The Dog & Lemon Guide™

DICTIONARY OF CAR TERMS

A

ABS - see *anti-skid braking*

A/C
Air conditioning

active rear-wheel steering
see *passive rear-wheel steering*

active suspension
A suspension system which detects changes in the road surface and alters the suspension to suit these changes as the car drives along.

active restraint
Something (a seatbelt for example) that restrains the movement of a passenger during an accident and which must be attached or connected by the person using it. A passive restraint (such as an airbag), on the other hand, will operate automatically.

advance
1) To make the engine fire earlier during its cycle.
2) The degree to which the engine is made to fire earlier in its cycle.
See also *timing*.

aerodynamics
Aerodynamics is the study of how objects move through the air. Generally, the smoother and more streamlined the shape, the less wind resistance you get. An aerodynamically-designed car means one that has been designed to move smoothly through the air. Because the car moves more smoothly, it can go faster with less fuel. Carmakers like to quote impressive-sounding figures (*Cd*, which is short for *Coefficient of Drag*) to show how smoothly their cars glide.

A-frame
1) A part of some cars' suspension, which is shaped like the letter A turned sideways — hence the name (A-frame is an American term. The English term is *wishbone*).
2) A rig for towing one car with another. It is also shaped like the letter A.

aftermarket
Extras such as alarms, mag wheels, body parts or decorations which are bought as add-ons after the vehicle was purchased. They are not usually bought from the same company that built the car, because the reason you buy aftermarket items is because they were either: not originally supplied with the car (eg., alarms), because they improve the car (eg., a better stereo than was originally supplied with the vehicle), or because they are cheaper than the car manufacturers' own parts.

airbag
A balloon-like bag that is rapidly inflated during a collision & cushions the occupants of a vehicle, helping to protect them from injury. A driver's airbag protects the driver only. Dual front airbags mean that both the driver and front passenger are protected. Side airbags may be fitted on both sides of either the front or rear seats, or both. If a brochure states that a vehicle has dual front and side/front airbags it means that both front occupants have airbags in front of and beside them, but the rear passengers have none. A four-door car fitted with dual front and dual side airbags gives frontal and side protection for the front occupants and side airbags for the rear occupants. In addition to conventional airbags, specialist airbags that protect body parts such as the knees or ankles are becoming common.

air brake
A braking system operated by compressed air. Usually used on trucks rather than cars.

air cleaner
Exactly what it says - a device that cleans the air before it goes into your car's motor. This makes the motor last longer and cuts down noise (a motor without an air cleaner makes a loud whooshing noise as it operates).

air-cooled engine
An engine cooled by air instead of water. Most lawn mower motors and many Porsche engines are air cooled.

airflow sensor
An instrument which measures how much air is flowing through an engine. Usually used with electronic fuel injection systems to enable the computer which controls the system to adjust the air/fuel mixture and other engine controls.

air/fuel mixture, air/fuel ratio
Most cars' engines work by burning fuel. The more efficiently you burn the fuel, the more power you get and the less fuel per kilometre you use. One key factor in getting the fuel to burn well is to mix it with the exact right amount of air before you burn it. This mixture of air and fuel is called the air/fuel mixture or air/fuel ratio. In an older-style engine the correct air/fuel mixture is delivered by a carburettor. In more modern engines the fuel injection system does this job.

ALB
Anti-Lock Braking. *See anti-skid braking*

all-wheel drive (AWD)
Most cars are pushed or pulled along by two wheels only. All-wheel drive cars are powered by all (usually four) wheels at once. In some cases, AWD means the same as four-wheel drive. The exceptions are the few vehicles that have more than four powered wheels. Also, some 'all-wheel drive' cars actually don't power all four wheels at once – they power the front or the back wheels most of the time and then allocate power to the other wheels as it is required. This type of 'on demand' all-wheel drive system is generally considered to be inferior to full-time four-wheel drive

alternator
A device which is attached to a car's engine and produces the electricity to charge the battery as well as running the lights etc. Technically speaking, an alternator is a generator which produces alternating current, as opposed to the dynamo generators on older cars, which produced direct-current. The chief advantage of an alternator is that it is highly efficient. See also *generator*.

amperes (amps)
Technically speaking, an ampere is unit of electrical current produced by 1 volt acting through 1 ohm of resistance. If it helps, think of electrical current as something that flows through a pipe like water. The voltage is the *water pressure*, the *size* of the pipe is the degree of resistance (measured in ohms), and the *amount* of flow through the pipe is your current, measured in amps.

amp/hour
Amp/hour is short for *Amperes times Hour*. Amp/hour is a measure which tells a technician how much electricity is produced or used. The measurement is obtained by multiplying the current in amps by the hours for which it flows. Fully charged and new, a 50Ah battery should deliver one ampere for 50 hours or two for 25 hours and so on. A typical car battery can produce 25-90 amp/hours. See also *amperes*. See also *battery*

analogue instrument
Analogue instruments (eg, a speedometer) generally show movement by a moving needle which points at markers around the dial. A traditional clock with hands is an analogue instrument. Digital instruments, by comparison, generally show you only the numbers without any moving needle. Please note that 'analogue' or 'digital' in this case refers to the way you view the instruments, not how they work inside - many modern cars have electronic instruments, even if they use an analogue display.

anchor/s
1) A mounting point on the vehicle for such things as seatbelts. Obviously, the anchor point has to be strong enough to hold the seatbelt in an accident.
2) A slang term for brakes. Eg, "I jumped on the anchors just in time".

anti-dive suspension
When you slam your foot on the brakes the car tends to dip or dive towards the road. This can cause a loss of control, so anti-dive suspension systems resist the urge to dip under braking, and are therefore less likely to cause you to lose control of the vehicle.

anti-foaming agent
Engines use oil to make the inside parts slippery. Without this slipperiness, the engine would disintegrate within a few seconds. However, when the engine is operating, the engine's internal parts tend to churn the oil around, and as the oil gets churned around it tends to foam, just as soap does in a washing machine. This is bad, because foamed oil does not work as well as it should and in fact is quite abrasive. For this reason, oil companies put an additive into the oil to stop it foaming.

antifreeze
A liquid which stops the water in your car's radiator and engine from freezing when the outside temperature drops below zero. This is important, because water expands as it freezes, and this expansion can wreck the engine. Antifreezes also usually make the water in the radiator boil at a higher temperature, meaning that your car will be less likely to boil over when the engine gets very hot if you use antifreeze. Antifreezes usually also contain a *corrosion inhibitor*, which helps stop rust and other forms of corrosion from eating away at the insides of your car's engine. For this reason antifreeze should be

added to most cars, regardless of whether they will be driven very hot or parked in cold places. Most brands of antifreeze are based around the chemical *ethylene glycol. See also our article 'Keeping it Cool' in the 'General Comments' section.*

anti-knock additive
Anti-knock additives are chemicals such as lead which raise the fuel's octane, and therefore make it less prone to knocking. See also *knocking* & *octane.*

anti-knock Dictionary
see *octane*

anti-roll bar
A part of a car's suspension that helps stop body roll, that is, the tendency for a vehicle to lean over during cornering. An anti-roll bar should not be confused with an *anti-sway bar.*

anti-skid braking (also called *ABS* or *ALB*)
A braking system that uses sensors to detect when a wheel is about to lock up (and therefore skid) during braking. The brake controller then lets the brakes off on that wheel just enough to keep it turning. The advantages of anti-skid braking are that 1) dangerous skids are avoided and 2) the car can still be steered while braking heavily.

anti-squat suspension
A suspension setup which helps stop the back of a car suddenly dropping during acceleration.

anti-sway bar
A part of a car's suspension that helps stop the vehicle swaying from side to side as it drives. Not to be confused with *anti-roll bar.*

anti-submarining device
Basically a steel ramp or tube built into a car's seat frame which helps stop you slipping underneath the seatbelt during an accident.

AWD
see *All-Wheel Drive*

axle
A metal shaft that carries the wheels. A live axle is one that actually takes the power of the engine and passes it to the wheel to push the car along the road. A dead/independent axle just supports the wheel.

backfire
A small explosion in the exhaust or intake system caused by unburnt fuel being ignited at the wrong time.

badge engineering
Producing the same product under different names. For example, the early Ford Lasers & the Mazda 323s are essentially the same car with different badges.

Baja
Pronounced *Baha*, Baja means 'lower' in Spanish. The term refers to the Mexican Baja California peninsular, the site of many of the world's toughest offroad races. In New Zealand the term Baja is mainly applied to modified VW Beetles which imitate an offroad design developed in the late 1960s by Drino Miller.

balance shaft
Some engines vibrate too much when they are tested at the factory, so the manufacturers add an extra shaft, which often looks a bit like 300mm of mangled steel broomstick. As the engine spins, this extra shaft spins inside. Because this precision-made shaft has carefully placed weights around it, it counteracts the engine's vibrations and therefore makes the engine run smoother.

ball joint
A part of a car's suspension or steering that works exactly like your knee joint.

ball and nut steering
See *steering box.*

barrel
1) A container to store beer or wine.
2) A cylinder.

base coat/clear coat system
Most modern cars use a base coat/clear coat system. First, the base coat (which contains the colour but no gloss) is sprayed on, then a clear coat (which contains gloss but no colour) is sprayed over the top to give protection and gloss to the colour underneath.

battery
A device for producing and/or storing electrical energy. *See our article 'Know your Battery' in the 'General Comments' section.*

bell housing
A bell-shaped piece of metal attached to the front of the gearbox which fits around the clutch or torque converter .

belt
Think of the belt you wear around your waist. Now think of it as being permanently joined in the middle, and you have a reasonable picture of the sort of belt used commonly on your car's engine, except that car belts are usually made of stronger materials. These belts work like the chain on a bicycle and are often made of synthetic rubber or nylon. See also *fan belt.* See also *timing belt.*

belt tensioner
See *timing belt tensioner*

benzene
A highly inflammable liquid which helps make up petrol. It is highly toxic. Benzene has the chemical formula of C^6H^6

bhp
see *brake horsepower*

block
see *engine block*

blow
1) To destroy or damage an engine or gearbox, especially after they have been strained by hard driving.
2) To supercharge or turbocharge an engine.

blower
A supercharger or turbocharger

body computer
A computer that coordinates the various functions of a car. The big advantage of such a system is that it enables different parts of the car to respond to changes in a coordinated way. For example, on some cars the windscreen wipers speed up as the car goes faster. *See also ECU*

bog
Motor industry slang for automotive body filler. See also *filler.*

bonding
A fancy word for gluing, joining or welding two or more different things.

boot
1) A flexible cover, often rubber or similar, which protects grease or oil-covered moving parts underneath from contamination such as dust.
2) British term for the rear compartment of a saloon car.

bore
1) The tubelike space in an engine or brake cylinder in which the piston moves backwards & forwards.
2) To rebore a motor.
3) A tedious person, especially one who spends hours trying to impress others with his technical knowledge and accuracy.

boxer
1) A person who punches other people for sport or pleasure
2) A horizontally opposed engine. See also *horizontally-opposed engine*
3) (with a capital B) A Ferrari model with a 12 cylinder boxer motor.

brake
A device that stops something, especially a car. See also *brake horsepower.*

brake booster
A device, usually powered by air vacuum from the engine, which makes the brakes much more effective.

brake cylinder
A tube through which a piston is pushed to operate a car's hydraulic brakes.

brake disc
Also known as a rotor, the brake disc is a heavy metal disk which revolves with the wheel of a car. See also *disc brakes.*

brake drum
A heavy metal drum, shaped a bit like a round cake tin. See also *drum brakes.*

brake fade
The tendency for brakes to be less effective if used hard.

brake fluid
A special fluid which is used in car braking systems.

brake horsepower
A measure of how much power an engine puts out. The system was developed during the Industrial Revolution when steam engines started displacing horses in mines. In
order to work out how many horses each engine was replacing, a device called a *prony brake* was developed. The engine pulled against the brake and its power was measured according to how many horses it had the power of, hence the term *brake horsepower.*

brake pad
A flat metal disc covered in a softer material such as asbestos. When the brake pads are pushed against the brake disc they help stop the car. Because the pad is softer than the disc, they wear out quicker than the disc.

B-Pillar
The metal tube that runs from the roof to the floor of a four-door car, between the front and the back doors.

brake shoe
A half-round piece of steel which lives inside the brake drum. The top of the shoe is covered with a softer material such as asbestos. When the brake shoes are pushed against the brake drum they slow the brake drum, therefore the wheel, therefore the car. See also *drum brakes.*

breaker points
See *contact points*

bulletproof
Damned near indestructible.

bulkhead
The British term for *firewall*

burn out
To burn or wear away a car component. For example, if you carry too heavy a load up a steep hill you can burn out the clutch plate.

burnout
Deliberately spinning the back wheels of a car in order to create lots of smoke & noise. Although a burnout is similar to a *wheelie*, there is a difference - a person dropping a wheelie is usually trying to accelerate away with lots of smoke and noise. A person doing a burnout may not move the vehicle very far at all - his or her main purpose is to make the back tyres spin for effect. See also *donut*. See also *wheelie*.

butane
A gas used as an alternative fuel to petrol. Both butane and propane are forms of *liquefied petroleum gas*. (LPG)

camber
1) The curvature of the road surface.
2) The inward or outward tilt of the wheels of a vehicle, as viewed from the front. If the wheels tilt in at the top, they have a *negative* camber, if they tilt out the camber is described as being *positive*.

camshaft
Part of a car's engine, namely a metal shaft with carefully machined lumps around it called lobes. As the camshaft is revolved, the lobes push directly or indirectly down on the valves to open them, then as the shaft continues around, the lobes move away from the valves, allowing them to close again. See also *engine valve*.

carbon fibre
A very strong synthetic fibre used to make lightweight yet high strength components. It is used in the Britten superbike and frequently in racing cars.

carbon monoxide
An odourless, colourless & extremely poisonous gas produced where carbon-based fuels such as petrol are not burned completely during combustion.

carburettor
A device which mixes fuel and air together and feeds this mixture into the engine. See also *fuel injection*.

caster
The vertical alignment of the steered wheel (usually the front wheel), when viewed from the side. This not as complicated as it sounds. Think of a bicycle. When viewed from the side the front forks (and therefore the front wheel) are not straight-up-&-down – they stick out at an angle. Because they stick out towards the front on most bicycles, this is called *positive* caster. If the wheel stuck out towards the back, it would be termed *negative* caster. See also *camber*. See also *toe in/toe out*. See also *wheel alignment*

catalytic converter
An anti-pollution device which theoretically helps purify a car's exhaust gases by changing them into less toxic substances as they leave the engine. It is mounted in a tube fitted into the exhaust system. As the exhaust gases pass through the converter, which contains a mesh of such noble metals as palladium and platinum, unburned hydrocarbons and carbon monoxide are theoretically converted to water vapour, carbon dioxide and other less toxic gases. The catch is, catalytic converters don't work properly unless the engine is hot, and wear out long before the rest of the vehicle (they are often not replaced).

cc
Short for cubic centimetres, the cc rating of an engine is a measure of how much it will hold, eg, a 1.5 litre engine has a cubic capacity of 1500, or to put it another way, 1500cc. Often, engine capacities are rounded up to the next major figure for the purposes of simplicity. For example, an engine might be described in a brochure as being a 1500, even though it is actually 1498cc. See also *cubic-inch displacement*.

Cd
Coefficient of Drag. See *aerodynamics*

chain drive
A drive system consisting of toothed sprockets linked by a chain. A bicycle uses chain drive. See also *timing chain*.

chassis
The chassis (rhymes with *lassie*) is a frame underneath a car which provides much of its strength. The engine, gearbox and suspension are usually bolted to the chassis. On older cars the chassis was a separate part to which the car's body was bolted or welded, but on modern cars it is manufactured as part of the car's body. When people talk about a full chassis, they are usually referring to a chassis which runs the entire length of the vehicle, as opposed to a modern car, which has a chassis front and back, but in the middle uses the body itself for strength. See also *monocoque construction*

clear coat
The top coat of a paint job, designed to produce maximum shine. See also *base coat*

climate control
A fancy term for air conditioning. It is usually applied to systems where the air can be programmed to remain at a set temperature, as opposed to the older systems which simply threw hot or cold air at you.

clock/clocked
A car which has had its odometer reading altered to hide its true mileage is said to have been *clocked*. The verb is *clock*. See also *odometer*

clutch
A device activated by the clutch pedal that temporarily and gradually disconnects the connection between the engine and gearbox in order to let you change gear and also to smoothly move the car from stationary. See also *torque converter*.

CNG
See *compressed natural gas*

cog
A toothed wheel. The evenly-spaced teeth lock into something such as another cog or a chain and are used to drive something or be driven by something. A bicycle uses a cog mounted between the pedals to drive a chain, and another cog driven by this chain to power the back wheel.

coil
An electrical device which converts the low voltage coming from the car battery into many thousands of volts in order to power the spark plugs. The coil is triggered by either the contact points or by an electronic ignition. See also *contact points*. See also *electronic ignition*. See also *spark plugs*.

computer torque control
see torque control

compressed natural gas (CNG)
Methane mixed with small quantities of $C0^2$, used to power engines.

concours
Short for *concours d'elegance*, a French term meaning 'contest of elegance'. In modern English concours means a display of, and often a contest between, fine cars. Although such a display will often be of luxury cars, the term concours is also applied to the quality of any classic car restoration, eg, a very well restored classic car is described as being of *concours* quality, meaning that it could win a contest for the quality of its restoration.

contact points
A switch that turns the engine's coil on and off at the appropriate time in order to fire the spark plugs, and therefore the fuel. The contact points live and work inside the distributor in older cars. Now replaced by electronic ignitions. See also *coil*. See also *distributor*. See also *electronic ignition*. See also *spark plug*.

constant velocity joint
A type of universal joint used primarily in front-wheel drive cars. Unlike the universal joints used on older-type driveshafts, the constant velocity joint means that both halves of the joint constantly spin at the same speed. Conventional universal joints momentarily speed up and slow down as they revolve, which causes them to vibrate and wear out quickly when used on very short shafts, such as the ones on front wheel drive cars. See also *driveshaft*. See also *half shaft*.

C-pillar
The roof support behind the rear door in a four-door car.

cruise control
A system which allows the driver to set his or her cruising speed. This speed is maintained automatically, regardless of such things as uphill or downhill slopes.

cubic-inch displacement
Sometimes abbreviated as CI or CID, an imperial, as opposed to metric, method of measuring engine capacity. For example, a Triumph 2.5 engine has a capacity of 152 cubic inches and a cc rating of 2498cc. See also *cc*.

cv joint
See *constant velocity joint*

cylinder head
The removable top of a car's engine. In almost all modern designs the engine valves and also usually the camshaft operate as part of the cylinder head. Because the job of the cylinder head is to seal in the explosions that power an engine, it must be a tight fit. See also *camshaft*. See also *engine valves*.

cylinder head gasket
In between the cylinder head and the engine block is a cylinder head gasket, a flat piece of flameproof material which acts as a seal. If this gasket leaks, bad engine problems, notably overheating, are likely to occur. Sometimes the gasket leaks so badly that the gasket is burnt away. This is called a *blown head gasket*.

diesel engine
Named after Rudolph Diesel, the man who invented it, the diesel engine works by compressing diesel fuel until it explodes. Actually, to be strictly accurate, the diesel engine works by squirting diesel fuel into highly compressed air inside a cylinder. Whereas a petrol engine requires a spark from a spark plug to ignite the fuel, the diesel engine fires its fuel through having the cylinder very hot before the fuel is injected in. The cylinder is made hot, believe it or not, by nothing more than compressed air: when air is heavily compressed, a great deal of heat is created in the process.

The faster it's compressed, the more heat is generated. The diesel engine, therefore, sucks in air, compresses it, which raises the temperature of the cylinder, then diesel fuel is sprayed into that cylinder through a tiny nozzle called a jet, which works like a syringe needle. Because the compressed air in the cylinder is very hot, this causes the fine mist of diesel fuel to explode, which drives the piston downwards and powers the engine. Traditional diesels are slow and smoky, but their efficiency can be increased dramatically by fitting them with a turbocharger, an air pump that forces more air through the engine and therefore allows more fuel to be injected. Because they work at extremely high pressures, diesel engines have to be built very solidly in order to go the distance, but when properly built, some diesels have offered incredible reliability (generally the larger ones, not the smaller ones). Certain older conventional diesel engines, such as the ones fitted to Toyota Land Cruisers and Nissan Patrols, could be relied upon for half a million kilometres or more with nothing but the most basic maintenance. This reliability was mainly because those engines were, like all conventional diesels, rather inefficient – on a conventional diesel vehicle, you need a motor roughly twice the size of the equivalent petrol engine in order to produce the same amount of power, and even then you won't get anything like the same acceleration. In other words, a three litre conventional diesel puts out about the same power as 1.5 litre petrol engine, but won't get up to speed as fast. However, with modern *common rail* technology, a diesel engine can be made to run with similar efficiency to a petrol engine. First, the diesel fuel is pumped into and stored at extremely high pressures in a single long tank called a *rail*. Because all the cylinders share a common rail, this type of diesel is called a *common rail*. Attached to this common rail are a series of special valves that carefully control the injection of fuel going into their particular cylinder. Because the timing and amount of fuel are both carefully controlled, and because the high pressure allows an extremely fine mist to be injected into each cylinder, common rail diesels operate far more efficiently and cleanly than convention diesel engines. The downside, which is only just beginning to show, is in the area of longevity. Older diesel engines chug along at low revs for years and years. They're not reliable because they're diesels, they're reliable because they are very solidly built and they don't work hard. However, when you make any diesel motor (which is already highly stressed) perform like a petrol engine, you dramatically increase the strain on the engine components. This, in our opinion, raises a big question mark over the future reliability of modern diesels. Also, the extremely high pressures required to operate the system mean that even minor leaks are a serious problem, and pumps are likely to wear out much sooner than on older versions. And last but not least, making a diesel work as hard as a petrol engine means that it will use far more fuel than its less efficient ancestors. Diesels will always have the edge on fuel economy, but the gap is no longer as dramatic as it was a generation ago, when many diesel powered cars would give twice the mileage for half the price of petrol.

See also *turbocharger*.

differential
A gearing system which allows the two powered wheels on the opposite sides of a car to move at different speeds as the car goes round corners. See also *limited-slip differential*. See also *transaxle*.

DIN
*D*eutsche *I*nstitut fur *N*ormung - the German Institute for Standardisation, an organisation which sets internationally-recognised standards for measurement.

direct ignition system
An ignition system used on some modern cars which use no distributor. Instead, electrical impulses are sent from a device called a modulator direct to the spark plugs. See also *coil*. See also *contact points*. See also *distributor*. See also *electronic ignition*. See also *ignition lead*. See also *rotor*. See also *spark plug*. See also *timing*.

direct injection
See *fuel injection*.

directional tyre
A tyre which is designed to rotate in one direction only.

disc/disk brakes
A braking system used on most modern cars. When you put your foot on the brakes the brake pads are pushed hard against the disk by the brake cylinder, which slows the disk and therefore the car. It's actually a very similar system to the one used on most bicycles. Because disc brakes tend to stop more evenly, they are often used on the front of cars, with drum brakes on the back. See also *drum brakes*.

distributor
1) A device, powered by the engine that does two separate jobs. Firstly, it houses and operates the contact points or the electronic ignition switching unit (see separate explanations for these). Having switched on the coil, it collects the coil's powerful pulse through the ignition lead and distributes this pulse to the appropriate cylinder in order to fire the fuel at exactly the right moment. This right moment, naturally enough, is known as the correct *timing*. See also *coil*. See also *contact points*. See also *distributor cap*. See also *electronic ignition*. See also *ignition lead*. See also *rotor*. See also *spark plug*. See also *timing*.
2) A device which distributes the fuel to the injectors in a fuel injection system. See also *fuel injection*.

distributor cap
A plastic cap, shaped rather like the top to an aerosol, which sits on top of the distributor and collects the voltages to pass to the spark plugs. The ends of the ignition leads are usually plugged into the distributor cap and are electrified by sparks leaping off the rotor. See also coil. See also contact points. See also distributor. See also *electronic ignition*. See also *ignition lead*. See also *rotor*. See also *spark plug*. See also *timing*.

DOHC
Double overhead camshafts. See also *camshaft*.

dog
1) A poorly performing or unreliable car. See also *lemon*.
2) A pin or stub used to mate & drive a gear or assembly.

donut
A controlled drift of a car in which the car is spun 360° while the tyres are spinning. It's done to show off. See also *burnout*. See also *wheelie*.

DOT
The American **D**epartment **o**f **T**ransportation. DOT standards for such things as brake fluid are often internationally-recognised.

double-declutch
The double-declutch technique is much easier to do than to describe. It was once part of every young driver's instruction, because before World War II and for quite a while after, carmakers couldn't or wouldn't stop cars crunching between gears on manual gearboxes when driving. The problem is caused by the fact that the gear you want to change into (say, third gear) is spinning at a different speed than the gear you are in, so the spinning gears collide and graunch before they lock together. If it makes it easier for you to visualise, think of two people trying to move through the same doorway when the one in front is going much slower than the one behind – either you speed one up or slow one down, because if you don't a confrontation is inevitable.

The purpose of the double-declutch is to make the two gears move at approximately the same speed so that they merge smoothly like the two halves of a zipper.

To double-declutch when changing *up* (that is, first to second, second to third etc), you simply momentarily take the car out of gear and into neutral. You then put the gearbox into the next gear.

When changing *down* (fourth to third, third to second, etc) you simply momentarily take the car out of gear and into neutral, then you give the accelerator a quick pump, then put the gearstick into the next gear.

That's it. With a bit of practice you can usually change gears nearly as smoothly as you would with a modern car.

The main reason for mastering the double-declutch is so that you can drive a modern car which has a gearbox suffering from dysfunctional synchromesh (look up *synchromesh* if you don't understand). On some high mileage modern cars the gearbox starts crunching between gears, even though it may otherwise work okay. The double-declutch should get you through everyday gearchanges without problem.

You probably don't need to be told this, but on almost every vehicle on the planet with a manual gearbox, you must come to a complete halt before changing from forward into reverse.

It's also worth noting that on some classic cars, **first gear was meant to be engaged only if the car was absolutely stopped**, and you should never attempt to double-declutch into first gear on one of these vehicles, because if you get it wrong you may wreck an otherwise perfectly good gearbox.

Mastering the above should get you through. For those who like challenging experiences, it's worth mastering the heel-and-toe changedown, which is useful for when you are braking and changing down at the same time. The left foot operates the clutch as usual, while the right foot is turned sideways and operates the brake with the ball of the foot while the accelerator is worked with the heel. This technique takes a bit of practice and until mastery is achieved should never be attempted in the presence of other motorists. It's best to practice the heeling-and-toeing of the brake and accelerator pedals on a flat driveway with the handbrake on and no kids around. Don't actually try and change gears at this point, just get the hang of operating the brake and accelerator with one foot. If you can't achieve reasonable skill at this, don't proceed with this technique on the road. When heeling-and-toeing of the brake and accelerator is mastered, you can practise the heel-and-toe double-declutch on an empty road in clear conditions. **Don't attempt the heel-and-toe double-declutch in ordinary road conditions unless a reasonable degree of mastery has been achieved.** However, most people can perform this technique with great skill after a bit of practice – some rally drivers use it on every race, in order to change down quicker and with a minimum wastage of power. The purpose of the heel-and-toe changedown, however, should never be to turn you into a rally driver; the point of the exercise is to enable you to change down a gear as you slow down on a corner. Aside from convenience and comfort, it's likely to offer greater safety under difficult conditions such as in the wet. But, in case you haven't taken the hint already, **if you're not good at it, don't try it on public roads at all!**

double overhead camshafts
Two camshafts mounted over the top of the engine. See also *camshaft*.

double wishbone suspension
A suspension system which uses two wishbones. See also *wishbone*.

drive-by-wire
See *electronic throttle control*

driveshaft
A metal shaft, usually hollow, that transmits the power from the gearbox to the differential in a front engined, rear-wheel drive car. One or both ends of the driveshaft are fitted with universal joints. See also *constant velocity joint*. See also *half shaft*. See also *universal joint*.

drive train
Everything (except the engine itself) that takes the power of the engine and delivers it to the road surface. This includes, transmission, clutch or torque converter, differential, axles, wheels & tyres etc. See also *power train*.

drive wheels
See *powered wheels*

driven wheels
See *powered wheels*

drum brakes
Drum brakes use a heavy metal drum, shaped a bit like a round cake tin, and this drum lives at the back of the car's wheel. When the car's wheels go round, the brake drum goes round too. The brake shoes live inside the drum, and when you put your foot on the brakes the shoes are pushed hard against the drum by the brake cylinder, which slows the drum and therefore the car. See also *brake shoes*.

dwell
1) The amount of time that the contact points stay closed before opening each time.
See also *contact points*.
2) The amount of time an engine valve stays closed during operation. See also *engine valve*. See also *camshaft*.

dynamo
A direct-current generator. See also *alternator*.

dyno, dynamometer
A device used to measure the power and speed of an engine. Sometimes called a *rolling road*, because to use most dynanometers you drive the car onto a series of rollers that simulate a car driving down the road.

east-west
An engine mounted sideways, that is with the front of the engine facing one front wheel and the back facing the other. Also known as a *transverse* mounting, this style of engine is used in most, but not all, front-wheel drive cars. See also *front-wheel drive*.

ECM / ECU
see *Electronic Control Unit*.

EFI
see *fuel injection*

electronic control unit (ECU)
The *electronic control unit*, more commonly known as the *ECU*, controls the basic engine functions such as the fuel injection system, ignition timing & idle speed control. It may be also called the *engine management computer* or *electronic control module*, and several other names that mean much the same thing. While they are working as God intended, ECUs generally offer very efficient operation because they usefully coordinate the engine's various functions. That's when they are working. Many manufacturers, including Mitsubishi, completely underestimated how rugged electronics had to be before you could put them inside a vehicle's engine bay. As a result, the typical life of an ECU from 1989-94 was as little as three to five years (the exception is Toyota). Some tired ECUs will just cause irritating problems like having the *Check Engine* light coming on, or idling problems. When ECUs get bad they may cause complete breakdowns, especially when the engine is hot. In case you don't know it, heat is very bad for computers, and life in the engine bay is very hot, so the computers cook, which is why they often give problems when the car has been running for a while. Honda and a few others came up with the bright idea of installing the ECU under the seats or somewhere else on the floor, which eliminated heat problems but introduced terrible problems caused by moisture. None of these problems had to happen. ECU problems on Toyotas are rare simply because Toyota builds their computers properly in the first place. The worst cars for computer problems are anything from Europe, Korea or America. With the exception of late 1980s to mid 1990s Hondas and Mitsubishis, Jap cars tend to have much more reliable ECUs. ECU problems tend to be very expensive to both diagnose and fix, so it's important that you never buy a vehicle that has a *Check Engine* light showing. See also *body computer*. See also *electronic ignition*. See also *fuel injection*.

electronic ignition
As the name suggests, a system of firing a car's fuel where the contact points are replaced with a (usually) more efficient electronic system. The big advantage of most electronic ignitions is that they are extremely reliable and rarely, if ever, need adjusting. See also *contact points*.

electronically controlled suspension
A suspension system where a computer controls the shock absorbers and sometimes the springs, in response to road conditions.

electronic stability control
Electronic stability control uses sensors to detect when a vehicle is straying from the intended direction of the driver. Sophisticated electronics then take over the brakes and engine to bring the vehicle back under control. *See also our article on electronic stability control in the 'Safety' section.*

electronic throttle control
On most cars built before the late 1990s, the accelerator pedal and the engine were linked by a piece of steel string called a bowden cable; when the driver pushed the pedal, the throttle was moved by this cable. On cars with electronic throttle control the bowden cable is gone; replaced by a electronic sensor called the *accelerator pedal position sensor*, linked to the accelerator pedal. This sensor records the movement of the pedal and relays this information to the engine control computer. Aside from being clever, the chief advantage of this system is that it makes it easier for car designers to develop safety systems like electronic stability control, because such systems need to take over the accelerator in an emergency. Electronic throttle control has little effect on things like fuel consumption or performance.
See also *electronic stability control*.

engine
A device with moving parts that converts power into movement.

engine block
A large block of moulded metal containing the cylinders of an internal combustion engine

engine valve
Basically, an engine valve is a tap which lets fuel & air into an engine or lets the burnt fuel out after the engine is finished with it.

fan belt
Originally used to drive the cooling fan on a car's engine, the so-called fan belt is now used to power the water pump, and sometimes several other devices on a modern engine such as the alternator & the air conditioning pump. In many cases the 'fan belt' does not operate the fan at all because most modern cars have electric fans. See also *belt*.

filler
One of a range of products designed to fill dents and sometimes cover rust holes on cars. Almost all are based around styrene resin. The trade slang for most fillers is *bog*, loosely meaning *shit*, because fillers were traditionally used to cover up badly repaired panels or unrepaired rust holes. The derogatory term still used for a bad panelbeater is 'bog artist'. This prejudice against 'bog' dates from the days when cars were 'properly' repaired with lead, a toxic substance so heavy that only the smallest amount was applied to a panel, and even then only after the panel was expertly beaten back into shape after an accident. People who were incapable of, or too lazy to, repair panels properly used the then-new fillers to cover bad workmanship. Times have changed, and the panels on modern cars are no longer beaten back to shape because they are too thin to repair properly - panels are simply replaced. Modern body fillers are also much lighter and more stable than their distant ancestors of the 1950s and come in a variety of different types. In recent years sophisticated and extremely strong, carbon fibre-based fillers such as *Newtech* (a brand name) have given fillers a certain respectability. There is nothing noble about using lead to repair a car (it's hard to work with and a deadly poison). Products like Newtech can be regarded as a semi-permanent repair in its place. See also *carbon fibre*.

firewall
A wall, usually of steel, which separates the engine compartment from the passenger compartment of a car.

4OHC
Four overhead camshafts. See *quad overhead camshafts*.

floorpan
Basically, everything below a car's doors.

four-wheel independent suspension
A suspension system which allows all four wheels to travel up and down independent of one another. This means that one wheel can go over a bump without affecting the others.

freeflow exhaust
An exhaust system, especially one that replaces the standard exhaust manifold, which is designed to provide the minimum resistance to exhaust gases. Because more gas can flow out of the engine, more fuel can be fed in, therefore a car with a freeflow exhaust can theoretically go faster. In order to achieve maximum gas flow, designers of these systems will often go to extraordinary lengths to incorporate long, flowing curves into the pipes. The result often looks quite beautiful. Freeflow exhausts are often used in racing engines or by people who like to think of themselves as racers. See also *headers*. See also *manifold*.

fuel injection
A system for spraying carefully measured amounts of fuel into a car's engine in order to make it run efficiently. Fuel injection systems have made carburettors obsolete on most modern cars. In older fuel injection systems the fuel was sprayed into the manifold. In direct injection systems, the fuel is spayed directly into the cylinder just before ignition. Direct injection systems are much more efficient. Because most modern fuel injection systems are electronically controlled they are therefore called electronic fuel injection systems (EFI). See also *carburettor*. See also *manifold*. See also *multi-point fuel injection*.

gas-filled shock absorber
A shock absorber which uses pressurised gas to assist in its action.

gasket
A piece of thin, compressible material, often flat, used to stop leakage between two surfaces. See also *cylinder head gasket.*

gearbox
Also known as *transmission*, the gearbox takes the power from the engine and uses a series of gears to give a car more power and less speed, or less power and more speed. The term *transmission* for a gearbox is okay, but is generally used with the word automatic to describe an automatic transmission. For a manual gearbox (one where you have to change the gears by hand as you drive along), the term *gearbox* is probably the preferred term. See also *clutch.* See also *synchromesh.* See also *torque converter.*

generator
In the usual way of speaking, a generator (as opposed to an alternator) is an older style producer of electricity for cars. Although mounted to the motor in a similar way to the more modern alternators, generators generally take longer to charge a battery, which is why they are usually found only on cars over 20 years old. Technically speaking, however, a car generator is actually *any* device which produces electricity by converting rotation into electrical energy. The device most mechanics describe as a *generator* is (technically speaking) actually a *dynamo,* or *direct-current* generator. See also *alternator.*

headers
Basically the same as a freeflow exhaust manifold, headers are often made with all pipes of equal length in order to achieve equal gas flow. See also *freeflow exhaust.*

half shafts
The individual axle shafts that pass the power from either side of the differential to the wheels.

hardtop
Some versions of sports cars and offroaders have no permanent roof, and instead come with a removable flexible cover called a *softtop.* They frequently leak. The versions of these vehicles that have a permanent, non-removable roof are sometimes called *hardtops* to distinguish them from their open-topped siblings. However, some sports cars and offroaders with no permanent roof come with the option of a more practical removable top that is made of a stiff material such as hard plastic or fibreglass. These are called *convertible hardtops or removable hardtops.*

head
See *cylinder head.*

head gasket
See *cylinder head gasket.*

hood
American term for *bonnet*

horizontally-opposed engine
An engine where the cylinders stick out sideways in opposite directions, such as in the Volkswagen Beetle or most Subarus.

hub
The centre of a wheel. On a car, the hub is a round piece of metal to which the road wheels are bolted.

ignition lead
(On most cars) A thick wire which passes the high voltages from the coil, first to the distributor, then from the distributor to the spark plugs. Also called an *HT* (high tension) lead. See also *coil.* See also *contact points.* See also *distributor.* See also *electronic ignition.* See also *rotor.* See also *spark plug.* See also *timing.*

ignition points
See *contact points*

ignition system
The part of a car which creates and distributes the electrical energy required to fire the engine's fuel.

independent rear suspension
A suspension system which allows both back wheels to travel up and down independent of one another. This means that one wheel can go over a bump without affecting the other.

intercooler
A radiator-like device which cools the hot air (and sometimes the air/fuel mixture) after it is driven through a turbocharger and before it enters the car's engine. Cooling the air increases the amount of air that can be pumped into the engine. How? Because the hotter the air is, the more that the air expands. Cooler air is far more dense, therefore much more air can be forced into the same engine. Increasing the amount of air flowing through the motor can increase the efficiency dramatically because as more air is forced in, more fuel can be usefully added. Also, because the air is cooled before it goes in, the cooler air tends to cool the insides of the motor and therefore smooth out the explosions that power it. The reason that the constant explosions inside an engine don't simply blow it apart are because the explosions are regular and controlled. If the explosions become erratic, this is known as knocking, and that's exactly what happens inside the engine - the parts knock around, although you will not always hear it. Mild knocking inside an engine is also known as *pinging* or *pinking.* Cooler air is also far kinder to the cylinder heads, which are prone to cracking, warping and blowing gaskets if abused, and engine valves, which will simply burn away if they get too hot for too long. See also *turbocharger.*

Kevlar (a trademark)
A lightweight, strong and extremely expensive plastic used in such things as racing cars which must be both strong and light.

knocking - Petrol & diesel-powered cars work by exploding the fuel inside the engine. The reason that the constant explosions inside an engine don't simply blow it apart are because the explosions are regular and controlled. If the explosions become erratic, this is known as knocking, and that's exactly what happens inside the engine - the parts knock around, although you will not always hear it. Mild knocking inside an engine is also known as *pinging* or *pinking.* See also *octane.*

lemon
A badly designed and/or assembled vehicle, especially a new one. A model of car is often labelled a lemon by the public when owners keep having problems with it from new. By comparison, a *dog* is a vehicle of any age which may be badly designed and/or assembled or it may simply be worn out. See also *dog.*

limited-slip differential (LSD)
Most differentials will allow one wheel to spin freely on slippery surfaces , which means a loss of power and control. Limited-slip differentials limit this slippage, therefore giving better control of the vehicle. See also *differential.*

liquefied petroleum gas (LPG)
Gases, predominantly propane and butane, which are present underground along with crude oil and which are often burnt in car engines as a substitute for petrol. Although these substances are naturally gases, they turn to liquids when compressed. See also *compressed natural gas.*

life, meaning of
"Ultimately, one cannot justify life and find meaning in it by intellectual analysis and the use of logic. One must reach a state in which he or she experiences emotionally and biologically that it is worthwhile to be alive and feels active excitement about the fact of existence. Agonizing philosophical preoccupation with the problem of the meaning of life, instead of being a legitimate philosophical issue, should be seen as a symptom indicating that the dynamic flow of the life process had been obstructed and blocked... A person who is actively engaged in the life process and experiences zest and joy will never question whether life has any meaning. In this state, existence appears to be precious and miraculous, and its value is self evident."
(Stanislav Groff, *Beyond the Brain*, 1982)

low profile tyres
Tyres which are lower in height than conventional tyres. They are used to improve handling, or to make a car look cool. They generally give a lousy ride and are more susceptible to damage on bad roads.

LSD
see limited-slip differential

manifold
A series of metal tubes that guide the combustion gases in and out of the engine. The inlet manifold guides the air (and often fuel) into the engine, while the exhaust manifold takes the burnt air and fuel mixture out. The exhaust manifold is attached directly to the exhaust pipe. Manifolds are usually carefully curved in order to allow maximum gas flow. See also *freeflow exhaust.*

monocoque construction
A system of construction where the main structural body parts of a car are produced as one unit from sheet metal in order to save effort and weight. See also *chassis.*

MPI / MPFI
see *multi-point fuel injection*

multi-point fuel injection
A fuel injection system where the fuel is injected directly in front of the inlet valve of each cylinder as opposed to single-point fuel injection system where the fuel is injected into the air intake of the manifold. Multi-point fuel injection systems are generally far more efficient than single point. See also *fuel injection.*

multi-link rear suspension
In conventional rear suspension systems the wheels tend to tilt during cornering, which means that the driver has less control of the vehicle. Multi-link rear suspension systems use a series of arms or links to keep the rear wheels vertical while the car is in motion. This system is more complicated but often gives better control when cornering. The major disadvantage of this system is that the suspension often wears out much more quickly and may begin giving inferior handling and knocking noises as the vehicle goes around corners. It is also easily upset by minor collisions and will cost much more to fix than a conventional rear suspension. See also *suspension.*

NVH (Noise, vibration & harshness)
An engineering term which has crept into car magazine articles and sales brochures. Terms like 'good NVH characteristics' are simply an attempt to dazzle you with science. You could just as easily say "This car runs quietly and smoothly." It means the same thing.

octane
The measure of a fuel's anti-knock quality. In other words, the higher the octane rating, the superior the anti-knock quality.

odometer
A device which measures the distance which as car has travelled. Because the odometer is often mounted in the same place as the speedometer, many people wrongly use the term *speedo,* or *speedometer,* when the actually mean *odometer.* See also *speedometer.*

OHC
see *overhead camshaft*

overhead camshaft
A camshaft mounted in the cylinder head of the engine. See also *camshaft.*

oversteer
see *understeer*

passive rear-wheel steering
A rear wheel suspension system which allows the rear wheels to follow the angle of the front wheels during cornering. By comparison, active rear-wheel steering systems are directly connected to the steering wheel and are moved by it.

passive restraint
See *active restraint*

pillar
The folded steel post that holds up a vehicle's roof and is often used to support the doors. The *A pillar* is the one immediately in front of the driver's door, the *B pillar* is the one immediately behind the driver's door and the *C pillar* is the one immediately behind the passenger's door.

pinging
See *knocking*

pinking
See *knocking*

piston
A round, often hollow, piece of metal with a flat or curved top. It moves backwards & forwards in a tube called a *bore* in much the same way as the plunger in a syringe draws in or pushes out liquid. Pistons are used in hydraulic cylinders such as the ones in a car's brakes. When the brake pedal is pushed a piston forces brake fluid down tubes towards the wheels. At the wheels, pistons inside the brake cylinders are pushed by the pressurised brake fluid, thereby pushing the brake shoes against the brake drum. Inside most car engines the piston's purpose is first to draw in vaporised fuel. Having drawn in the fuel it then compresses it by moving back up the bore and squashing it into a small space. After the fuel is ignited, the resultant explosion pushes the piston back down the bore. This pushing action is harnessed to power the car. The piston then goes back up the bore to push the exhaust gases left behind from the explosion out of the engine and into the exhaust pipe. The whole process then starts again as the piston draws in the next lot of fuel. This process happens many thousands of times for every kilometre you drive. See also *bore.* See also *engine valves.* See also *valves.*

platform
A platform is basically a single basic vehicle – empty of moving parts or outer 'skin' – that can be cheaply modified into different vehicles sold under different brands. Basing a number of vehicles around a single platform makes economic sense for manufacturers because of the high cost of designing a vehicle from scratch.

points
See *ignition points*

post
1) Something that sticks up and (usually) has something else attached to it.
2) A British term for *pillar.*

power steering.
A power steering system uses some external force to assist the driver to turn the wheels. On older cars this usually done with hydraulics, using a pump driven from the engine by a fan belt. On many modern cars power steering is achieved using electric motors. Electric power steering is cheaper to build and has the advantage that it is easy to make it speed-sensitive. On speed-sensitive power steering systems the amount of assistance given to the steering depends on the speed you are driving. These systems were developed because early power steering systems were notoriously insensitive. You need a lot of assistance to turn the wheel when parking; however, when you are on the open road you could probably drive without power steering at all. Hence, a speed-sensitive system adjusts the amount of help it gives you, depending on how fast you are going.

power train
Everything (including the engine itself) that takes the power of the engine and delivers it to the road surface. This includes, engine, transmission, clutch or torque converter, differential, axles, wheels & tyres etc. See also *drive train.*

powered wheels
Usually known as the *drive wheels* or *driven wheels*, these are the wheels that push or pull a vehicle along, as opposed to the ones that just spin around. Think of a bicycle. One wheel is attached to the chain and as you pedal the power of your feet is passed to that wheel. Therefore, it is called the *powered wheel, drive wheel* or *driven wheel.*

pretensioning seatbelts
See *seatbelts*

pulley
Basically, a pulley is a wheel around which a belt of some kind moves. See also *belt.*

pyrotechnic seatbelts
See *seatbelts*

rack-and-pinion steering
A simple yet extremely effective steering system which used to be mainly confined to Morris Minors and some sports cars, but is now the most common form of steering control. A rack is basically a flat cog and a pinion is a round cog at the bottom of the steering shaft that moves the pinion left or right when the steering wheel is turned in that direction. The advantages of rack-and-pinion steering are that the steering is often extremely direct and less prone to wander than with steering box systems. See also *power steering.* See also *steering box.*

regenerative braking
Regenerative braking is a system used in electric or hybrid vehicles so that the electric engine that powers the vehicle is temporarily converted into a generator during braking. This is easier than it sounds because a generator and an electric motor are technologically very similar. When the driver starts slowing down the wheels of the vehicle start spinning the electric motor. This energy from the spinning motor is then used to charge the batteries that power the electric engine during acceleration.

regulator
A device that controls the flow of energy, gas or fluid.

rotor
1) Any mechanical device which rotates in operation.
2) In many cars, a rotating device which takes the coil voltage and passes it to the appropriate spark plugs through the ignition leads.
3) The disc on a disc brake.

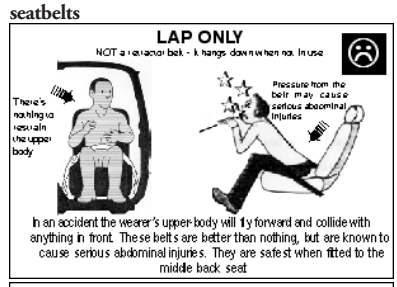
rotary engine
An engine which operates in a continual circular motion as opposed to a piston engine, where the pistons must continually change direction in order to operate.

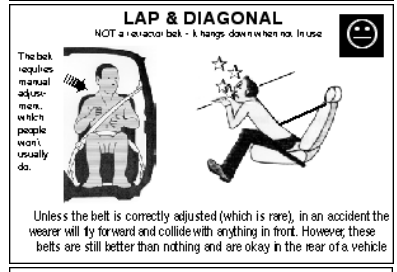
QOHC
see *quad overhead camshafts*

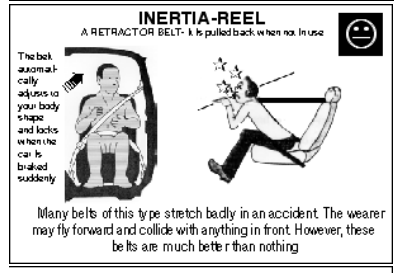
quad overhead camshafts
Four camshafts mounted over the top of a V6, V8 or V12 engine. See also *camshaft.*

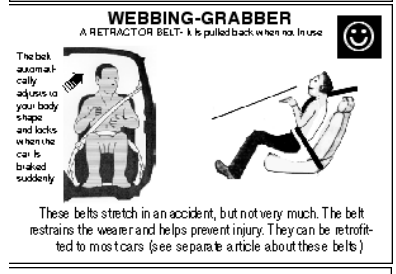
scuttle panel
The panel between the back of the bonnet and the windscreen.

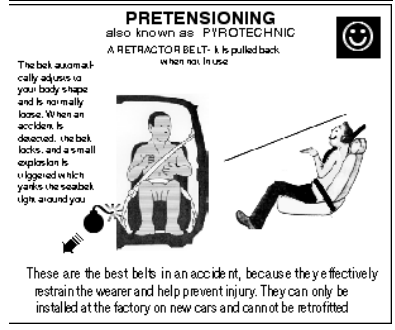
seatbelts











There's a detailed article: 'A Tragic Lack of Restraint' on our website, dogandlemon.com. Click on any icon on our website and then search for 'restraint'. The full address for the article is: *http://dogandlemon.com/media/Safety%20PDF/A%20Tragic%20Lack%20of%20Restraint.pdf.*

self-levelling suspension
An active suspension system designed to ensure that the car is always at a uniform height & position in relation to the road, regardless of road conditions. See also *active suspension.*

shift control logic
A computerised system which works out the best time to change gear on an automatic transmission. Some systems can adapt to suit the driver's own style.

shimmy
Wobble.

shock absorber
A car spring will bounce up and down like a yoyo if you leave it unrestrained and your vehicle will bounce up and down with it. Shock absorbers dampen the bounce of the suspension springs. In addition to cushioning the car from shocks caused by things like bumps in the road, shock absorbers help control the tendency of the car to sway or wander as it drives. See also *gas-filled shock absorber.*

single overhead camshaft
A single camshaft mounted over the top of the engine, as opposed to two or more. See also *camshaft.*

SIPS
Short for 'Side Impact Protection System', Volvo's excellent design to protect the car's occupants when the car is hit from the side. Similar systems are being fitted into many popular cars worldwide.

softtop
See *hardtop*

SOHC
See *single overhead camshaft*

spark plug
A tube-shaped device, usually made of a ceramic with a metal core, that is screwed into the engine's cylinder head. The spark plug is powered by the coil. When the coil's voltage is passed to the spark plug by the distributor, the spark plug, naturally enough, sparks, which fires the fuel inside the engine. See also *contact points.* See also *coil.* See also *distributor.* See also *piston.*

speedometer
A device which measures how fast a car is going. See also *odometer.*

speed-sensitive power steering
See *power steering.*

stability control
See *electronic stability control.*

steering box
A small gearbox mounted onto the bottom of the steering column which takes the movement of the steering wheel and passes it to the steering linkage and therefore moves the wheels. Modern steering boxes tend to be used on commercial vehicles only, because they can be stronger and more durable than rack and pinon steering, which is most commonly used on cars. Inside the older steering boxes is simply a series of gears. Modern steering boxes tend to be of the recirculating ball type, which is also an old fashioned design, but one which has endured. A recirculating ball steering box uses gears with wide spaces between them. This space is filled with ball bearings that are constantly recirculating around the box, hence the name. Because the ball bearings are constantly recirculating, wear is spread over a very large area and therefore the steering box parts can last a long time. The problem with this type of steering system is that it is slow and unresponsive compared to a steering rack. Also, recirculating ball systems tend to have a dead spot when the steering wheel is in the straight ahead position and also tend to allow the vehicle to wander a bit over the road. See also *power steering, steering linkages.* See also *rack-and-pinion steering.*

steering linkages
The rods and arms that move the wheels.
See also *steering box.*

supercharger
A pump, usually driven by a belt or chain from the engine, which forces air and fuel into an engine under pressure and can therefore make an engine produce more power. A supercharger is the same as a turbocharger except that they are driven by different methods. See also *turbocharger.*

suspension
The system of parts (including shock absorbers and springs) that operate between the car's wheels and its body. The car is suspended on these parts and their job is to cushion the body from shock and to allow the vehicle to travel in a controllable manner. See also *shock absorber.*

synchromesh
On cars before World War II, the gearboxes used to crunch every time you changed gears. Crunching gears are caused by the fact that the gear you want to change into (say, third gear) is spinning at a different speed than the gear you are in, so the spinning gears collide and graunch before they lock together. If it makes it easier for you to visualise, think of two people trying to move through the same doorway when the one in front is going much slower than the one behind – either you speed one up or slow one down, because if you don't a confrontation is inevitable.

The purpose of synchromesh is to make the two gears move at approximately the same speed so that they merge smoothly like the two halves of a zipper. When synchromesh is fitted to a manual gearbox (it is on all modern cars on all gears except reverse) it means that you can change into any gear except reverse without getting a crunch. On some cars, like old Toyotas, the synchromesh mechanism wears out before the rest of the gearbox, so you get crunches when changing down from third into second gear. You can continue to use a crunching gearbox if you master the *double-declutch* technique (see separate listing). However, if the car you a driving crunches even when you put it into first or reverse from standstill with the engine idling at normal speed, then the chances are that the problem is not the gearbox but the clutch and you should have this checked out. See also *clutch.* See also *double-declutch.* See also *gearbox.*

sway bar
see *anti-sway bar*

thread
A spiral ridge that winds around the outside of bolt or the inside of a nut.

timing
Most car engines work by exploding fuel. The firing has to take place at the exact right moment if the engine is to work properly; hence the term *timing.* As the engine speeds up, the firing must happen sooner and sooner; this is called *timing advance.* See also *advance.*

timing belt
A belt of synthetic material such as nylon, used to power the camshafts on many modern engines. See also *belt.* See also *timing belt tensioner.* See also *timing chain tensioner.*

timing belt tensioner
A device that keeps a firm and even tension on a timing belt. The exact amount of tension is usually adjustable by the mechanic, which is a mixed blessing. Without the right amount of tension, the belt is likely to slip, often with disastrous results for the engine, because an unrestrained or broken timing belt may allow the engine valves to collide with the pistons. However, many mechanics, who don't wish to be blamed later for a slipping timing belt, tend to heavily overtighten the belt tensioner, causing the timing belt or its supporting pulleys to break many thousands of kilometres too soon. See also *camshaft.* See also *timing belt.*

timing chain
A metal chain used to power the camshaft, on many older (and a few new) engines. A timing belt now does the same job on many engines, only more quietly. See also *camshaft.* See also *timing belt.* See also *timing chain tensioner.*

timing chain tensioner
A device which keeps an even tension on the timing chain. This is important for efficient operation, because an untensioned timing chain makes a devil of a racket & the engine will not work as well, even though the rattly chain may cause no actual harm to the engine. The rattly sound that old Morris Minor engines make is largely due to the fact that they came out of the factory with no timing chain tensioner at all. See also *timing chain.*

toe in/toe out
The sideways alignment of the front wheels on a car. If the front of the wheels stick out at the side, the car has toe-out. If the wheels point inward at the front, they have toe-in. You'd probably think that all wheels would be ideally set straight ahead, but front-wheel drive cars are often set with a slight toe out, while rear-wheel drive cars are often set with slight toe-in. See also *wheel alignment.*

TOHC
Twin overhead camshafts. The same as double overhead camshafts. See *double overhead camshafts.*

torque
Torque means *twist.* The amount of torque that an engine puts out is used as a measurement of its power.

torque control
A system, usually computer controlled, which limits the amount of torque going to the powered wheels of a car. The purpose is to minimise wheel spin. See also *limited-slip differential.* See also *torque.* See also *wheel spin.*

torque converter
A fluid-filled device (actually a type of viscous coupling) which takes the place of a clutch on cars with automatic transmissions. See also *clutch.* See also *gearbox.* See also *viscous coupling.*

torque steer
The tendency for front-wheel drive cars to pull to one side during heavy acceleration. See also *front-wheel drive.*

trailing arm suspension
Trailing arm suspension is a type of *independent rear suspension.* On a car fitted with trailing arm suspension the rear wheel assemblies are attached to the rest of the vehicle by two triangular arms – one on each side. Trailing arms are attached in front of the rear wheels. These arms move up and down independently of each other as the wheels go over bumps, etc. Semi-trailing arms are the same except that they are mounted at an angle instead of parallel to the vehicle. Trailing arm suspension has the advantage that it's simple and cheap to build. However it has two disadvantages: one, you tend to get more road noise passed up into the cabin of the car through the suspension. Two, to get ideal handling on a car the wheel should always be at the correct angle in relation to the road, however, as trailing arm suspension goes up and down the wheels tilt out of their ideal position, which means that the handling

suffers as a result. See also *camber*. See also *independent rear suspension* See also *multi-link suspension*. See also *suspension*.

transaxle
A combination of gearbox & differential in one unit. Transaxle setups are common on front-wheel drive cars. See also *differential*. See also *gearbox*. See also *front-wheel drive*.

transfer case/transfer gearbox
On four-wheel drive vehicles there needs to be a means of getting power to both ends of the vehicle. The transfer case takes the power coming out of the main gearbox and turns it sideways so that it can be passed to the front wheels. The transfer case is also often used as a means of selecting very low gears.

transmission
See *gearbox*.

transverse
See *east-west*.

traction control
See *torque control*.

turbocharger
Turbochargers are air pumps that look & work rather like a hair drier, except that they are powered by the hot gases passing out through the engine's exhaust system. These exhaust gases spin the fan inside the turbocharger & this spinning fan sucks in air from the outside & forces it into the engine under pressure, which makes the engine work more efficiently and therefore put out more power. When you first press the accelerator with the engine idling, there's not much exhaust gas to spin the turbocharger, so there's a delay before the exhaust gases build up sufficiently to make a difference to the way the engine runs. This delay is called turbo-lag and the symptom of turbo-lag is a noticeable delay before the engine starts to accelerate after you press the accelerator. See also *intercooler*. See also *supercharger*.

turbo lag
See *turbocharger*

understeer
Understeer and oversteer are caused by many different things, but to put it crudely, understeer is when you turn the steering wheel and the car doesn't turn as far as it should. Oversteer is the opposite – when you turn the steering wheel, the car moves *further* than it should. Many cars with the engine in the back suffer from oversteer because the weight of the engine tends to push the back of the car outwards on corners.

U-joint
See *universal joint*

universal joint
A connection which allows a shaft to spin around while swivelling in any direction. See also *constant velocity (CV) joint*.

valve
A valve is a form of tap, which works on the same principle as the taps on your kitchen sink - when you operate a valve, it starts, controls or stops the flow of some substance. See also *engine valve*.

variable valve control / variable valve timing (VVT)
A cylinder head design which enables the amount of lift of the engine valves (and/or their timing) to alter to suit the engine speed. See also *cylinder head*. See also *engine valves*.

viscosity
Basically, viscosity is the measure of the thickness of a liquid. The thicker the liquid, therefore the greater viscosity. If you want to be absolutely precise, viscosity is the measure of a liquid's resistance to flowing. See also *viscous coupling*.

viscous coupling
A device that uses the viscosity of a liquid to transmit power between two shafts (a torque converter on an automatic transmission is a type of viscous coupling). Viscous couplings allow a certain amount of slippage at low speeds, but as one shaft speeds up, the viscosity of the liquid means that both shafts are soon revolving at a similar speed. Viscous couplings are used in some limited-slip differentials, as a means of automatically engaging a four wheel drive system, and also to stabilise the power going between the front and back wheels of a four wheel drive, because they can send the most power to the wheels with the most grip.

viscous drive
See *viscous coupling*

voltage
See *amperes*

water pump
Part of the cooling system, a water pump circulates water from the engine to the radiator and back again after the water is cooled. Water pumps also pump water up to the heater. See also *radiator*. See also *thermostat*.

wheel alignment
In order to operate correctly, all four wheels on a car must work together; if one is pointing in the wrong direction, or is set at the wrong vertical position in relation to the others, then the car may not handle correctly, and one or more tyres will probably wear out before its time. Major components of a wheel alignment are setting the toe-in & toe out, together with the caster & camber. See also *toe-in/toe out*. See also *caster*. See also *camber*.

wheelbase
Strictly speaking, wheelbase means the distance between the front and back wheels, or rather the distance between the axles that the wheels revolve around. In everyday language it means the length of the vehicle, that is, a long-wheelbase vehicle is longer than a short-wheelbase vehicle.

wheel cylinder
see *brake cylinder*

wheel spin
If too much power is applied to the wheels which push or pull a car, the wheels spin rather than stay in firm contact with the road. This is called *wheel spin* and is accompanied by a squealing sound which is similar to the sound of a car skidding. It is sometimes done for fun, but is generally avoided because it wears out the tyres, wastes fuel and in some cases is downright dangerous.

wheelie
Where the powered wheels of a car are made to spin, generally to show off. See *wheel spin*.

wishbone
A triangular piece of metal shaped rather like a chicken wishbone. The long part (called the base) is bolted to the car's chassis, the pointed part (called the apex) is bolted to the hub carrying the road wheel. The Americans call them an *A-frame*.

wind resistance
see *aerodynamics*