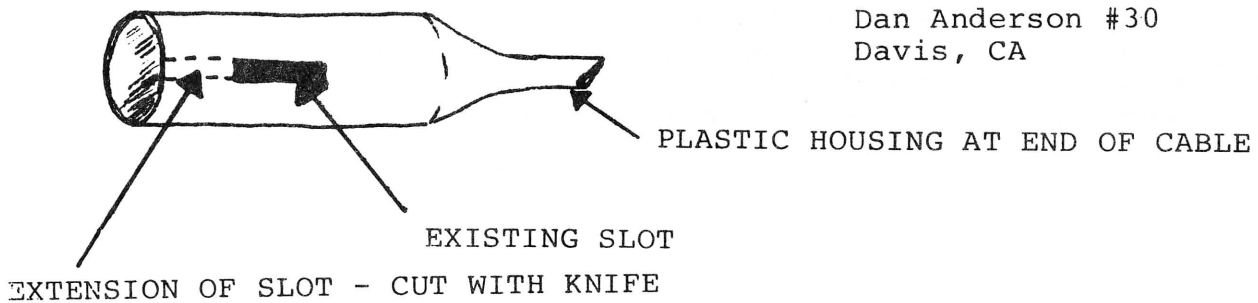
** Towing a 22 foot, 6500 lb. house trailer in 4-wheel drive.

As you can see, city mpg is not much improved but there is a significant improvement in highway mpg and power. My LR is equipped with Warn free-wheeling hubs and a Fairey overdrive. In top gear, in OD, with 30 inch tires, I turn 2700 rpm at 55 mph. I use leaded premium fuel.

Herman Karl, # 38
Menlo Park, CA

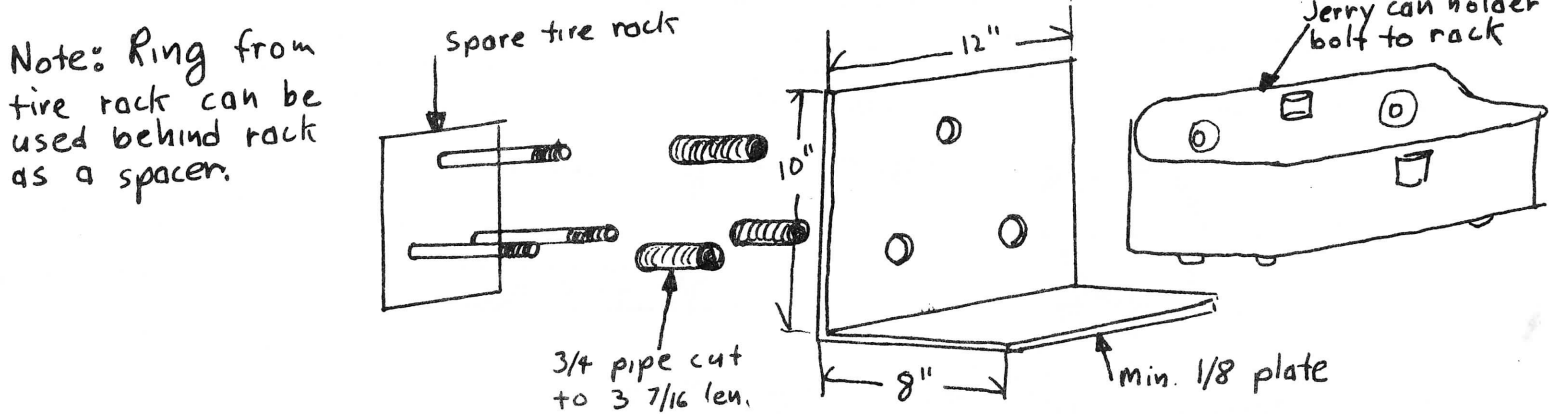
SERIES THREE SPEEDO CABLE REPAIRS

The speedometer cable on series III Land Rovers is held at the speedo end by a single plastic tab which engages a slot on the speedo. This tab is easily broken off leaving the speedo cable free to slip off. This can be repaired by carefully extending the slot in the plastic end out to the end (see illustration) with a sharp knife. A small hose clamp is then used to clamp the end of the cable to the speedo.



SIMPLE JERRY CAN RACK

A very simple jerry can rack can be made to bolt on the rear door spare tire carrier. It is not permanent and can be removed easily when not used. Buy a piece of plate steel and have it cut to the dimensions shown below and bent 90 degrees. Minimum thickness for the plate should be 1/8s inch. Once you have the plate done (it cost me \$10), simply drill the three holes to match the three on the carrier, bolt on the can holder and bolt onto the rear door using spacers, as shown. Your part of the job takes about an hour, not including painting.



Jim Allen, #2

FROM #51: A NOVEL WAY OF FILLING YOUR TRANNY

Filling the transmission and all the other goodies under the Rover with 90wt is not my favorite job. Simple solution: an enema bag! Fill it with the required fluid, hang it on the door, stick the hose into the fill hole, release the clamp and go have a cup of tea. No mess, no fuss. Write the required quantities on the bag with a magic marker so you don't have to look them up every time. Also, one of the plastic gizzies that comes with the bag fits that little hole on the swivel pin housings. Since this procedure looks a bit kinky, you may want to do it at night. Less questions that way.

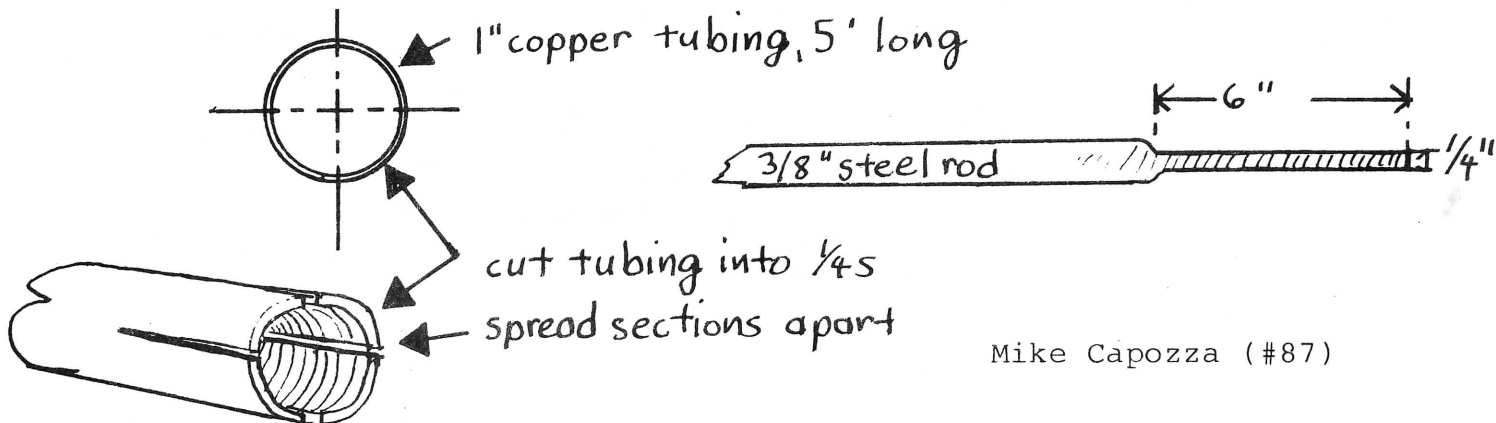
FRED SISSON

FROM #87 QUICK BROKEN AXLE CHANGE

For quick emergency axle changes without pulling the diff., get yourself five feet of streamline copper tubing, one inch in diameter and five feet of 3/8 inch steel rod.

Cut the end of the copper tubing as shown in figure 1 and slightly spread the sections. Then grind the end of the rod as shown in figure 2.

To remove the broken off section from your diff., first remove both drive flanges and axles. With a helper shining a light from the other side, slide in the cut end of the copper tubing and align it with the broken stub of the axle. Hold the copper tubing in place while the helper slides the steel rod in from the other side and taps out the broken stub into the copper fingers on the tubing. Be sure to drain the oil and dig out any chips of metal you can reach thru the drain hole. Refill the unit with fresh oil, install the axles and flanges and be on your way. This trick only works if you had the foresight to carry spare axles, oil, flange gaskets (or silicone sealer) and enough tools to get the job done.



FROM #54: SOLVING RADIC STATIC

Static from underhood electicals, such as the ignition system and the alternator or generator, can be lessened or eliminated with a simple little trick. Run a ground wire from the hood to the body. This will allow the hood to become a shield and will help keep static from your CB or radio. The hood hinges don't often ground well enough to do the job alone.

BOB BERNARD

FROM #51 (again): LUXURY SEATING

Get a pair of Volvo seats and bolt 'em in. They have adjustable backs and lumbar support and are very conservatine looking. In fact, they look as though they belong there. They are reasonably cheap and you won't believe how comfortable your Rover will be once you've put them in.

FRED SISSON

RUST PREVENTION FOR THE 109"

There is a natural water trap in 109" Safaris between the front and rear doors, in the form of a rubber plug at the bottom of the centre door pillar. In wet climates, it can be removed with needle-nose pliers from under the sill panel to allow moisture to drain out. In dusty areas, it should be left in place. Similar plugs exist at the rear crossmember and should be given similar treatment.

Charles Kellogg #5
Great North American LR Co.
Olympia, WA

FROM #2: ZIRCING YOUR TIE ROD ENDS

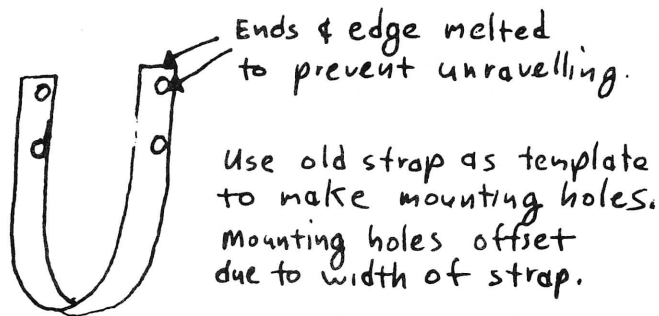
It's getting near impossible to find tie rod ends with grease fittings these days. I have found a way to install my own. I carefully measure and centerpunch the exact center of the flat portion of the tie rod end. Using a #3 drill bit, I carefully drill through the plate. Then, using a 1/4 - 28 N.F. tap (well greased), I tap the hole and screw in the grease fitting.

Jim Allen

TECH TIPS (continued)

REPLACEMENT REAR AXLE CHECK STRAPS

When my check straps rotted away, I let them go for a time, but later began worrying about pulling my rear shocks apart when really working the suspension. Walking thru a wrecking yard one day, I spotted a length of nylon tow strap about 1 3/4 inches wide. It was the type you find in auto parts stores for about 6 bucks. I cut two lengths of 33 inches, measured then cut the mounting holes with a gasket cutter, and lastly melted the edges of the holes and ends of the straps over a flame to prevent unraveling (be careful not to overdo this part - too much heat will weaken the nylon). The 1 3/4 straps are a little wider than the originals so the holes must be offset. These new straps are at least three times stronger than the originals, and will never rot.



Jim Allen, #2

OF SLEEVES AND SEALS

The wheel hub seal rides on a piece call the distance sleeve, a removable collar on the stub axle. This can wear from the constant rubbing of the seal and can cause a leak even if a new seal has been installed. If you rub your fingernail across the sleeve and feel (and usually see) a groove, it's time to replace it. The old sleeve can be removed with a cold chisel, taking care not to nick the stub axle. Sometimes it must be heated and expanded to come off. At home, several applications of boiling water might be enough to do the trick. For easy installation, cut a piece of 2" pipe to a length of 5 1/2 inches, screw a cap on one end and use it as a driver. Also, when installing new seals, always lightly lube the distance sleeve. A dry one will cause abnormal seal wear.

Charles Kellogg, #5



DATA

Land Rover owners are a much-ignored group here in the U.S. Since there are so few of us (relatively speaking), it is not hard to understand why this is so. We in the LROA desire to learn more about Land Rover owners and their vehicles. In order to anticipate your needs and improve our services, we ask that you fill out this questionnaire as completely as you can and return it to us at:

LROA DATA
P.O. Box 162201
Sacramento, CA 95816

NAME (OPTIONAL) _____ MEMBER NUMBER _____

Questions 1-5 are general information questions about how you use your Land Rover.

- 1) Do you drive your LR: DAILY _____ or JUST ON OUTINGS _____
A LITTLE OF BOTH _____? (CHECK ONE)
- 2) How many miles per year, approximately, do you put on your LR:
_____? How many miles are on the vehicle _____?
- 3) What is your average miles per gallon in city driving: _____?
In highway driving _____?
- 4) Do you ever tow trailers with your LR _____? If yes,
give type, size and weight of trailer and cargo _____?
- 5) Do you take your Land Rover on long distance trips (over 300
miles)? _____ If so, what is your longest trip and where did
you go? (use a separate sheet of paper if you'd like to share
more about the trip) _____

Questions 6-14 are specific and concern products you use on your Land Rover, modifications you may have made and your general repair habits.

- 6) How much of the maintenance and repair work do you actually
do yourself? ALL _____ SOME _____ NONE _____? (CHECK ONE)
- 7) Do you have a repair facility that you would recommend to
others? _____ If so, would you share it with us?

NAME _____
ADDRESS _____
CITY _____ STATE _____ ZIP _____
PHONE # () _____

8) Why do you prefer this establishment? SERVICE ___ PRICES ___
QUALITY OF WORK ___ OTHER (PLEASE EXPLAIN) _____

9) Do you have a parts establishment that you prefer over others?
_____ If so, would you share it with us?

NAME _____
ADDRESS _____
CITY _____ STATE _____ ZIP _____
PHONE # () _____

10) Why do you prefer this parts supplier over others?
PRICES ___ QUALITY OF PARTS INVENTORY ___ OTHER (PLEASE EXPLAIN)

11) Do you try to keep your LR as stock and original as possible?
YES ___ NO ___

12) Do you prefer to adapt and modify your LR to suit your needs?
YES ___ NO ___

13) Land Rover Information:

YEAR ___ WHEELBASE ___ SERIES ___ BODY TYPE _____
ENGINE _____ TIRE SIZE & BRAND _____

Check off optional equipment below:

EXHAUST HEADERS	___	EXTRA LIGHTS	___
2 BARREL CARB	___	HIGH OUTPUT ALT.	___
HIGH FLOW AIR FILTER	___	AIR CONDITIONING	___
WINCH:		WATER TANK	___
ELECTRIC	___	STOVE	___
PTO	___	BUNK(S)	___
CAPSTAN	___	OIL COOLER	___
CAPACITY	___	BRUSH GUARD	___
MODEL	___	ROLL BAR	___
WIDE WHEELS	___	AFTERMARKET SPRINGS	___
ROOF RACK	___	MAKE	___
EXTRA FUEL TANKS	___	AFTERMARKET SHOCKS	___
TOTAL CAPACITY	___	MAKE	___
OTHER	___		___
	___		___
	___		___

14) Does your Land Rover still retain an original engine
___ yes ___ no (check one). If no, list engine details:
engine make _____ year _____ no. of cyls. _____
size _____ year installed _____. Has the conversion
proved satisfactory ___ yes ___ no (check one). Please give
details whether yes or no. _____

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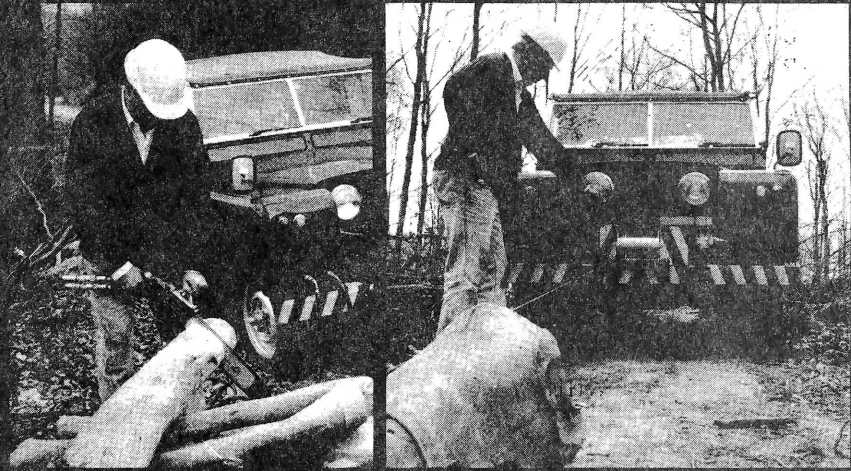
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