

**To the memory of my cat Percy**

# **Dictionary of Automotive Engineering**

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# Preface

English is a living language, and one with an integrity worth preserving. Its rich store of words has been lifted over many centuries from many different tongues, and grows every year. The motor vehicle has been responsible for no mean contribution to that growth.

Of the more than two thousand entries in the present work, many are receiving their first published definition; others have become part of everyday communication. Some reveal the country of origin, as the French carburateur. Some, like aerodynamics, derive from classical sources. Many can be traced back to an earlier craft or trade, while the numerous eponyms take the name of an inventor or manufacturer whose identity may become lost in the passage of time – terms as old as the Hooke's joint or as recent as the MacPherson strut. Some are coined by the engineer, some by the salesman, and some by the legislator. They all go into the vernacular melting pot and emerge as part of a living language to which the truck driver is as entitled to contribute as is the scientist.

Had this dictionary been intended for one isolated national market such as the USA or the UK, the thorny problems of spelling and terminology would not have arisen. Spelling in particular is a subject that seems to arouse passionate national feelings, though more often of prejudice than scholarship.

The very scope of this work calls for an open-minded approach, a policy stemming from a desire to ease communication. Faced with a choice of spelling I have tried to choose the etymologically more correct, and then the simpler. Thus tire rather than tyre, and balk ring rather than baulk ring, both of which are supported by the Oxford English Dictionary, the Concise Oxford listing tyre amongst words ' . . . in which -y- has intruded itself without dispossessing a more correct -i-.' The most traditional of English gentlemen ties his tie, and balk, just for interest, derives from the Old Norse, the -u- being a spurious later addition, as incidentally was the -h- in Thames. Color appears without its u not because Americans spell it that way but because it is simply the old Latin word color which picked up two 'u's en route through France and only lost one on arrival. Thus what some readers may interpret as a preference for American English is merely an attempt to promote the fairer choice. It has nothing to do with nationalism.

A studious endeavour has been made to include words from all possible sources. To readers from English-speaking lands other than America and Britain this may appear as an arrogant indifference to their own vernacular, but it is merely ignorance. A letter to the publisher listing and defining such omissions for a subsequent edition will do far more than wrath to serve future readers.

Even if common sense does not argue the case for a unified technical language, then the computer certainly does. The searching of data bases becomes less effective and more costly the more variants there are of the target words. Inlet, intake, induction and suction all mean the same thing in an engine's cycle of operation, but only one may yield the required result.

The definition one gives to a word is determined by the person for whom it is defined. An explanation for a layman may not satisfy an expert. This dictionary steers a middle course by assuming the knowledge required of the engineering student and acquired by many an enthusiast. It will therefore be within the grasp of all engineers and many others within the industry.

The words and terms selected are those that have an automotive connotation. General engineering terms are infrequently included as these can be found in works such as the *Dictionary of Mechanical Engineering* by G. H. F. Naylor, to which the *Dictionary of Automotive Engineering* is in many ways a companion – likewise the more esoteric aspects of fuels and lubricants, electricity and electronics.

Where the definition of a term may be made clearer by reference to another, the reader is invited to 'See also' which terminates many definitions. Where a particular term is neither preferred nor in mainstream usage, the reader will be directed to another entry with 'See . . .' for the full definition, for example **blocking ring** See *balk ring*. This does not imply official recommendation but merely reflects what is believed to be the trend in technical usage.

The definitions in this dictionary are intended to reflect usage, and not primarily to influence it. They do not carry the authority of official status (though some are derived from official documentation). Greater rigor is rendered impracticable by detailed but often significant differences from one country to another.

There is a simple lesson to be learned here for all who write technical material: if you are in the slightest doubt as to whether your reader will understand exactly what you mean, spell it out. You cannot assume that he has a copy of this dictionary by his side (happy as I would be if he did) or of any official document.

Where national practice is deep-rooted and unlikely to change in the interests of conformity both words or terms are defined, with an indication of the country of usage, for example crossply (US: bias ply). The only exception to this rule occurs where such terms are similar, and would appear within a page of each other.

It would be naive to suggest that clear demarcations of terminology separate the USA and Britain. For years I believed that after the Declaration of Independence the term kingpin had become taboo, and that was why Americans called it wrist-pin, but I was wrong. Trends in terminology are often more localized, expressing a manufacturer's preference, or revealing

the influence of an earlier local industry such as shipbuilding or railway (US: railroad!) engineering.

Seemingly insoluble problems arise with the hyphen and capitalization. As a general rule, the hyphen is included where within technical text its omission might impair comprehension or cause ambiguity, or where two vowels might otherwise be juxtaposed. Three-way converter obviously needs its hyphen, as does pre-ignition, but there are many instances in which no hard-and-fast rule can be established. Within the dictionary hyphenated words have the same priority as would be accorded to two words separated by a space, so that dual-drive takes its place between dual control and dual fuel, either of which might justifiably have carried a hyphen.

As with hyphenation, the capitalization of eponymous terms within the dictionary attempts to follow popular usage. The tendency has always been the loss of the capital as the term becomes more familiar. Younger generations often write diesel engine without the capital D, though it seems that MacPherson strut is assured of its upper case. Here as elsewhere an apparent lack of consistency merely reflects usage in the knowledge that some trends cannot be reversed.

Informal and slang terms are included because they are a part of the language and often, in time's fullness, are blessed with official sanction. The distinction between informal and slang is sometimes narrow, but it is made as a guidance to usage, particularly to those for whom English is a second language. The many omissions in such specialized pursuits as trials riding or drag racing stem from ignorance and too narrow a circle of friends. Genial enlightenment will be welcomed – we all have our blind spots.

Illustrations have been included where they are likely to clarify a meaning, consistent with limitations of space. Many of the drawings are of assemblies rather than individual items, and call up various components. Where possible these have been labeled to refer the reader to related entries, though it has not always been possible to give alternative names for parts so labeled. To help the reader who is referring to a component that is illustrated on an assembly drawing appearing under another, and often distant, entry a figure reference will allow the assembly drawing to be located. The system is simple. Figure S.5 simply means the fifth illustration in section S – an admittedly less exact but far more practical method than giving a page number.

That the *Dictionary of Automotive Engineering* should be published in America and Britain under a co-publication agreement (between the Society of Automotive Engineers and Butterworth Scientific) has made possible the production of a work that is international both in spirit and content. A national dictionary would have presented fewer problems, but would be less useful. While inevitably manufacturers follow national or company custom, the industry is international in outlook, and largely English speaking, even where English is not the first language.

Don Goodsell

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From *Motor Vehicle Mechanic's Textbook* (F. K. Sully): Figures A.1, B.2, B.4, C.11, F.4, H.1, H.3, M.2, O.2, S.7, T.2, T.10, W.4

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Before the days of the computer the lexicographer worked with weighty files of cards, which had to be set in order and typed before they were submitted to the publisher. The word-processor has taken much of the burden from that job, allowing definitions to be amended at random, automatically ordered, and presented on a disc hardly larger than a card from a card index. Because many users of this book will be the men behind the scenes who receive little recognition of their engineering ingenuity I would like to pay credit to their counterparts who created the BBC micro-computers on which the text has been generated, to the software houses Computer Concepts, Norwich Computer Services and IFEL, and to the ever-helpful staff of the BBC user group, Beebug.

Many people have contributed something of their knowledge or experience to this dictionary, providing material, reading and checking definitions and offering advice. Amongst the many I would like to acknowledge the following by name:

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## A

**A-pillar** See *A-post*.

**A-post** Structural member forming the forward corner of the cab or passenger compartment. In structural analysis, the post may be assumed to include adjacent (contingent) parts of the door frame. Also *A-pillar*. See Figure B.4.

**ABS** See *anti-lock brake system*.

**ABS relay valve** Electrically actuated pneumatic valve that controls the air pressure in the brakes of an *anti-lock braking system* during braking.

**accelerator** Pedal by which the fuel flow to the engine is controlled, depression of the pedal causing the vehicle to accelerate.

**accelerator heel point** Assumed point of contact of driver's heel with floor when foot is placed on the undepressed accelerator. Also *AHP*.

**accelerator pump** Carburetion pumping system that introduces additional flow of fuel into the carburetor *choke* on acceleration, particularly when accelerating from lower speeds.

**accumulator** (1) Rechargeable electrical storage *battery*. Obsolescent term. (2) An hydraulic accumulator.

**Ackermann angle** The angle between the planes of the steered wheels of a vehicle, particularly when *steering lock* is applied. The angle would usually be measured in the horizontal plane. With steered wheels in the ahead position, that is, with zero *steering angle*, the Ackermann angle would merely be a measure of *toe-in* or *toe-out*. Definition subject to variation.

**Ackermann steer angle** (1) The mean angle through which the steered wheels of a vehicle are turned to turn the vehicle to a given radius. (2) The angle whose tangent is the wheelbase divided by the radius of turn (SAE definition). Also *Ackermann steering angle*.

**Ackermann steering** System of *double-pivot steering* in which two steered wheels pivot about a vertical axis, and are steered by linked *steering arms*. The system was devised by Lankensperger but takes its name from the patent agent Ackermann. It was originally introduced to prevent capsizing of horse drawn vehicles when turning sharply. See also *Jeantaud steering*.

**active restraint** Occupant restraint system requiring manipulation by wearer, as for example a *seat belt*.

**adhesion** Grip between road and tire, proportional to the static coefficient of friction.

**adiabatic engine** Engine in which combustion heat loss to coolant is minimized, a greater portion of the thermal value of the fuel being converted to useful work.

**admission stroke** See *induction stroke* or *intake stroke*.

**advance stop** Mechanical contact to restrict ignition advance in a *vacuum advance* system. See also *retard stop*.

**advanced ignition** Maladjustment of ignition timing in a *spark ignition engine* whereby the spark occurs before its optimum setting.

**aerial (US: antenna)** Wire or rod, often retractable, for receiving radio signals.

**aerodynamic noise** Noise generated by the flow of air around and through a vehicle due to its forward motion, and excluding noise of forced ventilation.

**aerodynamic stability** Stable response of a moving vehicle to air perturbations such as gusts, side winds and disturbances from passing vehicles.

**aerofoil (US: airfoil)** Streamlined planar shape, such as a wing intended to produce positive or negative *lift*, or otherwise derive some effect from the flow of air.

**afterburner** Device that completes the combustion of incompletely burned exhaust products within the *exhaust system*. See *emission control*.

**aftercooler** Heat exchanger that cools the induction air before it enters the cylinders of an engine, most often used in diesel engines downstream of a *turbocharger*. See also *intercooler*.

**agglomerator** Device such as a *separator* or trap for removing water from fuel or oil. See also *filter*.

**aggregate body** Commercial vehicle truck body for the conveyance of aggregates, ballast and similar bulk materials, usually equipped with *tipping gear*.

**aiming** Adjustment of direction of beam of lamps to meet highway or legislative requirements.

**aiming screws** Screws for adjusting the aiming of a *headlamp*.

**air-assisted hydraulic brake** Commercial vehicle braking system in which the *master cylinder* of a hydraulic braking system is actuated by pneumatic pressure or vacuum. Also *air-over-hydraulic brake*; *vacuum-assisted hydraulic brake*; *vacuum-over-hydraulic brake*.

**air bag** Passive vehicle *occupant restraint system* in which on impact the rapid inflation of a bag fitted in the *fascia* region restrains the body above torso level and prevents direct contact with the vehicle structure.

**air bellows** Usually cylindrical or torose rubber vessel or sleeve which, when filled with a compressed gas or air, acts as a compression spring. Mainly used in commercial vehicle or trailer suspensions. See also *air spring*; *air suspension*; *gas spring*.

**air bleed passage (UK: compensating jet)** Jet or passage in a *carburetor* with a branch to atmosphere through which air is drawn and introduced into the fuel flow at high flow rates, thus preventing over-richness. See also *compensating jet*.

**air brake** (1) Brake in which the force that actuates the brake mechanism is provided by compressed air acting on a diaphragm within a *brake chamber* or *servo*. Used mainly in commercial vehicles. (2) Aerodynamic *spoiler* for retarding high speed vehicles.

**air cell** A small chamber, located in the cylinder head particularly of an *indirect injection* engine, in which combustion is initiated. The burning fuel charge passes through a throat to the main combustion chamber. Also *swirl chamber*. See also *antechamber*; *Comet head*; *indirect injection*; *Lanova*; *pre-chamber*.

**air check valve** One-way valve in a *pulse air injection* system to prevent return of exhaust gases to *induction system*.

**air cleaner** Any device such as a porous paper or wire mesh *filter* that prevents airborne particles from entering air-breathing machinery.

**air compressor** Machine for delivering compressed air, as for example to an air brake system.

**air-cooled** Cooled by the passage of air as opposed to water, etc. Describes engines in which combustion heat is lost mainly through *finning* (Figure A.1).

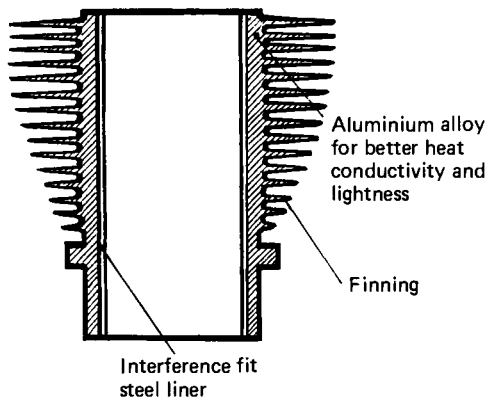


Figure A.1 Cylinder of air-cooled engine showing finning and liner (sleeve)

**air dam** Aerodynamically shaped transverse extension or *spoiler* below front bumper which reduces *drag* created by vehicle underbody. Also *apron*; *underbumper apron*. See also *spoiler*.

**air deflector** Contoured panel mounted on the roof of a commercial vehicle cab to improve air flow between cab and body.

**air dryer** Device for removing moisture from air, but particularly from the compressed air of a commercial vehicle braking system.

**air filter** See *air cleaner*. Air filter is the customary UK term.

**air-fuel delivery ratio** Mass ratio of air to fuel inducted by an engine. The *mixture strength* (informal). See also *stoichiometric ratio*.

**air horn** (1) Audible warning device in which sound is produced by a blast of air through a reed or resonator. (2) Engine induction tract leading from air filter or cleaner to a *carburetor* or *intake manifold* (US informal).

**air-injection** Addition of an air stream under pressure, but particularly to an *exhaust system* to promote combustion of *unburned hydrocarbons* and conversion of carbon monoxide to carbon dioxide.

**air-lift axle** Pneumatically operated *lift axle* of *tandem axle* commercial vehicle undercarriage. In some examples lifting or lowering are achieved by manipulation of pressure in the *air bellows* of an *air suspension*.

**air-line** Pressure or vacuum resisting tubing or piping for connecting the components of a pneumatically operated system.

**air-line connector** Plug and socket for making connections within a pneumatic system. See also *gladhand*; *suzies*.

**air-over-hydraulic brake** See *air-assisted hydraulic brake*.

**air resistance** See *drag*.

**air scoop** Normally forward-facing raised aperture on vehicle bodywork to act as an intake for ram air, as for example for engine cooling or ventilation. See also *naca duct*.

**air shield (US: air deflector)** Flat or contoured plate normally extending vertically from the cab roof of a commercial vehicle, or any vehicle towing a substantially taller trailer, to improve air flow. Also *dragfoiler*.

**air shift PTO** Pneumatically actuated *power take-off*.

**air silencer** Device placed at the entry to an *induction system* to attenuate the noise of induction.

**air spring** Spring using the compressibility of air or other gas to react against the imposed load. See also *air bellows*; *air suspension*; *gas spring*.

**air strainer** An air filter or air cleaner (US informal).

**air suspension** Vehicle suspension in which air in compression is the main or only spring medium. Also *pneumatic suspension*. See also *air bellows*; *air spring*; *Hydragas*; *Hydrolastic*; *Moulton suspension*.

**airless injection** Fuel injection by mechanical pressure only. The normal method of injection in a *diesel engine*. Also called *solid injection*.

**airscoop** See *scoop*.

**alternator** Alternating current electrical generator.

**ambulance** Vehicle for conveying the sick or injured.

**anchorage** Point of a vehicle structure to which a non-structural stress carrying item is attached, as for example a *seat belt*, or seat.

**angle of lock** The horizontal angle between the plane of a steered wheel when cornering, and the plane when adjusted for straight ahead. See also *lock*.

**annulus** (1) A ring shaped component. (2) The annular internally toothed wheel of an *epicyclic gearbox* or *planetary transmission*. Also *annulus gear*; *internal gear*; *ring gear*.

**annulus gear** A spur gear in the form of an internally or externally toothed ring. See also *annulus*; *ring gear*.

**antechamber** See *air cell*; *indirect injection*; *prechamber*.

**antenna (UK: aerial)** Wire or rod, often retractable, for receiving radio signals.

**antibackfire valve** Valve that allows air to flow from an air-pump into the *intake manifold* on deceleration to prevent *backfire*.

**anti-compounding valve** Valve in air brake circuit that prevents driver from applying *air brakes* and *spring brakes* simultaneously, and so overloading the brake mechanism. Also called *differential protection valve*.

**anti-dive** Suspension geometry that reduces or prevents nose-down pitching on braking.

**anti-lock braking system** System that automatically controls wheel slip or prevents sustained wheel-locking on braking. Widely called by acronym *ABS* (regrettably the same as that of polymer acrylonitrile butadiene styrene). Also called *anti-skid* (informal) and *wheel slip brake control*.

**antiknock additive** Compound such as *tetraethyl lead* added to a gasoline

fuel to reduce the tendency to detonation and thereby increase the *Octane Number*.

**Antiknock Index** Measure of the anti-knock properties of a gasoline fuel, particularly in North America where it is defined by half the sum of the *Research Octane Number* and *Motor Octane Number*.

**antiperculator** Valve or channel through which excess vapors can be vented, as from a carburetor.

**anti-roll bar** Transverse torsion bar attached to a vehicle underside to couple the vertical displacements of nearside and offside wheels and so reduce the vehicle's displacement in *roll*. Use of term *roll-bar* is discouraged as this is used in a different context. Also *stabilizer*. See also *anti-sway bar*. See Figure A.2.

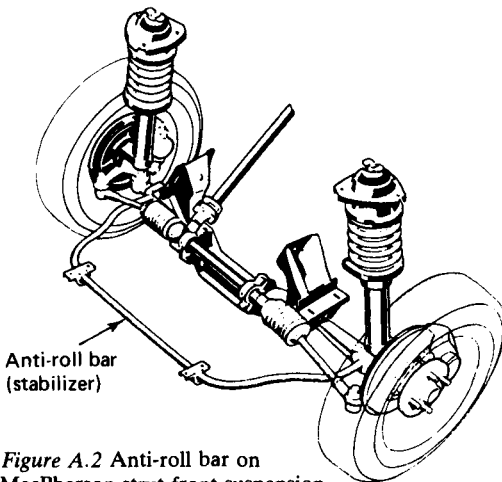


Figure A.2 Anti-roll bar on MacPherson strut front suspension

**anti-sail bar** Horizontal bar to restrain deflection in service of an *anti-spray flap* or *mudflap*.

**anti-skid** See *anti-lock braking system*.

**anti-spin regulation** Control or prevention of *wheelspin* or *wheel slip* under power, normally by electronic sensing in conjunction with *anti-lock braking*. Also *ASR*.

**anti-spray flap** Flexible flap or curtain attached behind roadwheel to reduce roadspray.

**anti-squeal shims** Shims inserted between *brake piston* and *backplate* to reduce brake *squeal*.

**anti-sway bar** (1) Suspension member, particularly applied to beam axle rear suspensions, that limits vehicle body lateral movement or sway. (2) An *anti-roll bar* (US informal). See Figure A.2.

**anti-vibration mounting** Flexible mounting, as for an engine or other mechanical item, that reduces the transmission of noise and vibration from the mounted item to a structure such as a vehicle chassis.

**antifreeze** A chemical, such as ethylene glycol, added to the cooling water of an engine to depress the freezing point for winter operation.

**antiperculator** Tube and orifice in *carburetor* through which fuel vapor can escape from main jet tube to prevent over-enrichment due to vapor pressure.

**apex seal** Gas seal to epitrochoidal surface in a *Wankel engine*.

**appliance** Specifically in automotive context, a fire fighting vehicle. Contracted from fire appliance. Mainly UK usage. See *fire appliance*.

**apron** Downward panel extension, usually transversely mounted at front of a vehicle, to reduce *drag* resulting from disorderly flow under the vehicle. Also *air dam*; *underbumper apron*. See also *spoiler*.

**aquaplaning (US: hydroplaning)** Effect whereby a vehicle tire rides up on a thin surface of water and in so doing loses contact with the road surface, resulting in sudden loss of traction and control.

**aromatics** Benzene and its derivatives, toluene, xylene and related hydrocarbons.

**artic** An *articulated vehicle*, usually a goods vehicle tractor unit with *semi-trailer* (UK informal). See Figure A.3.

**articulated bus** Usually single-decker bus with central articulation and accommodation for passengers in tractor and trailer units.

**articulated vehicle** Vehicle consisting of two or more usually separable wheeled units, and consisting of a towing vehicle, or tractor, and a towed unit, such as a *semi-trailer*. Articulation is primarily in the steering mode, though some degree of horizontal axis articulation will be necessary to enable the vehicle to negotiate road surface irregularities. The term usually refers to a tractor and semi-trailer commercial vehicle combination, though it may also describe a close-coupled city bus. See also *artic*; *articulated bus*; *truck*; *van*. See Figure A.3.

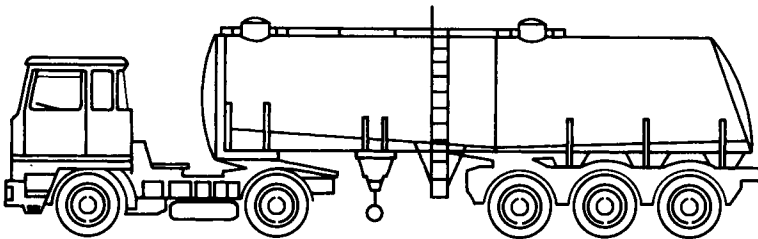


Figure A.3 An articulated road tanker

**aspect ratio** Ratio of length to width or, in the context of aerofoils, of span to average chord.

**aspiration** Breathing or induction process of an engine. Non-turbocharged diesel engines are often referred to as *naturally aspirated*.

**ASR** See *anti-spin regulation*.

**asymmetrical beam** Light beam in which the light distribution is not symmetrical with respect to the median vertical plane of the beam.

**Austin Hayes transmission** See *Hayes transmission*.

**auto-ignition** Continued running of a spark ignition engine after the ignition has been switched off. Also *dieseling; running-on*.

**autocar** A passenger car (archaic). A motor vehicle, but especially a passenger coach (from French).

**autocycle** Light *motorcycle* with pedals for assisting the motor on starting and on inclines. Obsolescent. The forerunner of the *moped*.

**Autogas** Liquefied petroleum gas motor fuel. Trade name in UK. Also LPG.

**automatic** Vehicle with *automatic transmission* (informal).

**automatic choke** Thermostatically operated *choke* valve in carburetor inlet tract, closed when engine is cold and opening automatically as engine or induction air temperature rises.

**automatic gearbox** (US: *automatic transmission*) Geared transmission unit in which gear ratios are automatically selected and engaged without driver intervention. See also *pre-selector*. See Figure A.4.

**automatic levelling system** Suspension system that automatically adjusts front and rear ride heights to compensate for changes in axle load.

**automatic slack adjuster** Device that automatically maintains the correct disposition of push rod and cam lever in an air brake system. See also *slack adjuster*.

**automatic speed control** Device or system capable of maintaining selected vehicle speed in changing road conditions. See also *cruise control*.

**automatic transmission** (1) (UK: *automatic gearbox*) Transmission system in which gear ratios are selected and engaged automatically, though usually with provision for the driver to manually override the selection. (2) An automatic *continuously variable transmission* such as a belt with expanding pulley. See also *Hayes transmission; pre-selector; Variomatic transmission*. See Figure A.4.

**automatic wear adjuster** Device that automatically compensates an actuating system for wear in the item being operated, such as a clutch or brakes.

**automobile** (UK: *passenger car*) Self-propelled or motorized land vehicle.

**auxiliary brake** Any brake that serves in addition to the main braking system of a vehicle. See also *engine brake; exhaust brake; retarder*.

**auxiliary driving lamp** Lamp intended to provide illumination forward of the vehicle and to supplement the upper beam of a standard headlamp system. See also *fog lamp*.

**auxiliary gearbox** Gearbox used in conjunction with a main change speed gearbox to provide an extra range of speeds, as for example by providing a 2:1 reduction in addition to normal gearbox speeds. Also *auxiliary transmission*. See also *range-change; splitter transmission*.

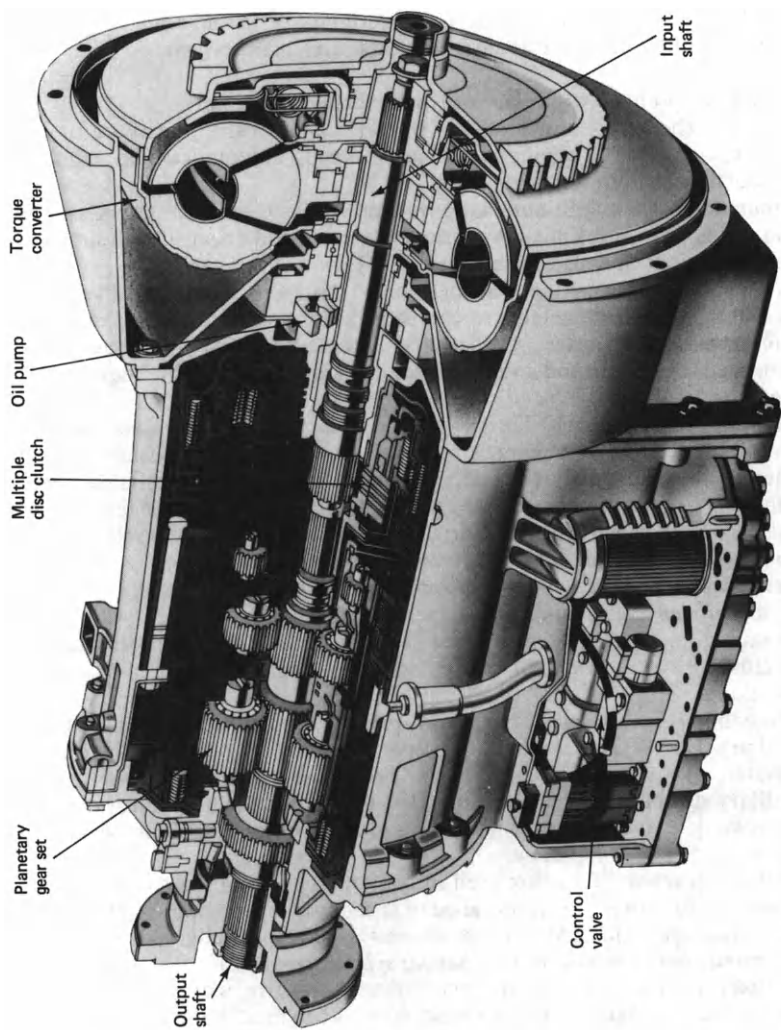
**auxiliary pressure** (1) Additional control pressure within an automatic transmission regulator control unit, normally to modify the response of the *regulator valve* to supply pressure. (2) Any additional hydraulic or pneumatic pressure that influences the response of a control system.

**auxiliary transmission** See *auxiliary gearbox*.

**auxiliary venturi** See *secondary venturi*.

**average piston speed** See *mean piston speed*.

**axle** Horizontal transverse shaft or beam with spindles on which road



*Figure A.4 An Allison automatic commercial vehicle transmission*

wheels are mounted. See also *dead axle*; *fully floating axle*; *half-shaft*; *live axle*; *stub-axle*; *transaxle*.

**axle bearing** Any bearing that supports an *axle* or *half shaft*.

**axle camber** Wheel *camber* achieved in a beam *dead axle* by convex curvature of the axle.

**axle casing (US: axle housing)** Rigid non-rotating casing that carries an *axle* or *half shaft*.

**axle fore-and-aft shake** Longitudinal oscillatory motion of an axle.

**axle housing** See *axle casing*.

**axle lift** Mechanism for raising and lowering a *lift axle* of a commercial vehicle.

**axle shaft** See *axle*.

**axle side shake** Lateral oscillatory motion of an axle of a moving vehicle.

**axle sleeve** Tubular casing of a live or dead axle shaft.

**axle spindle** Shaft machined to carry wheel bearings and seals and with means for securing the wheel to the axle.

**axle tramp** (1) Form of wheel hop on live axles in which the left and right hand wheels hop in opposite phase. (2) Resonant oscillation of an axle/suspension system, usually due to *axle wind-up* of an insufficiently damped suspension during heavy acceleration. The term is also used to describe a similar effect on vehicles without a beam axle.

**axle weight** Static weight imposed on the highway by one axle.

**axle wind-up** (1) Torsional deflection of an axle shaft, as due to sudden application of power or brakes. (2) Rotation of an axle casing due to flexure of *semi-elliptical springs* in reacting torsional loads. (3) Oscillatory motion of an axle about the horizontal transverse axis through its center of gravity. See also *axle tramp*. See Figure A.5.

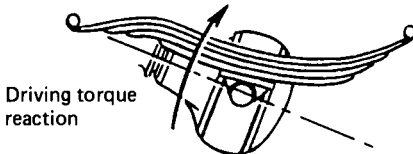


Figure A.5 Axle wind-up of live-axle leaf spring suspension (exaggerated)

## B

**B-pillar** See *B-post*.

**B-post** Nominally vertical structural support of the roof of a vehicle, against which the front door closes. Also *B-pillar*; *central pillar*.

**Babbitt metal** An alloy of tin, copper, antimony and lead formerly used for engine bearings. Sometimes Babbitt's metal.

**back axle** The rearmost axle (usually of a two wheeled vehicle). Also *rear axle*.

**backbone chassis** Chassis in which a single structural spine carries all powertrain and running gear, the body shell generally forming a secondary structure. See also *punt-chassis*; *spine-back*.

**backfire** An explosion of unburned or partially burned fuel in an exhaust or inlet system. See also *antibackfire valve*.

**backlash** Loss of motion between the input and output of a mechanical system, as due to looseness or flexure. Term implies some restoring torque at the input, though no effective output, as for instance in a system of gears and/or linkages. See also *play* (which generally implies an insignificant restoring torque).

**backlight** The rear window or screen of a vehicle.

**backlight defogging system (UK: rear screen heater)** System for clearing moisture from the interior surface of a rear window of a vehicle, either by an electrical element within the glass or heated air from a blower.

**back-plate** (1) Non-rotating plate carrying the shoes of a drum brake. (2) Metal member carrying friction material of pad of *disc brake*. See Figure D.8.

**back pressure** Pressure resisting the flow of a gas in a pipe, as in an *exhaust pipe*.

**backrest** Rear part of a seat against which the back rests. *Squab* (informal UK).

**back-up alarm (UK: reversing bleeper)** Acoustic warning that automatically sounds when a vehicle, particularly a commercial or public service vehicle, engages reverse gear.

**backup lamp (UK: reversing lamp)** (1) Lamp used to provide illumination behind a vehicle, particularly when reversing. (2) Lamp to supplement a standard headlamp system.

**baffle plate** An internal transverse plate in a *muffler* or *silencer*.

**balance beam** Beam or lever that couples the suspensions of the two axles of a rear *tandem axle* arrangement of a heavy vehicle, thus making the suspension reactive. On a *leaf spring* suspension a balance beam might couple the adjacent eye-ends of the leafs. See also *walking beam*.

**balance pipe** Pipe or tube joining the *venturis* of twin carburetors.

**balance shaft** A rotating shaft incorporating a *harmonic balancer* or *vibration damper*.

**balanced crankshaft** Engine crankshaft designed so that the disposition of

its mass counteracts the out-of-balance effects of the crank and sometimes the reciprocating components. Balance is usually achieved by extending the *crank webs* to form counter-balances.

**balk ring** Rotating component of a *synchromesh gearbox* that prevents, or 'balks', premature engagement of gears. Sometimes *baulk ring* or *blocking ring*.

**ball and socket** Mechanical joint in which a spherical end moves freely within a recessed socket. Used on suspension and steering linkages. Also *ball joint* (informal).

**ball bearing** Rolling element bearing in which hardened balls run in tracks formed in inner and outer races. Various types exist, capable of carrying journal or thrust loads, or a combination of loads.

**ball joint** See *ball and socket*.

**ball thrust bearing** Rolling element bearing for carrying axial loads by way of hardened steel balls running between races. Sometimes, though informally, called a *thrust race*.

**ballast resistor** Electrical resistor used to regulate *ignition coil* output at higher engine speeds and increase spark voltage for cold starting.

**balloon tire** Low pressure, bulbous sectioned tire used in the late 1920s and 1930s.

**band brake** External band with friction lining, sometimes used as an additional parking brake, and as a change-speed brake in certain types of semi-automatic transmissions.

**brake piston** The hydraulically operated piston assembly that forces apart the shoes of a *drum brake*, thereby instigating the braking friction that retards the vehicle. The piston of the wheel *slave cylinder*.

**banjo** Hose fitting that connects a hose at right angles to the axis of a pipe. The circular body with one radial pipe connector gives the appearance of the musical instrument from which the item takes its name.

**banjo axle** Drive axle with a drum shaped final drive or differential case.

**barrel** Main air pipe through a carburetor. Also *mixing chamber*.

**barrel cranking motor** Starter or cranking motor for engines with small flywheels, the pinion being attached to a barrel to increase inertia.

**barrel tappet** A hollow cylindrical *tappet*, sometimes with facility for adjustment.

**barrel valve lifter** A barrel tappet. Alternative US terminology.

**bath tub** Combustion chamber shaped like an inverted bath tub in the base of which the valves are seated (Figure C.11).

**battery** Direct current electrical storage unit which converts chemical or other forms of energy into electrical energy. Also *accumulator* (archaic).

**battery charger** Static device for recharging an electrical storage battery.

**battery ignition** Conventional ignition system using battery and coil, as opposed to a *rotating magneto*. Also *coil ignition*; *Kettering ignition*.

**battery shedding** Loss of material from a battery plate, as caused by age or repeated over-charging.

**baulk ring** See *balk ring*.

**Baveray compound jet** Submerged carburetor *compensating jet* through which the flow is determined by the ratio of throat pressure to atmospheric pressure.

**BDC** See *bottom dead center*.

**bead** Part of a tire that seats onto a wheel rim, normally strengthened with an embedded hoop of wire about which the *casing* cords are anchored.

**bead core** Wire or filamentary fiber reinforcing hoop about which the *bead* is formed. See also *bead filler*.

**bead filler** Solid rubber fillet that bonds the outer plies of a tire to the *bead core*.

**bead flange** Fixed or removable lip on the outer periphery of a wheel that retains the tire. Also *rim flange*. See also *spring flange*.

**bead heel** Part of the *bead* of a tire that fits into the angle formed by the *rim* and *rim flange*.

**bead seat** Part of a road wheel, below the *bead lip*, on which the tire *bead* is seated.

**beaded edge** Any edge, as of a tire, upholstery, or body panel, in the form of a continuous lip or bead.

**beam axle** Rigid transverse beam on which nearside and offside wheels are mounted. The term originally described a *dead axle* of forged I-beam section but sometimes describes any rigid live axle or dead axle.

**beam deflector switch** See *dip switch*.

**beam indicator lamp** Warning lamp on dash panel or instrument panel to indicate operation of main *headlamps*. Also *main warning lamp*; *high beam warning lamp*.

**bearing cap** (1) Rigid, semi-circular retainer that locates and secures one half of a *shell bearing*, as in an engine *main bearing* or *connecting rod bearing* (Figure B.1). (2) Removable disc or plug to prevent ingress of foreign matter into a bearing housing.

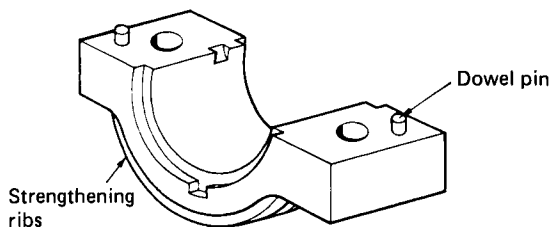


Figure B.1 Bearing cap for main bearing, showing dowel pins for accurate alignment with upper half of bearing in the crankcase

**beaver back** Rear body styling characteristic of some pre-war passenger cars in which a nominally vertical back is splayed into an outward sloping lower part.

**beaver tail** Ramped or lowering rear section of a *low-bed trailer* or *low-loader*. Also *tilt-bed trailer*. (US informal).

**Belgian block** (UK: *Belgian pavé*) Road surface of convex-surfaced granite stone setts, used on proving grounds to assess vehicle integrity and durability, and response to vibration.

**Belgian pavé** See *Belgian block*.

**bell housing** Conical or bell-shaped extension of an engine crankcase, containing the *flywheel* and *clutch*.

**belt** (1) Continuous reinforcing around the periphery of a *radial ply tire*, usually woven from steel or a man-made fiber. Also *breaker*. (2) Drive or power transmission belt such as a V belt or toothed belt. (3) A driver or passenger *seat belt*.

**belt drive** System of power transmission in which a flexible endless belt transmits power between pulleys. See *fan belt*; *toothed belt*; *Variomatic transmission*.

**belt idler** See *idler wheel*

**belt line** Horizontal styling feature of side and sometimes rear of a car body, to accentuate length and reduce appearance of height. Also *waist line*.

**belt slip** Excessive slip of a power transmission belt such as a V belt on a driving or driven pulley.

**belted bias** See *bias belted*.

**bench seat** Wide vehicle seat for more than one person.

**bench test** Operating test carried out on an engine or other major item removed from the vehicle and mounted to facilitate observation and instrumentation. A static proving test.

**Bendix drive** A drive comprising a pinion wheel carried on a helically grooved shaft. The sudden rotation of the shaft causes axial movement of the pinion. Widely used to transmit *starter motor* power, the pinion engaging the *ring gear* teeth on the engine flywheel periphery. The sudden rotational acceleration caused by the firing of the engine throws the pinion out of engagement. See Figure B.2.

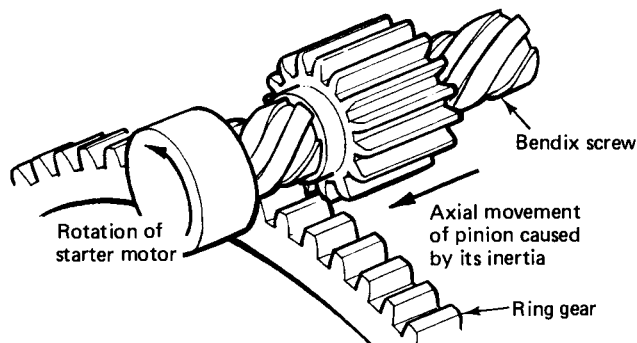


Figure B.2 Bendix drive of starter motor

**Bendix screw** The coarse helix thread of the shaft of a *Bendix drive*. See Figure B.2.

**Bendix starter.** Starter motor employing a Bendix drive.

**Bendix-Tracta joint** A proprietary form of *constant velocity joint* in which forked jaws are in sliding engagement with two slotted knuckles.

**Bendix-Weiss joint** A proprietary form of *constant velocity joint* in which the input and output elements are engaged by balls rolling in formed cavities. Both shafts require axial support. See also *universal joint*.

**benzole** Mainly aromatic hydrocarbon fuel additive and solvent.

**bevel differential** Differential in which the principal gear elements are bevel gears, with input and output shafts mutually at right angles.

**BHP** See *brake power*.

**bias belted** Tire of *bias ply* or *crossply* construction but incorporating a peripheral reinforcing belt such as used in a *radial ply tire*. Also *belted bias*. See also *bias ply tire*.

**bias ply tire (UK: crossply tire)** Tire constructed on core or *carcass* of diagonally laid plies of fabric (Figure B.3).

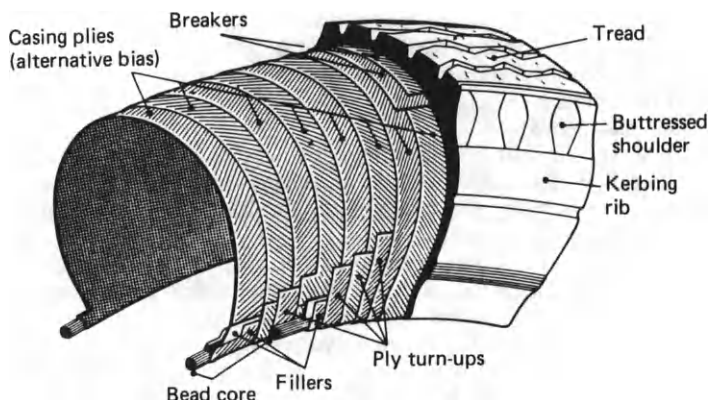


Figure B.3 Construction details of a bias ply or crossply tire

**big-end** The end of a *connecting rod* that engages with a *crankshaft* (UK informal). Also *crankpin end*. See Figure C.9.

**big-end bearing (US: connecting rod bearing)** The *connecting rod* to *crankshaft journal bearing*. Before *shell bearings* were introduced big-end bearings were cast on the connecting rod and reamed to size. On some types of engine, especially smaller two-stroke engines, rolling element bearings are used. Also *rod bearing* (US informal).

**binnacle** A console or self-contained unit in which an instrument array or controls such as switches are located, as an alternative to mounting on the dash panel or fascia. The binnacle may be located near or attached to the steering column, particularly in a commercial vehicle. From maritime terminology.

**Birfield universal joint** Proprietary *constant velocity joint* that allows plunging action of one shaft relative to the other, named after manufacturer Birfield Transmissions Ltd.

**blade connector** Flat metal tongue-shaped electrical connector.

**bleed** (1) To empty a system of working fluid prior to maintenance or replenishment. (2) A valve or other means whereby a system can be drained of working fluid, or pressure reduced.

**bleed screw** Form of threaded tap to facilitate draining of a hydraulic system, as for example a brake system.

**blind spot** Part of a vehicle's environment invisible to the driver in normal driving position, whether viewing directly or through a mirror.

**block** See *cylinder block*.

**blocking ring** See *balk ring*.

**blow-back** Sudden reversal of air flow through a *carburetor*, often as a consequence of incorrect *ignition timing* or *valve timing*.

**blow-by** Unwanted leakage of gas under pressure, as past a piston or its sealing rings.

**blow-out** Sudden bursting of a tire.

**blowdown** Escape of exhaust gases from an engine between opening of exhaust valve and bottom dead center.

**blower** An exhaust *turbocharger*, though occasionally a mechanically driven *supercharger*. (Informal)

**blown** Supercharged, turbocharged (informal).

**bluff body** Aerodynamic terminology for any body that is relatively wide in relation to its length, and particularly one with a blunt or squared front end.

**boat tail** Tapered rear termination of a vehicle, giving an appearance similar to that of the stern of a double-ended or canoe-sterned boat (UK informal).

**bob tail** Articulated vehicle tractor operating without a trailer (US informal).

**body-number (US: VIN)** Manufacturer's bodywork identification number, normally unique to each vehicle.

**body shell** (1) The assembled body paneling of a vehicle. (2) The body structure of a vehicle, particularly of a *monocoque* construction passenger car, minus running gear, and electrical and other ancillaries.

**bodywork** The structural panelwork of a vehicle (Figure B.4).

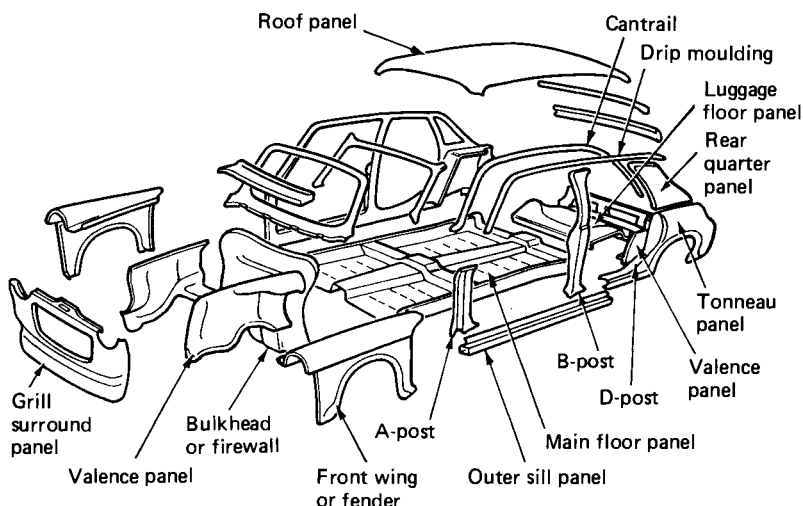


Figure B.4 Passenger car bodywork terminology

**bogey** Alternative spelling of *bogie*

**bogie** Heavy vehicle undercarriage in which *tandem axles* are mechanically linked and suspended as a unit. Also *bogey*, particularly in US.

**bolster** Usually transverse horizontal commercial vehicle chassis member for carrying a distributed load, as for example a *demountable body* or load of poles.

**bonnet** (US: *hood*) Hinged body panel that gives access to the engine compartment of a vehicle.

**boom** Acoustic effect of air flow over a vehicle, particularly where excited by apertures in the passenger compartment, such as open windows or sunshine roof. Also *booming*.

**booming** See *boom*.

**boost** (1) To increase, amplify or add to, particularly at a more vigorous rate than normal, as for example in boost charging a battery. (2) A measurable additional quantity, as of flow rate, pressure or electrical charge. (3) The additional pressure provided by a supercharger.

**boost start** Starting an engine of which the battery is discharged or feeble by applying a higher than normal voltage and current to the electrical system from an external source.

**booster brake** Brake used in addition to the *service brakes* of a vehicle to increase retardation under exceptional circumstances.

**booster coil** Auxiliary coil that increases the voltage or duration of the spark in a spark ignition engine.

**boot** (US: *trunk*) Rear luggage compartment of a passenger car, internally isolated from the passenger compartment, and with a hinged lid for access.

**bore** (1) The internal diameter of the *cylinder* of an engine or pump. (2) The cylinder wall of an engine (informal). (3) To make a cylindrical or circular aperture with a suitable cutting tool.

**bore diameter** See *bore*.

**bore-stroke ratio** Ratio of *bore* to *stroke*. A ratio of 1:1 is referred to informally as *square*. See also *oversquare*; *undersquare*.

**bottler's body** (UK: *brewer's dray*) Normally enclosed goods vehicle for conveyance of crated bottles.

**bottom board** Floor panel of a van, particularly when removable (UK). See also *loadfloor*.

**bottoming** (1) Deflection of a vehicle suspension to its maximum compressive travel due to road surface irregularity or excessive load. (2) Deflection of a pneumatic tire so that the carcass is momentarily flattened against the wheel rim. (3) Contact between the underside of a vehicle and raised ground. See also *break-over angle*.

**bottom dead center** The point of piston travel when the *piston* is nearest to the axis of the *crankshaft*. On a vertical engine, the lowest point of travel of the piston. Also *BDC*; *lower dead center*; *LDC*.

**bottom end bearing** The *connecting rod to crankshaft journal bearing*. (US informal).

**bottom gear** (1) The gear in a *change-speed gearbox* or transmission that gives the lowest ratio of driven wheel rotational velocity to engine speed. (2) The gear that gives the highest ratio of engine speed to road speed, and consequently the highest torque at the driven wheels, as for starting, hill climbing. First gear.

**bounce test** Testing of the suspension, and particularly the *shock absorbers*, of a vehicle by manually depressing and then releasing each corner and observing the decay of vibrations.

**Bowden brake** Mechanical *drum brake* operated by a sheathed cable.

**Bowden cable** Form of mechanical control in which a multi-strand wire in tension operates within a flexible wire-wound outer sheathing, as frequently used for brake controls of motorcycles.

**box** Enclosed *trailer* or *semi-trailer* (US informal). See also *horse box*.

**box-body** Enclosed box shaped freight-carrying body of a *van* or *demountable*.

**box section** Closed section structural member capable of reacting loads in shear and torsion.

**box-van (US: panel body)** Rigid, enclosed *van* in which a rectangular freight compartment is mounted behind the cab. See also *luton*.

**boxer engine** A *horizontally opposed* engine. Informal.

**brake** (1) Device to retard the motion of a vehicle or to prevent inadvertent motion when parked. (2) Dynamometer for measuring the power of an engine, originally a friction brake by which torque could be measured. Also brake dynamometer (informal). (3) (US: station wagon) Passenger car body with rear doors and side lights, often with external wood framework, originally for carrying sporting equipment and dogs. A *shooting brake*. More recently *estate car* (UK).

**brake actuator** See *brake chamber*.

**brake anti-roll** Device to ensure that brake pressure is maintained when a vehicle is stopped on an incline.

**brake chamber** Chamber containing diaphragm and push rod to apply brakes in an air or hydraulic brake system. Also *brake actuator*.

**brake fade** See *fade*.

**brake fluid** Oil with which a *hydraulic brake* system is charged.

**brake lamp** See *stop lamp*.

**brake mean effective pressure** (1) Engine cylinder pressure, derived by calculation, that would give the measured *brake power*. (2) The product of *indicated mean effective pressure* and *mechanical efficiency*.

**brake power** Power developed by an engine as measured at the shaft by a *brake* or dynamometer. Specifically *brake horsepower*. See also *indicated power*; *pumping losses*.

**brake thermal efficiency** The ratio of the measured output of an engine to the heat value supplied to the engine as fuel.

**brake valve** (1) Valve operated by driver to pass air to *air brakes* at a pressure related to driver's pedal effort. (2) Foot operated unit to provide graduated control of the brakes in a heavy vehicle *service brake* system.

**braking ratio** Ratio of braking effort on front wheels to that on back wheels.

**break-over angle** Included angle determined by *wheelbase* and *clearance height* under the vehicle that determines the ability of the vehicle to traverse a humped road surface. Whether or not the vehicle is laden must be stipulated. See also *bottoming*.

**breakdown truck** See *recovery vehicle*.

**breaker** See *belt*.

**breaker contact** See *contact breaker*.

**breaker points** See *contact breaker*.

**breakerless ignition** See *electronic ignition; module*.

**breaking-in (UK: running-in)** Driving a vehicle or running an engine or other mechanical unit at reduced speed and load when new, to prevent *scuffing* and *seizure* of the bearing surfaces, and to ensure even initial wear. Also *wearing-in*.

**breakout box** Terminal box for connection of electronic test instrumentation to relevant vehicle electrical and electronic circuits.

**breather** A vent to an enclosed container or case, as for example a fuel tank or engine crankcase.

**breeches pipe** Y configuration *exhaust pipe* forming confluence of two *exhaust manifolds* to one exhaust pipe, and resembling a pair of breeches, inverted.

**bridge washer** Washer that spreads load to its outer radius, particularly used for tire valve mounting on wheel rim.

**bucket seat** Deep and rigid seat with side restraints to provide occupant constraint in fast cornering.

**bucket tappet** Cylindrical bucket-shaped tappet which encloses the end of a *valve stem* and retains the camshaft-end of the *valve spring*. Sometimes refers to the lower ends of the *push rods* when of such shape and function.

**buddy seat (UK: sidecar)** Single wheeled carriage attached alongside a motorcycle.

**buffer bar** Horizontal bar mounted at front and rear of vehicle to prevent or reduce damage in low speed impacts. Also *bumper*.

**built-up crankshaft** Crankshaft assembled from separate component parts, for example with separate *crankpins* where a rolling-element connecting rod bearing is used.

**bulkhead (US: firewall)** Transverse structural panel of a vehicle. The US term firewall (also known in UK) generally refers to the transverse panel between engine compartment and passenger compartment (Figure B.4).

**bullet connector** Round headed cylindrical electrical cable connector for insertion into an insulated connector tube.

**bump steer** Change of *steer angle* resulting from sudden vertical deflection of the suspension.

**bump stop** Compression spring, usually of rubber, that limits the deflection of a vehicle suspension on striking a bump.

**bumper** Horizontal bar mounted at front and rear of vehicle to prevent or reduce damage in low speed impacts.

**bus** A vehicle for conveying passengers, usually by serving a regular route. An *omnibus*.

**bush (US: bushing)** Cylindrical sleeve forming a bearing surface for a shaft or pin.

**butterfly carburetor** Carburetor in which the flow of the air-fuel mixture is controlled by a *disc valve* or *butterfly valve*. A *fixed choke carburetor*.

**butterfly valve** Disc valve pivoted about its diameter and acting as a throttle in a pipe or chamber. A mild misnomer as the true butterfly valve consists of two hinged half-discs, opening and closing like the wings of a butterfly. See also *throttle valve*.

**by-pass** (1) Passage through which gas or liquid may flow instead of, or in addition to, its main channel, or any device for arranging this. (2) The transition system between the idle and main metering system in a carburetor.

**by-pass filter** Liquid filter, such as an oil filter, that filters only part of the flow on the principle that, during repeated circulation, all fluid in circulation will be filtered.

**by-pass valve** A valve for directing flow through a by-pass.

## C

**C-matic transmission** Trade name for semi-automatic clutchless transmission developed by Citroen.

**cab** (1) Compartment occupied by the driver, particularly of a commercial vehicle. (2) A taxi (informal).

**cab-alongside-engine** Vehicle configuration in which the driver's cab is situated alongside the engine, notably in some off-highway vehicles and earlier designs of bus. Also *CAE*.

**cab-behind-engine (UK: normal control)** Commercial vehicle in which the engine is mounted forward of the driver's cab. Also *CBE*.

**cab-over-engine** Vehicle configuration in which all or most of the engine is located beneath the driver's cab.

**cab-tilt** See *tilt-cab*.

**cable brake** Brake operated by cable and levers, either open cable in tension or Bowden cable. Obsolete except for parking brakes.

**cabriolet** A *soft-top* or *drop-head* car.

**cage** See *differential cage*.

**caliper** In a *disc brake* system, the mechanism that brings *brake pads* to bear on the disc by a clamping or pinching action, similar to that of the jaws of a vernier caliper. Sometimes *calliper*. See also *floating caliper*; *swinging caliper*. See Figure D.6.

**cam** (1) A shaped or profiled component that produces linear or angular motion or lift of a follower. Except in the steering box, most automotive cams are in the form of non-circular wheels which impart motion to the follower by their rotation. (2) A *camshaft* (informal). Misleading usage, as for instance *twin cam* to describe an engine with two camshafts.

**cam-actuated brake** Type of *drum brake* in which the brake shoes are brought into contact with the drum by rotation of a cam. Also *cam brake*. See also *fixed cam brake*; *floating cam brake*. See Figure C.1.

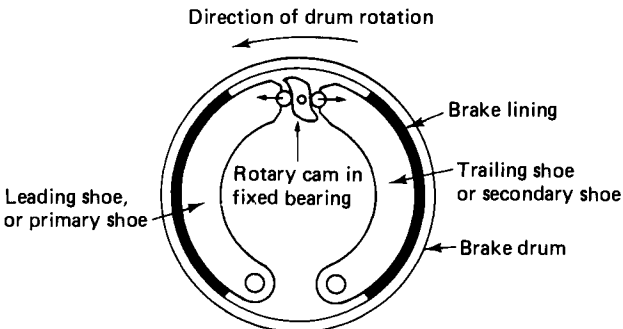


Figure C.1 A cam-actuated drum brake

**cam and lever** See *cam and peg*.

**cam and peg steering gear** Steering mechanism in which a conical peg mounted on a lever or rocker shaft engages in a helically cut cylindrical cam, the steering action being imparted by the lever. Also called *cam and lever* or *worm and lever steering gear*. (Obsolescent).

**cam and roller steering gear** Steering mechanism in which a tapered disc or discs (the rollers) engage with a helically cut waisted cam, the steering action being imparted by the leverage about the steering drop arm shaft of the thrust on the faces of the rollers. See also *Marles steering gear*.

**cam brake** Drum brake in which the shoes are actuated or spread by the rotation of a cam. Also *cam-actuated brake*. See Figure C.1.

**cam contour** See *cam profile*.

**cam follower** The part of a cam mechanism that rides on the contour surface of a cam. See *tappet; valve lifter*.

**cam ground piston** A piston ground to a slightly out-of-circular section to counteract thermal distortion. Oval piston (informal).

**cam profile** The shape of the periphery of a cam. The contour determines the stroke (throw) and linear acceleration of the follower.

**cam roller** Cam follower in the form of a rotating wheel.

**camber** (1) Convex arched curvature of a (usually horizontal) surface. (2) Average curvature of the chordwise section of an aerofoil. (3) Mildly arched profile of a road or pavement. (4) Inclination of the plane of a wheel to the vertical plane of symmetry of a vehicle. Camber is considered positive if the wheel leans out towards the top, and negative if it slopes inward. Also *camber angle*. See Figure C.2. (4) Curvature of a *leaf spring*.

**camber angle** Angle between the plane of a wheel and the vertical axis of a vehicle when viewed in end elevation. Normally quoted under specified load or ride height and with steering ahead. *Rake angle* (informal). See Figure C.2.

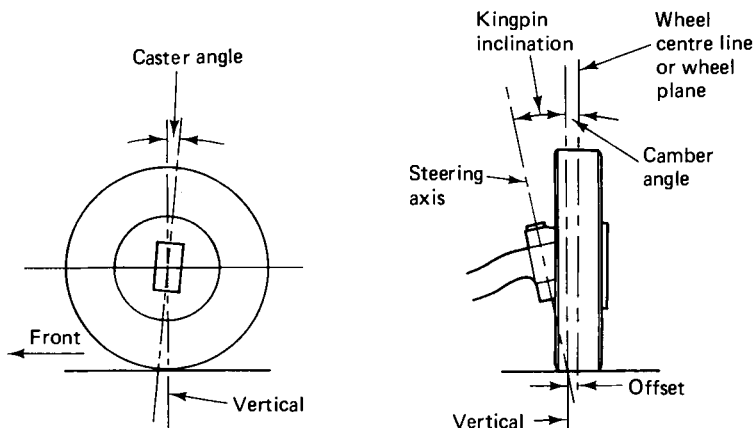


Figure C.2 Left: side view of steered wheel. Right: steered wheel viewed from forward; the illustration shows a wheel with a small positive camber

**camber stiffness** Rate of change of lateral force on tire with change in *camber angle*.

**camber wear** Wear pattern of tire in which tread on one side of the tire is evenly worn.

**camper** Touring vehicle with van-type body with sleeping and residential facilities. A *motor caravan*.

**camping trailer** Low-profile trailer unit from which temporary recreational accommodation can be erected at a campsite.

**camshaft** Shaft on which suitably phased cams are mounted, as for example to operate intake and exhaust valves of an engine. In four-stroke engines the camshaft rotates at half crankshaft speed. See Figure E.1.

**camshaft pump** (1) A pump, as for oil or cooling water, driven directly from a cam on the camshaft of an engine. (2) A reciprocating pump in which the piston is moved by a cam rather than by a connecting rod and crank.

**cantilever spring** Suspension spring, normally a quarter elliptical leaf, rigidly attached to the vehicle at its major section and carrying the undercarriage at its end section.

**cantrail** Upper longitudinal structural member of a vehicle body to which the *roof panel* and *roofsticks* are attached. See Figure B.4.

**capacitor** Electrical component which stores an electric charge when subjected to a voltage difference.

**capacitor discharge system** Ignition system which stores its primary energy in a capacitor. Also *capacity discharge system*.

**capacity** (1) In an engine, the product of the bore cross sectional area, the piston *stroke* and the number of cylinders. Expressed in Europe as cubic centimeters or liters, and in the US as cubic inches. See also *displacement*; *swept volume*. (2) The volume or usable volume of any reservoir or container, such as a *fuel tank*.

**capsize mode** Directional perturbation, often oscillatory, that if unstable may lead to the overturning of an uncontrolled vehicle.

**car** (1) A passenger car or automobile, normally with a maximum of eight seats. (2) A passenger coach, from French usage. (3) A streetcar or tram.

**car-derived van** A delivery van based on a passenger car running gear or chassis. Also *sedan delivery body*.

**caravan** Trailer, usually with one axle at or near balance point, equipped for leisure accommodation. Mainly UK usage.

**carbon** (1) Element, most commonly black in colour and of high electrical conductivity in some of its forms, such as graphite. (2) A constituent element of hydrocarbon fuels. (3) Deposit found on *piston crown* and *cylinder head*, often with polymerized materials, and resulting from incomplete combustion. Informally referred to as *coke*.

**carbon monoxide** Colorless, odorless toxic gas and product of incomplete combustion of hydrocarbon fuel with air. One of the principal toxic pollutants of an incompletely combusted exhaust, particularly of spark ignition engines. See also *emission*; *emission control*.

**carburetion** The atomizing and/or vaporizing of a fuel for mixing in appropriate proportions with a stream of air in a carburetor.

**carburetor** (UK: *carburettor*, *carburetter*) Device for vaporizing liquid fuel and mixing it in appropriate proportions with a stream of air prior to

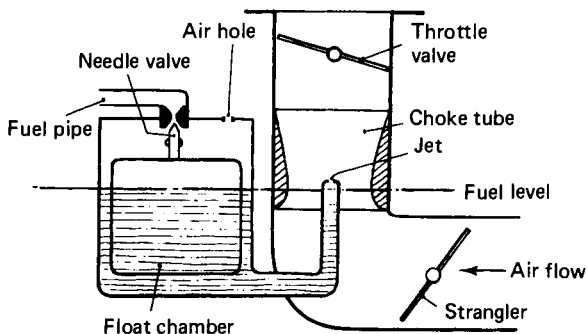


Figure C.3 A simple carburetor

combustion in an engine. See Figure C.3.

**carburettor** See *carburetor*.

**carcass** Structural body of a tire built to resist air pressure and to which the rubber *tread* and *sidewall* rubber are bonded (Figure B.3).

**cardan axle** Axle with one or more *cardan joints*, as for example the drive shafts of a *de Dion* system. Sometimes *Cardan axle*.

**cardan drive** See *cardan shaft*.

**cardan joint** Universal joint in which a cruciform member couples two yokes. Also *Hooke's joint* (Figure H.1).

**cardan shaft** Propeller shaft or driveshaft fitted with *universal joints* at each end. Also *cardan drive*.

**cardan tube** A tubular cardan shaft.

**cargo floor** Commercial vehicle or trailer floor surfaced and stressed for carrying cargo. Also *loadfloor*.

**casing** Reinforcing structure of a tire, to which the extensible rubber *tread* and *sidewalls* are attached. See also *carcass*.

**caster** (1) Originally an undercarriage member with a vertical pivot axis behind which the wheel trailed, so that the wheel aligned itself to its direction of motion. (2) Longitudinal distance at ground between projected vertical axis through wheel *spin axis* and projected point of intersection of *steering axis* with ground, giving the effect of caster as described in 1. Also *caster offset* and *caster trail*. *Castor* (alternative spelling). See also *caster angle*. See Figure C2.

**caster action** Self-centering steering action, particularly when attributable to *caster*.

**caster angle** Angle in side elevation between the steering and vertical axes. See also *self-aligning torque*. See Figure C2.

**caster offset** Longitudinal distance between intersection of *steering axis* with the ground and the center of tire contact (or intersection with ground of vertical through wheel spin axis). Offset is considered positive when the intersection point is forward of *tire contact center*. Also *mechanical trail*.

**catalytic converter** Emission control device fitted in the exhaust system of spark ignition engines. The converter reduces the toxicity of products of combustion by catalytic re-combination. See also *emission control*.

**Caterpillar track** Proprietary linked metal chain of *track laying vehicle*, after name of manufacturer. Term often loosely used to describe any form of track laying mechanism.

**cell** (1) Any single unit, either singly or as part of a battery, for storing or releasing electricity by electrochemical reactions. (2) The combustion chamber of a *rotary engine*, particularly where non-cylindrical, as in a Wankel engine. (3) An air cell or prechamber of an indirect injection engine.

**cell swept volume** Difference between maximum and minimum cell volume of a rotary engine as it rotates. Various of one cell or the total of the three cells attending each rotor of a Wankel engine. See also *geometric displacement*.

**center of parallel wheel motion** Centre of curvature of path along which each pair of wheel centers moves in a longitudinal vertical plane relative to the sprung mass when both wheels are equally displaced. See also *instantaneous suspension center*.

**center of tire contact** Intersection of *wheel plane* and vertical projection of the *spin axis* of the wheel onto the road plane.

**center point steering** Steering geometry in which steering axis meets plane of steered wheel at ground level, that is, with no *lateral offset*. For most practical purposes this implies that the *steering axis* passes through the longitudinal centerline of the tire *contact patch*. See also *kingpin offset*; *negative offset steering*; *positive offset steering*. See Figure C.2.

**central chassis lubrication** Grease lubrication of chassis components (excluding engine, gearbox, etc) from one central pressurized reservoir.

**central pillar** Nominally vertical structural support of the roof, against which the front door closes. Also *B-post* or *B-pillar* (Figure B.4).

**centrifugal advance** A mechanical device that employs rotating masses in a similar way to a mechanical governor, to advance the spark timing in a spark ignition engine. Also *centrifugal ignition advance*. See also *open loop engine control*.

**centrifugal caster** (1) Self-centering effect brought about by rotation of a wheel. (2) Unbalance moment about the *steering axis* produced by lateral acceleration equal to gravity acting at the combined center of gravity of all the steerable parts. Considered positive if the combined center of gravity is forward of the steering axis and negative if rearward. (SAE definition).

**centrifugal clutch** Friction clutch in which friction elements are brought into contact with the clutch face by centrifugal force. The clutch will therefore automatically engage and disengage at a certain speed of rotation. A centrifugal clutch may be of a drum (direct acting) type or disc type, in which weights actuate a lever mechanism.

**centrifugal filter** Filter in which particulate matter is removed from a flow of liquid, such as oil or fuel, by the action of centrifugal force brought about by rapidly rotating the liquid flow in a spinning element. Also *centrifuge*.

**centrifugal ignition advance** See *centrifugal advance*.

**centrifugal turbocharger** Turbocharger in which the turbine and compressor are of centrifugal or radial flow design as opposed to axial. Most turbochargers are of this type.

**centrifuge** A *centrifugal filter* or *separator*.

**cetane improver** Diesel fuel additive for improving the *Cetane Number*.

**Cetane Index** Rating for diesel fuels, generally approximating *Cetane Number* but calculated from agreed formulae rather than being derived from tests using a standard engine. The method can yield misleading results as it may not acknowledge the effect of *cetane improvers*.

**Cetane Number** Rating for diesel fuels and a measure of ignition delay, higher Cetane Numbers having shorter delays. Cetane Number is determined from tests on a standard engine and is the percentage of cetane which must be mixed with alpha-methyl naphthalene to give the same ignition performance, under test conditions, as the fuel under examination. It is therefore a measure of the time required for a liquid fuel to ignite after injection into a *compression ignition engine*. See also *Cetane Index Rating*; *Diesel Index*.

**CFR engine** Variable compression test engine developed under the direction of the Cooperative Fuel Research Committee (CFR) and by which the octane quality of fuels can be determined.

**chain** (1) A series of interlinked ovoid metal rings forming a length or continuous loop. (2) A series of pairs of links interconnected at their joints by parallel rods which may carry, in the case of a roller chain, hardened steel rollers. (3) A roller chain consisting of two or more parallel sets of links and rollers, as in the *duplex chain* or *triplex chain*.

**chain and sprocket drive** Power transmission in which a roller chain engages with two or more toothed wheels or sprockets. Used mainly on bicycles, motorcycles, and in engines as a drive from crankshaft to camshaft.

**chain case** Case to enclose a chain and sprocket drive.

**chain drive** See *chain and sprocket drive*.

**chain driven** A vehicle or other mechanism in which power is transmitted by a chain and sprocket drive.

**chain guard** Partial housing, casing or cover to shield a chain and protect the user from soiling by oil or grease.

**chain tensioner** Mechanically or hydraulically operated device to maintain tension in a chain.

**chain track** Metal linked track of a track laying vehicle. See also *Caterpillar track*.

**chain wheel** Any wheel around which a chain runs, but particularly a toothed sprocket wheel.

**change down (US: downshift)** To select a lower gear.

**change speed gearbox (US: transmission)** Set of movable gears permitting the speed ratio between input and output shafts to be changed at will either mechanically or automatically (Figure G.1).

**Chapman strut** Suspension system comprising a telescopic *strut* with its uppermost end attached to the chassis, and the lower end constrained in the lateral and longitudinal planes by two links, as for instance a *wishbone*. A development of the *MacPherson strut*. Generally used for rear suspensions. Term falling into disuse.

**charabanc** A motor coach (archaic, from French char-a-banc).

**charcoal canister** Trap containing charcoal granules to store fuel evaporating from a fuel system and prevent its loss to atmosphere, particularly from a carburetor and fuel tank.

**charge** (1) Usable electrical capacity, as of a storage battery or capacitor (condenser). (2) To increase the electrical charge in a battery. To charge a battery, using a battery charger, dynamo or alternator. (3) The quantity or mass of fuel (or air and fuel) entering the cylinder of an engine on each *stroke*.

**charge cooling** Removal of heat from the induction charge of an engine to increase its density and consequently the total charge mass and engine output per firing stroke. See also *intercooler*.

**charge current (UK: charging current)** Electrical current flowing to the battery when charging.

**charging stroke** The *stroke* of an engine in which the charge enters the *combustion chamber*. The induction or *inlet stroke*.

**chassis** Structural lower part of a vehicle to which the *running gear* and body are attached. The true chassis is now evident only in heavy goods vehicles and some public service vehicles.

**chassis cab** Commercial vehicle chassis complete with cab, engine and running gear, and equipped for road use, but without body or load platform. See also *chassis cowl*.

**chassis cowl** Commercial vehicle chassis complete with engine and running gear, and equipped for road use, but with only the front of the cab, from which a body builder can construct an integral van such as a *pantechnicon* or horse box.

**chassis stop** Bracket or other robust protrusion from the chassis, particularly of a heavy vehicle, against which a leaf helper spring bears when the main spring is greatly deflected.

**chatter** Any irregular or jerky motion of a component, as for example a wiper blade over glass, or the noise associated therewith.

**check valve** (1) Hydraulic valve that maintains a residual pressure in a brake system when the brake is not applied. (2) Valve to control flow of air or mixture upstream of an engine intake valve.

**choke** (1) Valve that restricts the amount of air entering an engine on the induction stroke, thereby enriching the fuel:air ratio for ease of starting and running when cold. *Strangler* (informal). See also *automatic choke*; *butterfly valve*. (2) A carburetor venturi (informal). Also *choke tube*.

**choke stove** Heat exchange chamber on exhaust manifold to speed the operation of an *automatic choke* (mainly US usage).

**choke tube** A carburetor *venturi* (US informal). See Figure C.3.

**choke valve** A valve that restricts the flow of a gas or liquid.

**choked** Of an engine, running with the choke in operation.

**chunking** Loss of pieces of tire tread while a vehicle is in motion.

**CI engine** A compression ignition engine. See also *diesel engine*.

**circuit breaker** Device for interrupting an electrical circuit when the current exceeds a predetermined value. The device can be reset after the circuit malfunction has been corrected.

**circulating pump** Mechanical pump for circulating a working or cooling fluid, for example a *water pump*.

**city cycle** Any standard vehicle test cycle that simulates urban driving, with frequent gear shifts, and driving predominantly in the lower gears. See also *highway cycle*; *urban cycle*.

**clay model** Full size model made prior to manufacture, by which styling, panel molding and other qualities are assessed.

**clearance lamps** Lamps mounted on the permanent structure of a large vehicle near to the upper left and right extreme edges to indicate the overall width and height of the vehicle. See also *marker lamp*.

**clearance height** (1) Unobstructed height between road surface and underside of vehicle. See also *break-over angle*; *bottoming*. (2) Maximum height of a vehicle (usually unladen). (3) Height of vehicle that can pass safely under an obstruction such as a bridge, or the height of that obstruction.

**clearance volume** Volume remaining above the piston of an engine when it reaches top dead center. See also *swept volume*.

**clerestory head** Engine cylinder in which often axially opposed intake and exhaust valves open into an extended chamber of smaller cross section than the cylinder bore.

**clicker wheel adjuster** Adjusting mechanism with toothed indexing wheels, used for example for brake adjustment.

**climatic tunnel** Wind tunnel with facilities for simulating climatic influences such as temperature and humidity.

**climatic wind chamber** Test facility that simulates air flow and climatic conditions. See also *climatic tunnel*.

**closed cycle turbine** Gas turbine in which the working gas is recirculated rather than exhausted to atmosphere.

**closed-loop dwell-angle control** Electronic feedback system that maintains ignition primary current under varying conditions of battery charge.

**closed-loop engine control system** Automatic control of engine parameters through direct feedback of data, as from electronic sensors. See also *limit cycle control*; *proportional control*.

**closed-loop fuel system** Electronically controlled carburetor or fuel injection system in which mixture strength is adjusted by feedback signal from the monitoring of exhaust gas composition, as for example the oxygen or unburned hydrocarbon content of the exhaust.

**cloverleaf head** Engine cylinder head in which the disposition of the valves, with a central spark plug, gives the appearance of the leaf of a clover.

**cluster gear** (1) Set of gears fixed to a *layshaft* (UK) or *countershaft* (US). (2) Layshaft or countershaft gear assembly. See Figure G.1.

**clutch** Mechanism for engaging or disengaging the transmission of power between two axial shafts. In vehicle manual transmission systems the clutch allows smooth and progressive engagement between engine and gearbox for taking up initial drive, and rapid disengagement for gear selection. Clutch terminology is far from standardized, varying considerably from manufacturer to manufacturer. See also *centrifugal clutch*; *cone clutch*; *diaphragm clutch*; *dog clutch*; *fluid flywheel*; *freewheel*; *multi-plate clutch*. See Figure C.4.

**clutch brake** Brake that slows the rotation of a disengaged *clutch driven plate* to make gear engagement easier, particularly on large capacity clutches.

**clutch cover** Bowl-shaped cover that houses the rotating elements of a friction clutch, anchors the *clutch springs*, and is normally attached to the

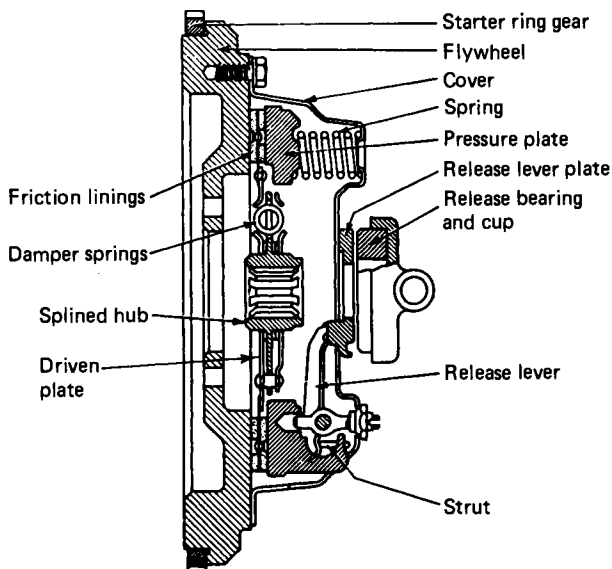


Figure C.4 Push-type clutch mechanism

flywheel, rotating at engine speed (Figure C.4).

**clutch disc** (UK: **clutch plate**, **clutch center plate** or **driven plate**) Rotating clutch element, to which the friction material is attached. See also *cushion drive*. (Figure C4)

**clutch drag** Incomplete disengagement of a clutch, so that some drive torque is transmitted when the **clutch pedal** is depressed, making gear changing difficult.

**clutch driven plate** See *driven plate*.

**clutch fluid** Oil used in the actuating system of a hydraulically operated clutch.

**clutch housing** The outer casing of the clutch assembly. The housing often forms a structural link between engine *crankcase* and *gearbox (transmission)*. See also *bell housing*.

**clutch judder** Faulty condition in which the clutch does not take up smoothly but vibrates during engagement due to oil on friction surfaces or to warped plates. Also *clutch shudder*.

**clutch pedal** Pedal by which the driver of a vehicle operates the clutch, through a mechanical or hydraulic linkage.

**clutch pedal free travel** Distance moved by clutch pedal before clutch actuating mechanism begins to operate.

**clutch plate** (US: **clutch disc** or **disk**) Rotating clutch element, to which the friction material is attached. See also *cushion drive*; *solid drive*. See Figure C.4.

**clutch pressure plate** Robust metal disc which holds the friction-lined clutch disc (plate) by spring pressure against the engine flywheel and thereby

causes engine torque to be transmitted to the transmission system under spring pressure. Sometimes incorporated in the clutch cover. Also **pressure plate**. See Figure C.4.

**clutch release bearing (US: throwout bearing)** Shaft-mounted thrust bearing that transmits the action of the clutch pedal to disengage a clutch. See also **clutch release lever**. See Figure C.4.

**clutch release lever** Lever, mechanically or hydraulically actuated by clutch pedal, that acts on clutch release bearing to disengage clutch. Also **release fork; throwout fork; thrust bearing actuating lever**. See Figure C.5.

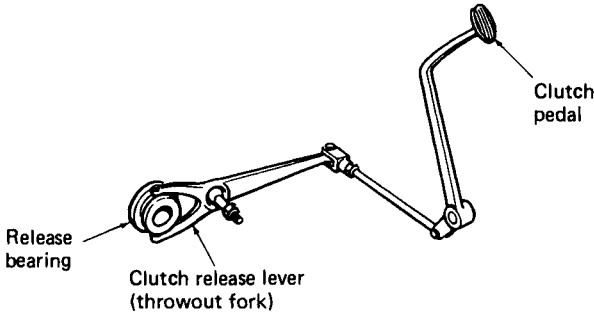


Figure C.5 Mechanical clutch release mechanism

**clutch release mechanism** The mechanical and/or hydraulic parts that release the pressure between **driven plate** and **pressure plate** to disengage the clutch. See Figure C.4.

**clutch servo** Compressed air operated **servomechanism** that assists the hydraulic operation of a clutch **slave cylinder** on heavy vehicles.

**clutch shaft** Shaft through which power is transmitted from **clutch driven plate** to gearbox or transmission input shaft. **Drive pinion** (US informal).

**clutch shudder** See **clutch judder**.

**clutch slip** Faulty condition in which the friction in the clutch is insufficient to prevent relative movement of the driving and driven plates under power, so that engine speed rises without a corresponding increase in road speed.

**clutch springs** Coil springs (or diaphragm spring) that provide the clamping force between **pressure plate** and **driven plate** in a clutch. Also **pressure plate springs; thrust springs**. See Figure C.4.

**clutch start** To start an engine of a manual transmission vehicle by pushing or towing the vehicle with the clutch disengaged and a high gear engaged, then engaging the clutch so that the engine is turned by way of the transmission system.

**clutch stop** A brake, operated by the clutch pedal, to reduce rotational speed of engine and so facilitate upward shifting of gears, particularly in commercial vehicles with **crash gearboxes**. Obsolete.

**coach** A single deck multi-passenger touring vehicle.

**coachwork** The panelled bodywork of a vehicle (Figure B.4).

**coast-down** (1) Aerodynamic test procedure for deriving total resistance from deceleration, from which aerodynamic drag is deduced in knowledge of data on rolling resistance. (2) Deceleration test for gaseous emissions or noise level.

**cocktail-shaker piston** Piston incorporating an oil chamber beneath the *undercrown*. Contact between the oil and undercrown provides additional cooling to the piston crown. See Figure C.6.

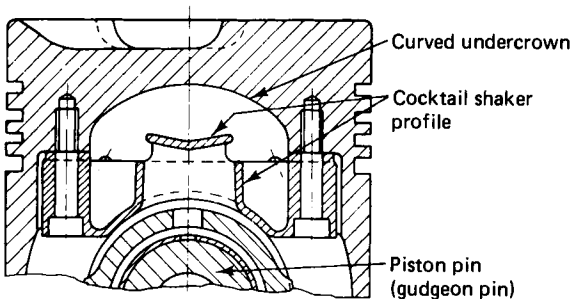


Figure C.6 Upper part of cocktail-shaker piston; oil supply to the shaker is replenished while the engine is operating

**cogged belt** A toothed rubber *timing belt* (informal).

**coil** See *ignition coil*.

**coil and wishbone** (1) *Independent suspension* in which the wheel assembly is located by *wishbones*, with a coil spring as the springing medium. (2) Suspension comprising a *beam axle* suspended by two coil springs and constrained longitudinally and transversely at each side by *wishbones*.

**coil spring** A helical spring, mainly used in vehicles for reacting compressive loads, as in suspensions or clutch assemblies.

**coil spring clutch** Clutch in which the friction plate is held in position by a set of coil springs acting around its outer edge (Figure C.4).

**coke** Carbon deposit in engine (informal).

**cold cranking rating** Current drain of battery when starter motor is turning a cold engine for a specified time.

**cold start ballast resistor** See *ballast resistor*.

**cold start device** Any device, such as a choke or additional fuel injector, that temporarily enriches the flow of fuel to an engine to facilitate starting from cold.

**cold start injector** See *cold start device*.

**cold sticking** Sticking of piston ring in groove when engine is cold. The ring will normally become free when the engine is warm. See also *hot sticking*.

**column change** Gear-shift mechanism operated by lever mounted on steering column, usually immediately below the steering wheel.

**combination** Vehicle consisting of two or more separable units, of which each part need not be independently mobile, for example a motorcycle and side-car combination or a commercial vehicle *tractor* and *semi-trailer* combination (Figure A.3).

**Combined Fuel Economy** Standard measure of fuel economy derived from a stipulated proportion of urban and highway cycle driving.

**combustion chamber** The part of an engine in which combustion takes place, normally the volume of the cylinder between *piston crown* and cylinder head in a reciprocating engine. In indirect injection compression ignition engines and in certain designs of spark ignition engine in which combustion is initiated in a separate *cell* or cavity, the cell or cavity often being considered to be part of the combustion chamber. See also *combustor*.

**combustion chamber surface:volume ratio** Ratio of surface area of the combustion chamber to its volume at a stated stroke of the piston. The ratio influences the *quench* effect of the cylinder walls and the local formation of *unburned hydrocarbons*.

**combustor** The combustion chamber of a gas turbine. The chamber between compressor and turbine into which fuel is sprayed and burned. Also *combustion chamber*.

**Comet head** Indirect injection combustion system for diesel engines, developed by Ricardo. See also *prechamber*. See Figure C.7.

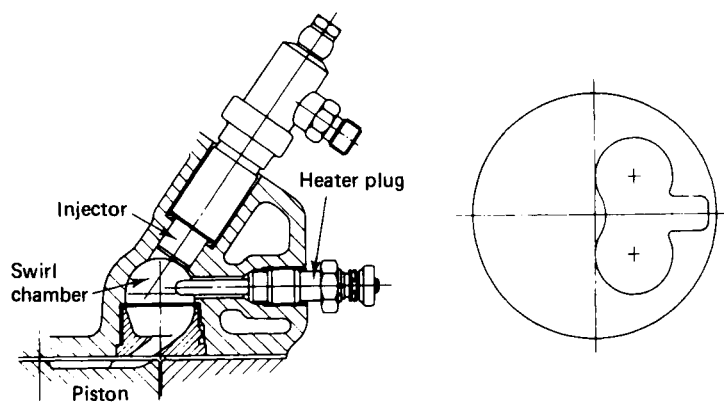


Figure C.7 The Ricardo Comet swirl chamber and head

**commercial vehicle** Vehicle used for the transportation of goods, materials, or for gain or reward other than in the conveyance of passengers, and registered or licensed as such. Exact definition will be liable to local variation and interpretation. See also *articulated vehicle; goods vehicle; lorry; public service vehicle; truck; van*.

**compensating axle suspension** Tandem axle suspension in which there is a positive transfer of load between axles, for example by mechanical, pneumatic or hydraulic interconnection. Also *reactive suspension*. See also *balance beam; walking beam*. See Figure T.1.

**compensating jet (US: air bleed passage)** Jet or passage in a carburetor with a branch to atmosphere through which air is drawn and introduced into the fuel flow at high flow rates, thus preventing over-richness (Figure C.8).

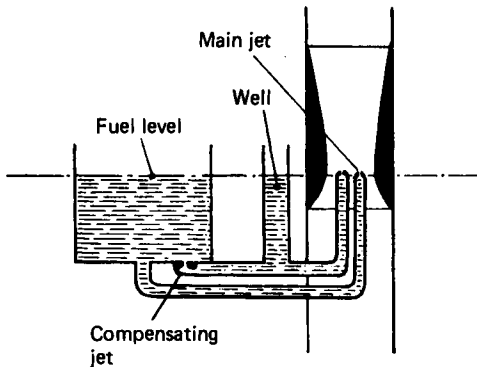


Figure C.8 Compensating jet in a simple carburetor

**compensating linkage** See *compensator*.

**compensator** Device or system of linkages in a braking system to compensate for uneven wear, to ensure simultaneous operation of brakes on each axle, or to apportion braking effort. See also *proportioner*.

**compound carburetor** Carburetor with more than one *choke* or mixing chamber per inlet port.

**Compressed Natural Gas** Natural gas, normally predominantly methane, stored under pressure for automotive use. Also *CNG*.

**compression** (1) Of a solid material, subjecting to axial forces that would decrease the distance between points of load application. A coil spring is said to be in compression when carrying such a load, though the metal of the spring is actually in torsion. (2) The increase of pressure in an engine cylinder as the piston travels towards top dead center. The *compression stroke*.

**compression ignition engine** Reciprocating engine in which the fuel charge is ignited spontaneously by the heat of compression. The term *diesel engine* is (mildly inaccurately) used to describe automotive compression ignition engines.

**compression ratio** In a *reciprocating engine*, the ratio of cylinder plus combustion chamber volume at the bottom of the stroke (at moment of greatest volume) to the volume at top of stroke, when the volume is least.

Note that compression ratio is a volumetric ratio and not a pressure ratio.

**compression ring** The uppermost *piston ring* (Figure P.2).

**compression stroke** The stroke in a reciprocating engine in which the air or air/fuel charge is compressed prior to ignition.

**con-rod** A connecting rod (informal).

**condenser** (1) Device for condensing a liquid from its vapor. (2) An electrical capacitor (term falling into misuse).

**cone clutch** Clutch in which the driving and driven elements engage on a conical surface. Obsolete for most automotive power clutch applications, though used in the synchronizing mechanism of *synchromesh gearboxes*.

**connecting rod** Linkage that connects the crank to the piston in an engine or

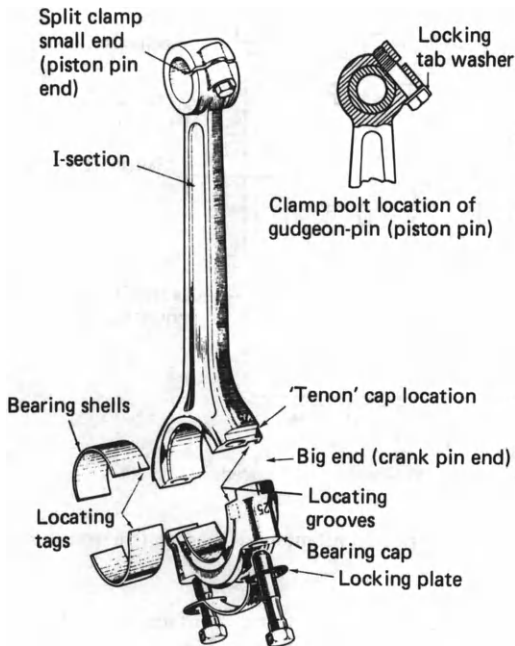


Figure C.9 Connecting rod with diagonally split big end (crankpin end)

other reciprocating machine. See also *crankpin end*; *piston pin*. See Figure C.9.

**connecting rod bearing** (1) The crankshaft-end bearing of a connecting rod. The connecting rod to crankshaft journal bearing. (2) The connecting rod shell bearings. The terms *crankshaft-end bearing* or the less formal *big-end bearing* more clearly indicate which of the connecting rod's two bearings are referred to.

**constant depression carburetor** Carburetor with variable section venturi. Also *variable choke* or *constant vacuum carburetor*.

**constant mesh gearbox** Gearbox in which all forward gear pairs remain in mesh, the driving pair being engaged by a clutch mechanism, such as a *dog clutch*, or by a *synchromesh mechanism* (Figure C.10).

**constant velocity joint** Universal joint in which the output shaft rotates at constant angular velocity with no cyclic variations, given a constant input shaft speed. See also *Bendix-Tracta joint*; *Bendix-Weiss joint*; *Rzeppa joint*.

**constant voltage control** A voltage regulator.

**constantly variable transmission** See *continuously variable transmission*.

**contact breaker** Mechanical spring-loaded switch located in the distributor of an ignition system, and actuated by a rotating cam, that makes or breaks the ignition circuit to deliver a spark to the spark plug. See also *contact breaker points*; *distributor*; *electronic ignition*. See Figure I.1.

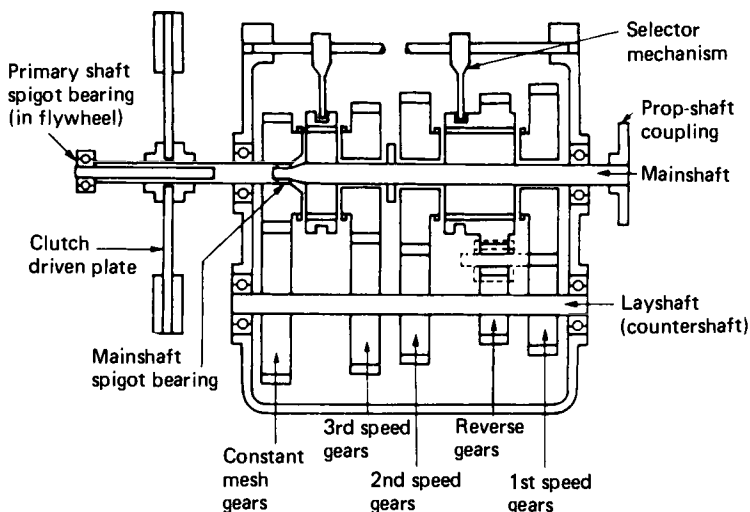


Figure C.10 Simplified diagram of a four-speed constant mesh gearbox (transmission)

**contact breaker points** Hard metal cylindrical switch contacts whereby an ignition circuit is made and broken. Also *points*. See Figure I.1.

**contact coupling** Air line coupling with tapered plug and socket for connection of pressure and vacuum air brake systems. See also *dummy coupling*; *quick-detachable coupling*.

**contact patch** Area of contact of a tire with the ground. Also *footprint*.

**container** Enclosed rigid and secure box for conveying goods by road, rail or sea, and of a standard size and design.

**continuous spray pump** Fuel injector pump that provides a continuous rather than an intermittent spray, normally for fuel injection in spark ignition engines.

**continuously variable transmission** Transmission system in which the speed ratio of driving to driven elements is infinitely variable over the required working range, or is varied over a very large number of fixed ratios. Also *constantly variable transmission*.

**control arm** Any lateral swinging arm of a suspension that controls the camber of a wheel, as for example the upper or lower arms of a *double wishbone suspension*.

**control box** (1) Container for the voltage and current regulators of an engine charging circuit (informal). (2) Any box or unit containing control circuits or presenting an operator with means of operating controls.

**control lever** Hand lever for selecting gears manually in an automatic transmission (mainly US). Also *stick-shift* (informal).

**control ring** An oil-scraper piston ring.

**controlled separation** Aerodynamic boundary layer separation from a surface achieved by a discontinuity of body profile.

**converter** (1) A *catalytic converter*. Occasionally a *thermal reactor*. (2) A *torque converter* (informal).

**convertible** Passenger car with removable top or roof, enabling it to be converted to an open car. Also *soft-top*; *rag-top* (informal).

**coolant** Fluid, usually a liquid such as water or water/glycol mixture, used in a *cooling system* for an engine, compressor or other machine that requires cooling in operation.

**cooling system** System of components devised for the cooling of an engine or other machinery, usually consisting of a *radiator* or other heat dissipator, a *circulating pump*, *thermostat*, *coolant* and pipework.

**cornering coefficient** See *cornering stiffness coefficient*.

**cornering force** Force on tire generated by the *slip angle* or *distortion angle* on cornering. Also *lateral control force*. See also *cornering stiffness*.

**cornering lamp** Constantly illuminated lamp used in conjunction with the turn signal system to supplement headlamp illumination in the direction of turn.

**cornering stiffness** The lateral or cornering force generated by a tire per unit slip angle. See also *cornering stiffness coefficient*.

**cornering squeal** See *squeal*.

**cornering stiffness coefficient** Ratio of cornering stiffness of a free straight-rolling tire to the vertical load (SAE definition). Also *cornering coefficient*.

**counter shaft (UK: layshaft)** Shaft that runs parallel to the mainshaft in a gearbox, and carries the pinion wheels. Also *cluster gear*. See Figure G.1.

**coupling** (1) Device for connecting together mechanical components, such as rotating shafts. (2) Means whereby a trailer is coupled to a tractor unit. Also *coupling hook*.

**cover** The main outer body of a pneumatic tire. See also *carcass*.

**cowl** (1) Rigid covering or ducting, particularly when of nominally circular section. Also *cowling*. (2) Front part of a vehicle cab or body directly below the base of the windshield and between the *firewall* or *bulkhead* and the instrument panel.

**crabbing** Vehicle movement resulting from axle misalignment such that the longitudinal axis is not in line with the vehicle's direction of motion.

**crank** (1) Arm attached to a shaft and carrying a pin or handle or pedal parallel to the shaft. (2) To turn manually by means of a crank or starting handle. To crank an engine. (3) To turn an engine crankshaft by an external agency, as for example a cranking or starter motor.

**crank throw** Radial distance from crankshaft axis to crankpin axis, equal to half the stroke. Occasionally defined as twice this distance.

**crank web** Radial arm, usually of flat section, that supports the *crank-pin* on a crankshaft.

**crankcase** Part of the structure of an engine that contains and supports the *crankshaft* and *main bearings*. See also *monobloc construction*.

**crankcase dilution** Dilution of the lubricating oil in the oil pan or sump of an engine by fuel which has entered the crankcase.

**crankcase emissions** Emission of gases or vapors, and particularly of hydrocarbons, from an engine crankcase.

**crankcase emission control system** System for reducing or eliminating

**crankcase emissions.** See also *positive crankcase ventilation*.

**cranking enrichment** Provision of excess fuel for cold starting as by choke or electronic fuel injection control.

**cranking motor** (UK: **starter motor**) Electric motor for starting an engine. See also *Bendix drive; overrunning clutch starter motor; pre-engaged starter*.

**cranking speed** Rotational speed at which an engine is turned for starting.

**crankpin** Journal bearing of the crank of a *crankshaft*, to which the *connecting rod* is attached.

**crankpin end** The lower, and larger, end of a *connecting rod* that bears on the *crankpin*. The end may be separable to enclose a shell bearing and to facilitate assembly to the crank, or may, with a split crankshaft, be in one piece housing a rolling element bearing. Also *big end* (UK informal). See Figure C.9.

**crankshaft** The main power shaft of a reciprocating engine comprising the cranks that impart reciprocating motion to the pistons by way of their *throw* or offset from the shaft axis, and the journals whereby it is located and supported by the crankcase main bearings. See Figure E.1.

**crankshaft-end bearing** (UK: **big-end bearing**) The bearing between connecting rod and crankshaft (Figure C.9).

**crankshaft journal bearing** Bearing between the crankshaft and engine crankcase. Also *main bearing*. See Figure E.1.

**crankshaft throw** See *stroke; throw*.

**crash gearbox** (1) Gearbox or transmission with coaxial driving and driven shafts in which geared pairs of straight spur gears are engaged by the axial sliding of straight spur wheels to engage with paired wheels on a *layshaft* or *countershaft*. (2) Any change speed gearbox or transmission without synchromesh.

**crawler** (1) A slow large vehicle. (2) Very high reduction gear ratio, for use when climbing steep gradients or hauling heavy loads. (3) A *track-laying vehicle*. See also *crawler tractor*.

**crawler tractor** Off-highway vehicle with traction provided by chain tracks rather than wheels.

**critical speed** Speed at which some, usually untoward, phenomenon manifests itself, as for example the rotational speed at which a driveshaft whips or whirls.

**cross flow** Particularly of a *four stroke engine*, having the intake and exhaust manifolds on opposite sides of the cylinder block so that the gas flow is ostensibly across the cylinder.

**cross flow scavenging** See *cross scavenging*.

**cross scavenging** Scavenging of a two stroke engine by flow across the cylinder, a favorable flow pattern being induced by a wedge-shaped deflector on the piston crown. Also called *cross flow scavenging*. See also *loop scavenging; reverse flow; Schnuerle system; uniflow scavenging*.

**cross-pins** Cruciform component for carrying pinions or bearings, as for example the pinion carrier of a differential or the yoke connector of a *Hooke's joint* (informal).

**crossbar** Horizontal structural or stiffening member of a framework, as for example the upper member of a bicycle or motorcycle frame.

**crossply** (US: **bias ply**) Form of tire construction in which the casing plies

are laid diagonally and alternately so that each ply lies at an included angle, usually of more than 40 degrees, to the adjacent ply. See also *radial ply tire*. See Figure B.3.

**crown** (1) The external road-contacting periphery of a tire. (2) The upper part of a piston. See *piston crown*.

**crown wheel** A bevel gear wheel in which the teeth are set around the periphery, giving the wheel the appearance of a crown. The larger wheel of a crown wheel and pinion bevel pair. See also *differential*.

**cruise control** Automatic control that adjusts engine output, and selects gear in an automatic gearchange system, to maintain a constant pre-selected speed. Also *automatic speed control*.

**crush zone** Part of a vehicle bodywork designed to absorb energy of structural collapse in collision thus reducing its transmission to the passenger compartment.

**crystal chromatic light** Lamp unit which is white or clear when unlit, but which gives off amber or other colored light, dependent on type of filter, when lit.

**cuff valve engine** Type of *sleeve valve* engine in which the sleeves operate in a separate chamber rather than within the working cylinder.

**curb weight (UK: kerb weight)** Weight of vehicle with fuel, lubricants and coolant, but without driver, passengers or payload.

**current regulator** Electro-mechanical switch which opens when the current from the generator exceeds a certain value. See also *control box; voltage regulator*.

**curtainsider** Commercial goods vehicle or trailer body with sides of a removable, flexible fabric secured over a framework and fastened at the base.

**cushion drive** Vehicle driveline incorporating a clutch with a *cushion spring*.

**cushion spring** Flat annular spring which provides resilience between the friction linings of a clutch disc, thereby cushioning the shock of engagement.

**custom car** Production car modified to personal tastes, but particularly one individually finished with elaborate decorative paintwork.

**cut-in speed** (1) Rotational speed at which output voltage from a generator exceeds the voltage across the battery terminals. Also *cutting-in speed*. (2) Minimum rotational speed at which an ignition system will function effectively.

**cut-out** (1) Any device that halts the operation of a mechanical unit or electrical circuit. (2) Electro-magnetic switch in control box that protects a *dynamo* against reverse current flow when battery potential exceeds dynamo voltage. See also *cut-in speed*.

**cutting in speed** See *cut-in speed*.

**CVT** See *continuously variable transmission*.

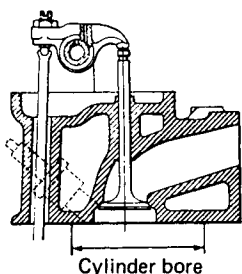
**cyclemotor** Motor for propelling, or assisting the propulsion of, a pedal bicycle.

**cyclone** A centrifugal separator or filter. See also *filter*.

**cylinder** Cylindrical or tubular chamber in which the piston of a reciprocating engine or pump reciprocates. See also *bore; stroke; cylinder block*.

**cylinder block** The part of an engine containing the *cylinders*. The cylinder block may also incorporate the water cooling jackets and provision for the *valve gear*. See also *monobloc construction*. See Figure E.1.

**cylinder head** Part of a *reciprocating engine* that seals or closes the upper ends of the cylinders. See also *fixed head*; *gasket*. See Figure C.11.



*Figure C.11* Cylinder head with valve set in an offset bath-tub

**cylinder liner (US: cylinder sleeve)** Thin walled hard metal cylinder inserted into a cylinder block of an engine and in which the piston runs. See also *dry sleeve*; *wet sleeve*.

## D

**damper** Device for dissipating energy of vibration, and hence for reducing vibration, as for example in an engine, camshaft drive or vehicle suspension. See also *shock absorber*; *steering damper*; *vibration damper*.

**damper springs** Springs set within a clutch plate to absorb shock loads arising from sudden or uneven engagement. Also *torque cushion springs*.

**damping** Dissipation of energy in a vibrating system, usually by mechanical friction or fluid flow through an orifice.

**damping slipper** Damping device bearing on a chain drive (and particularly an overhead camshaft timing chain) to minimize periodic oscillation or thrash of the chain.

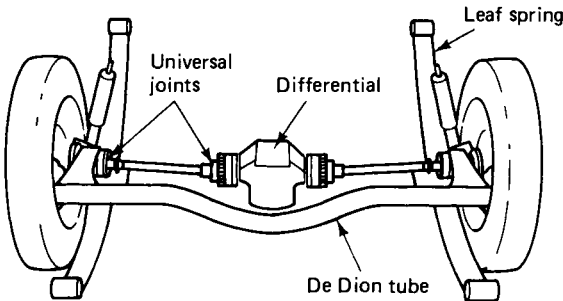
**dash** See *dashboard*.

**dash panel (US: firewall)** Bulkhead between passenger compartment and engine bay. See also *bulkhead*; *scuttle*. See Figure B.4.

**dashboard** Interior panel beneath the windscreen or windshield, on which instruments are mounted. Also *dash*; *fascia*.

**daylight opening** Maximum unobstructed opening through any glass aperture. Also *DLO*.

**de Dion axle** Combined system of power transmission and suspension in which the rear wheels of a vehicle are carried on a sprung dead axle or beam axle, the final drive to each wheel being by cardan shafts from a chassis-mounted differential (Figure D.1).



*Figure D.1* One of the many configurations of the de Dion rear wheel drive system. Coil springs are often used as an alternative to leaf springs. The de Dion tube may also incorporate a sliding joint

**de Dion joint** A shaft joint allowing relative axial movement of the joined shaft. A plunging joint. Also *sliding-block joint*.

**de Normanville transmission** Change speed gearbox in which ratio changes are effected by applying hydraulically actuated band brakes or external

shoe brakes to the outer drums of epicyclic gear units. Despite mechanical similarity to automatic transmissions and pre-selector gearboxes, the de Normanville is a manual shift transmission.

**dead axle** A non-driven axle, as for example the rear axle of a front wheel drive vehicle, or a de Dion axle. See also *beam axle*.

**dead center** The location of the piston of a reciprocating engine when at either extremes of its stroke. There are two such positions or 'dead centers', one when the piston is at the top of its stroke (upper or top dead center) and one when the piston is at the bottom of its stroke (lower or bottom dead center). The coincidence of the cylinder axis and crankpin axis indicates the dead centers only in engines in which the bore axis and crankshaft axis are in the same plane, which is not the case in engines with offset bores. See *desaxe engine*. Inner and outer dead center are alternative terms, though less often used.

**decarbonize** To remove the carbon deposit from the cylinders (and exhaust tract) of an engine. *Decoke* (informal).

**deceleration valve** Valve that allows extra air to flow into an intake manifold on deceleration to prevent backfire. See also *antibackfire valve*.

**deck** The floor of a vehicle, but particularly of a passenger or goods vehicle. See also *cargo floor; double-deck bus*.

**decoke** To decarbonize (informal).

**decompressor** Valve, often manually operated, to allow free passage of ambient air to and from an engine cylinder to facilitate manual starting without turning the engine against compression. The decompressor is released before the compression stroke when adequate rotational speed has been reached. Mainly found on smaller diesel engines.

**deep cycling** Repeated total discharging and recharging of an electrical storage battery.

**deflection** See *static tire deflection*.

**deflector head** Two stroke cylinder configuration associated with cross scavenging, in which the piston crown is in the form of a wedge shaped gas deflector (Figure T.10).

**defogger** (UK: *demister*) Device or system for dispelling condensation on front or rear screen (shield), either by a flow of warm air or by an electric element within or attached to the glass.

**defroster** (UK: *demister; screen heater*) Heater for melting frost or ice on windscreen (windshield) or backlight. See also *defogger*.

**Delco-Moraine brake** Form of sliding caliper disc brake.

**delivered air-fuel ratio** The ratio of mass of air to the mass of fuel, delivered to, but not necessarily combusted within, the cylinder(s) of an engine. See also *carburetor; rich mixture; weak mixture; stoichiometric*.

**delivery van** Light commercial vehicle equipped mainly for short distance delivery of goods. Also *delivery truck*.

**deltic engine** Opposed piston diesel engine with banks of three cylinders set in triangular configuration, originally introduced by Napier.

**demister** See *defogger*.

**dismountable** Free-standing rigid box structure or container for conveyance of goods, fitted with retracting legs to facilitate mounting on a specially adapted commercial vehicle which backs beneath the box body,

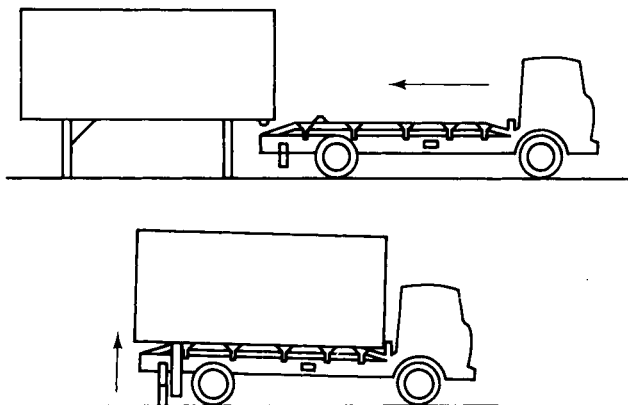


Figure D.2 A demountable freight system

whereupon the body can be lowered onto the vehicle's chassis bearers. A *swap-body* (also swop-body). See Figure D.2.

**deposit induced runaway surface ignition** Form of pre-ignition caused by the incandescence of progressive deposit formation. Also *DIRSI*.

**desaxe engine** Engine in which the crankshaft axis is offset from the cylinder axis, to increase the torque on the power stroke.

**design H-point** See *H-point*.

**desmodromic valve** Inlet or exhaust valve which opens and closes under positive cam action, sometimes with spring assisted final seating.

**detonation** Rapid combustion, particularly of the end-gas, when heated by the advancing flame front from the spark plug. Detonation can occur in the cylinder of a spark ignition engine when operating on a fuel of inadequate octane rating, or with ignition timing too far advanced. The noise made by persistent detonation is called *pinging* (US) and *pinking* (UK) in a spark ignition engine, and *diesel knock* in a CI engine. See also *pre-ignition* (which is not the same thing).

**diagnostic testing** Testing of a vehicle, or vehicle system, as for example an electrical system, engine, etc., to detect maladjustment and identify causes of malfunction. Generally used to describe automated or computerized workshop testing of production vehicles.

**diagonal split brake system** Brake system in which separate cylinders actuate the brakes for one front wheel and one rear wheel on the opposite side, the paired wheels thus being linked diagonally so that failure of one linked pair will provide reasonably balanced braking.

**diaphragm** Flexible disc or membrane which deflects under pneumatic or hydraulic pressure and, in so doing, imparts linear motion to a centrally-located rod or other form of mechanical actuator, as in an air brake or carburetor.

**diaphragm carburetor** Floatless carburetor incorporating one or two diaphragms and capable of operating at any angle and normally unaffected by vibration and acceleration.

**diaphragm chamber** Air-tight metal chamber or drum containing the diaphragm and push rod to apply the brakes in an air brake system. See also *brake chamber*.

**diaphragm clutch** Clutch in which the pressure plate is maintained in contact with the friction plate by a diaphragm spring (Figure D.3).

**diaphragm spring** A disc-shaped metal spring, used particularly in clutches. The spring force is exerted by bending of fingers formed by radial slotting.

See also *clutch pressure plate*; *clutch release bearing*; *diaphragm spring ring*.

**diaphragm spring clutch** See *diaphragm clutch*.

**diaphragm spring ring** Fulcrum ring about which a clutch diaphragm spring pivots when the clutch is actuated (Figure D.3).

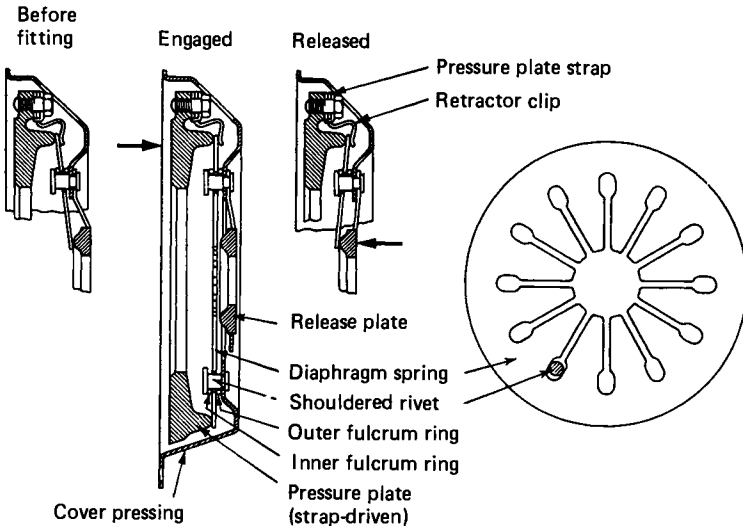
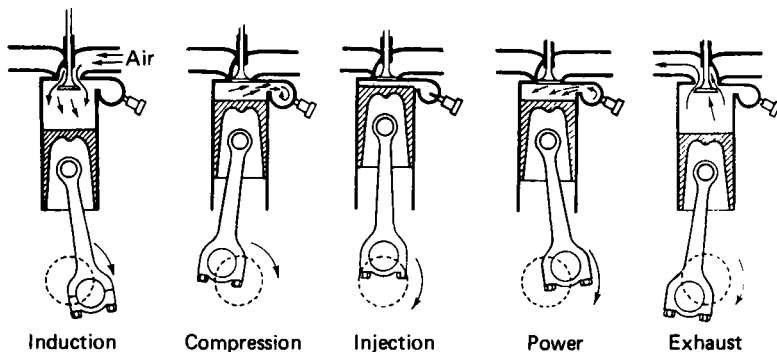


Figure D.3 Diaphragm clutch assembly and diaphragm spring

**diesel cycle** Thermodynamic cycle in which air is compressed, heat added at constant pressure by injecting fuel into the compressed charge, the combusting mixture expanded to do work on the piston, and the products exhausted at completion of the cycle. After inventor and patentee Dr Rudolf Diesel (1858–1913). See also *adiabatic engine*; *diesel engine*. See Figure D.4.

**diesel electric drive** Engine-transmission system in which a diesel engine drives an electric generator which, in turn, drives an electric motor. The system allows the engine to run at close to optimum speed, and eliminates the need for a change-speed gearbox. Generally used only on large industrial and off-highway vehicles, and railway locomotives.

**diesel engine** (1) Reciprocating engine operating on the compression ignition diesel cycle, in which a charge of vaporised fuel is injected into the cylinder at completion of the compression stroke. (2) Informally used to



**Figure D.4** The operating cycle of the practical high-speed diesel engine deviates from that of the ideal diesel cycle. In the conventional four strokes of the diesel cycle, 'injection' and 'power' would normally be counted as one stroke

describe any compression ignition engine. Occasionally spelt with a capital D. See also *Cetane Number*; *compression ignition engine*; *diesel cycle*; *direct injection*; *indirect injection*. See Figure D.4.

**Diesel Index** A measure of diesel fuel quality, derived from the aniline point test and API Gravity, and approximating Cetane Index, by which it has been largely superseded.

**diesel knock** The noise made by the rapid pressure rise in certain types of CI engine, particularly at low speed and load. The effect is also encountered with fuels of lower ignition quality.

**dieseling** See *auto-ignition*; *run-on*.

**differential** System of gears capable of dividing the input torque of one shaft between two output shafts where rotation at different speeds is likely to occur, as in cornering. Used as the final drive of vehicles with two or more driven wheels. See also *crown wheel*; *limited-slip differential*; *spur differential*. See Figure D.5.

**differential angle** Difference between bevel angle of poppet valve seat face and that of its seating, particularly in an IC engine.

**differential cage (US: differential housing)** Rotating housing, usually a casting, attached to the crown wheel and carrying the final drive pinions in a bevel differential (Figure D.5).

**differential case** The case or housing for a differential, often forming a structural part of a live beam axle. Also *differential carrier (US)*. See also *banjo axle*. See Figure D.5.

**differential housing** See *differential case*.

**differential protection valve** See *anti-compounding valve*.

**dilution air** In exhaust emission testing, ambient air which is passed through filters to stabilize the hydrocarbon concentration and dilute the vehicle exhaust.

**dilution factor** Arbitrary numerical representation of the concentration of carbon monoxide, carbon dioxide and unburned hydrocarbons in exhaust gases, derived from the stoichiometric equation.

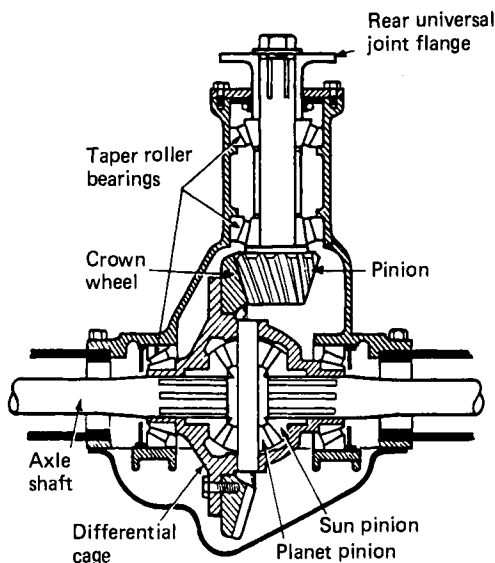


Figure D.5 Rear axle differential

**dilution ratio** An index of the dilution by filtered air of an exhaust gas test sample to the gas concentration in the exhaust.

**dim-dip** Lighting system whereby the dipped or lowered beam of the headlamps has an alternative lower intensity setting to prevent annoying oncoming drivers.

**dimmer switch (UK: dip switch, dipper switch)** Electrical toggle switch by which main headlamp beam is extinguished and dipped beam switched on.

**DIN rating** Standard for measurement of engine performance specified by the Deutsche Institut für Normung (DIN), characterized by the requirement that the test be conducted with an engine driving all normal ancillary machinery. See also *SAE rating*.

**dip switch (US: dimmer switch)** Electrical switch by which the headlamp main beam is lowered, or dipped.

**dipped beam (US: lowered beam)** Lowered headlamp beam for illuminating road when meeting other road users. Also *lower beam* or *meeting beam*.

**dipstick (US: oil gage)** Graduated rod to indicate oil level in engine oil pan (sump) or gearbox (Figure E.1).

**direct drive** Transmission drive mode in which engine and transmission shafts rotate at same speed, by-passing the reduction stages of the gearbox. This term is more common in marine than in automobile engineering.

**direct injection** Diesel engine injection system in which the fuel is injected directly into the engine cylinder, rather than into a *pre-chamber*. See also *indirect injection*.

**direction indicator (US: turn indicator; turn signal lamp)** Flashing lamp to indicate direction a driver intends to turn, normally mounted at each

corner of the vehicle, with optional or mandatory repeater lamps at side.

Also **turn indicator**; **turn signal lamp**. See also **flasher unit**.

**directional control** Control and quality of response of a vehicle in steering.

**directional stability** Ability of a vehicle to maintain its course, or remain under normal steering control, while being subjected to directionally disturbing influences such as cross-winds, camber changes, or braking on irregular surfaces.

**director plate** Multiple orifice plate fitted within a gasoline fuel injection nozzle to encourage accurate spray formation.

**disc brake** Brake in which external friction pads are brought to bear on the faces of a disc, usually by the clamping action of a **caliper** (Figure D.6).

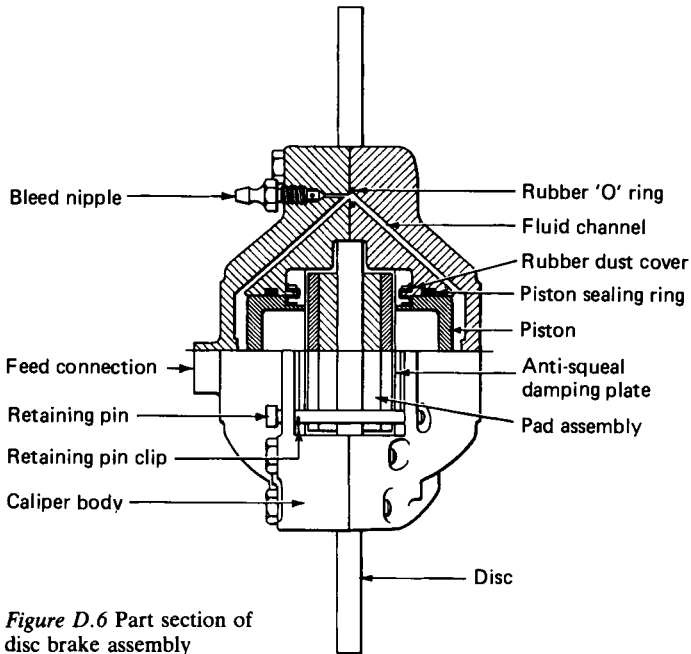


Figure D.6 Part section of disc brake assembly

**disc valve** Rotating valve that provides open passage to a fluid by presenting an arcuate slot to an aperture, sometimes used to time the admission of mixture in a two-stroke engine. A form of **rotary valve**.

**disc wheel** Wheel consisting of an inseparable wheel disc and rim, but particularly when made from pressed steel.

**discharge tube** Tube by which an emulsified air-fuel mixture enters the venturi of a **fixed choke carburetor**.

**displacement** The product of stroke and of cylinder bore and number of cylinders of an engine, representing the theoretical volume of (incompressible) working fluid that can be drawn into an engine with each cycle. See also **capacity** and **swept volume**.

**displacement factor** Index of vehicle performance usually expressed as a product of engine *displacement* and *axle ratio* divided by the product of drive wheel rolling radius and gross weight. Mainly US usage.

**distortion angle** Angle between plane of wheel and direction of motion of wheel in a steered vehicle. Also *slip angle*.

**Distribution Octane Number** Measure of gasoline ignition quality determined through tests on a modified *CFR Engine*. Also *DON*. See also *Motor Octane Number*; *Research Octane Number*.

**distributor** Engine-driven rotary switch that switches the high voltage ignition current to each spark plug in turn (Figure I.1).

**distributor cam** A multi-lobed cam that actuates a contact breaker to initiate an electrical discharge to each cylinder in turn.

**distributor cap** The cover for the *distributor*. This item usually incorporates the attachments and terminals of the spark plug leads and the high tension lead to the coil, and is made of non-conductive material.

**distributor pump** High pressure rotary *fuel pump* that meters and delivers the fuel sequentially to the individual cylinders of multi-cylinder diesel engines. See also *injection pump*. See Figure D.7.

**distributorless ignition** System of ignition in which the high tension (high voltage) electricity is switched electronically to each cylinder, rather than by an electro-mechanical rotary switch. The term is misleading, the distributor merely functioning in a different and non-mechanical way. *Electronic ignition* is the preferred term. See also *distributor*; *module*.

**dive** Nose-down pitching of a vehicle, as on braking.

**divergent instability** Instability in which a disturbance, as for example to direction or heading, leads to an increasing deviation without oscillation.

**divided system (US: split brake system)** Brake system in which failure of brakes on one pair of wheels will not prevent the brakes on other wheels from operating. Also *split system*. See also *diagonal split brake system*.

**divided propeller shaft** Shaft drive system between gearbox and final drive comprising two shafts with central bearing attached to chassis, suspension travel being accommodated by movement of the final shaft. Mainly employed to prevent *whirling* problems with long shafts on heavy vehicles.

**division-control multivibrator** Electronic engine control circuit that determines the pulse characteristics of an electronic injection system from data feedback of engine speed and inlet air-flow.

**dog clutch** Clutch which transmits power by engaging metal teeth or dogs. It allows only direct mechanical engagement or disengagement without slipping or progressive torque transmission.

**dolly** (1) Wheeled apparatus, often equipped with a fifth wheel, for handling an uncoupled *semi-trailer*. (2) Landing legs for a semi-trailer.

**donkey engine** A small auxiliary engine, usually for driving ancillary equipment or services when the main engine is stopped.

**dope** Fuel additive, particularly nitromethane or of one of the aromatic hydrocarbons. Used in competitive events where regulations permit. (Informal).

**double** See *double trailer*.

**double-acting** Of an engine or pump, where work is done on, or by, each side of the piston. Extremely rare in diesel engines, though common practice in steam.

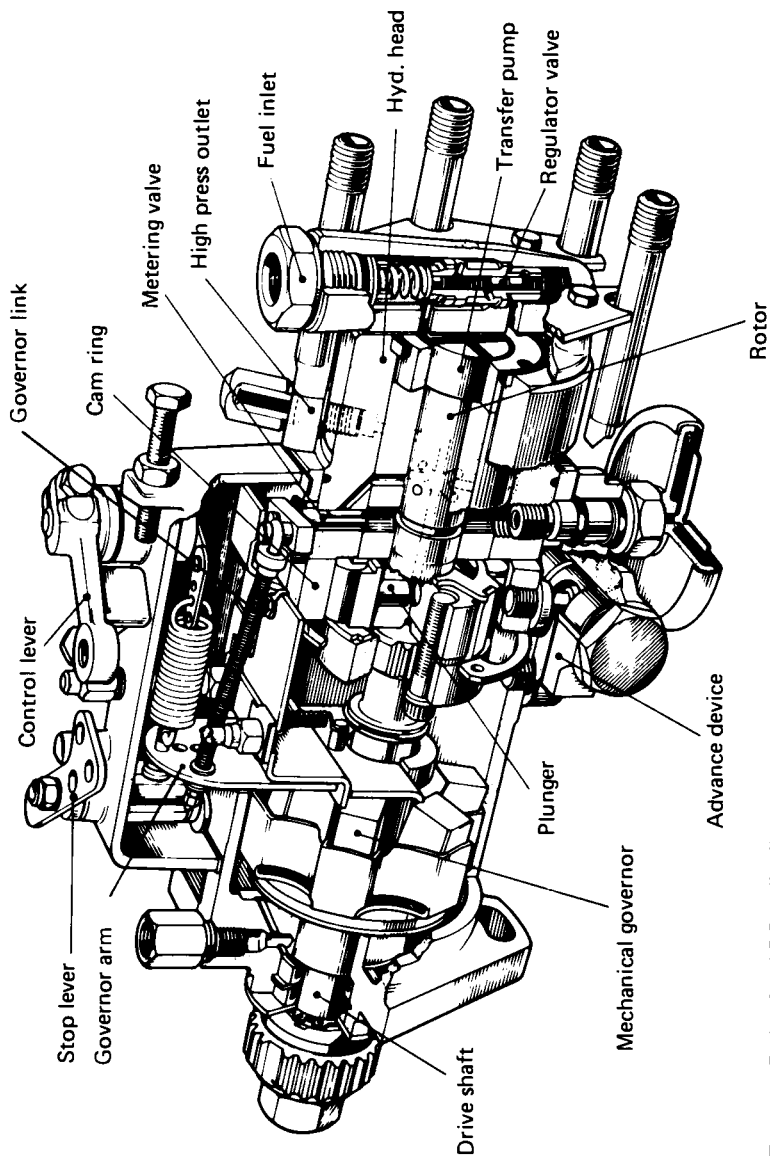


Figure D.7 The CAV DPA distributor pump

**double-barrel carburetor** Carburetor in which two barrels share the same float chamber. Typically used where an intake manifold has two intake ports, as is the case with many six cylinder engines.

**double bottom** See *double trailer*.

**double cardan joint** A type of compound *constant velocity joint* employing two Cardan or Hooke's joints in series. This type of joint accommodates limited axial misalignment, and approximates constant velocity operation whereas a single joint does not. Cardan is variously spelt with a capital and lower-case C. In this context, the small C is more usual.

**double-deck bus** Bus with an upper passenger deck set above a lower deck. A *double-decker* (UK informal).

**double-declutch** Double operation of the *clutch pedal* to facilitate gear changing in a vehicle with a *crash gearbox* or sliding mesh gearbox.

**double pivot steering** Steering in which each steered wheel pivots about its own kingpin – the normal system for almost all modern vehicles. See also *Ackermann steering*; *Jeantaud steering*; *single pivot steering*.

**double-reduction axle** Heavy vehicle axle with two stages of reduction gearing between *propeller shaft* and *final drive*.

**double trailer** Articulated commercial vehicle also towing a full-trailer. Also *double bottom*, *double*, and *turnpike double* (US informal).

**double wishbone suspension** Form of *independent front suspension* in which the bump travel of each wheel is controlled by two longitudinally pivoted *wishbones* or A frames, the steering knuckle or stub axle assembly often being carried on *ball joints*. See also *parallel wishbone*; *unequal wishbone*.

**downdraft carburetor** Carburetor through which the intake air flows vertically downwards into the *manifold*.

**downshift** (UK: *change down*) To select a lower gear.

**downstream injection** Gasoline fuel injection system in which fuel is injected at the downstream end of the inlet tract, often directed at the inlet valve. Also *downstream spray*.

**downstream spray** See *downstream injection*.

**downtake pipe** First exhaust pipe after exhaust manifold. See also *breeches pipe*.

**downwash** Downward component of air motion, particularly following a moving vehicle. See also *upwash*; *vortex pair*.

**drag** Air resistance. The external aerodynamic friction forces that resist movement of a vehicle.

**drag link** The link in a steering system that connects the *drop arm* or *Pitman arm* to the *steering arm*. Also *steering side tube*.

**dragfoiler** See *air shield*.

**dragster** Competition or record vehicle for straight line sprinting or drag racing.

**drain plug** Plug, often hexagon-headed and threaded, removal of which allows a fluid to be drained from a reservoir such as an engine oil pan or sump (Figure E.1).

**drain valve** Valve by which condensation is removed from the reservoirs of an *air brake* system.

**drainback passage** Passage through which a recirculating fluid, such as a lubricating oil, returns to its source.

**drawbar** Horizontally hinged rigid bar or A-frame by which a *full trailer* is towed and steered, the forward pair of wheels being steered by the drawbar assembly. Sometimes *draw-bar*.

**drawbar combination** Commercial vehicle towing a *drawbar trailer*.

**drawbar pull** Tractive force exerted at the drawbar of a towing vehicle, sometimes expressed as factored power per unit speed, which gives a value in units of force.

**drawbar trailer** Full-trailer towed by means of a drawbar.

**dray** Vehicle for conveyance of agricultural produce or drink. A brewer's dray (mainly UK usage). A type of low-loader truck (US informal).

**drip molding** Narrow reflexed guttering attached to longitudinal roof edges.

**drive line (US: drive train)** Transmission system from engine output shaft to driven road wheels. See also *powertrain*.

**drive shaft** (1) Shaft or shafts by which power is transmitted to a rear axle differential. (2) Any rotating shaft by which power is transmitted. See also *divided propeller shaft*.

**drive train** See *drive line*.

**driveability** Of an engine or vehicle, exhibiting ease of control, particularly of engine torque and low speed operation. See also *flexible*.

**drivebox** A *gearbox* or *transmission* (US informal).

**driven disc** See *driven plate*.

**driven plate** Disc shaped clutch element with annular friction lining to which torque is transmitted from the engine, and which transmits that torque through splines to a gearbox or other driven shaft. Also called clutch disc, driven disc and friction plate. See also *pressure plate*.

**driver's field of view** See *field of visibility*.

**driveshaft tunnel (UK: transmission tunnel)** Longitudinal raised tunnel-shaped section along center of floor-pan to house a driveshaft (propeller shaft).

**driving axle** Axle capable of transmitting power by way of a differential or other transmission arrangement. A *live axle*. See also *double reduction axle*; *single reduction axle*.

**driving beam** See *main beam*; *upper beam*.

**driving cycle** See *test cycle*.

**driving mirror** Mirror providing a driver with rearward vision, particularly when mounted within a vehicle. See also *wing mirror*.

**driving wheel** A *steering wheel* (UK archaic).

**dromedary** Cargo-carrying truck (not merely a tractor unit) equipped with a *fifth wheel* for towing a semi-trailer (US informal).

**drop arm (US: pitman arm)** Lever or arm that translates the rotary output of a *steering box* to the linear movement of a *drag link*. Also *steering arm*. See Figure S.6.

**drop axle** Dead axle of which the main portion of the beam is lower than the axis of the wheels. See also *drop-center axle*.

**drop box** See *drop gear*.

**drop-center axle** Dead axle, the center part of which is lowered, usually to give clearance to a *drive-shaft*. See also *drop axle*.

**drop-center rim** Wheel rim with smaller radius well-like centre part to facilitate tire changing.

**drop-frame trailer (UK: low loader)** A flatbed trailer with platform raised only in way of the axles.

**drop gear** Gearbox with output axis lower than input axis, used particularly on commercial vehicles where the engine is mounted considerably higher than the drive axles. See also *transfer gear*.

**drop-head** Passenger car with collapsible fabric roof (UK informal).

**dropwell** Lowered portion of a vehicle floor.

**dropside flat** Flatbed truck or lorry with horizontally hinged sides that may be dropped for loading and unloading.

**drum brake** Brake in which friction blocks or brake shoes lined with friction material are brought to bear on the periphery of a drum or cylinder. In most vehicle applications the shoes are brought into contact with the inner periphery of the drum. See also *internal expanding brake*. See Figure D.8.

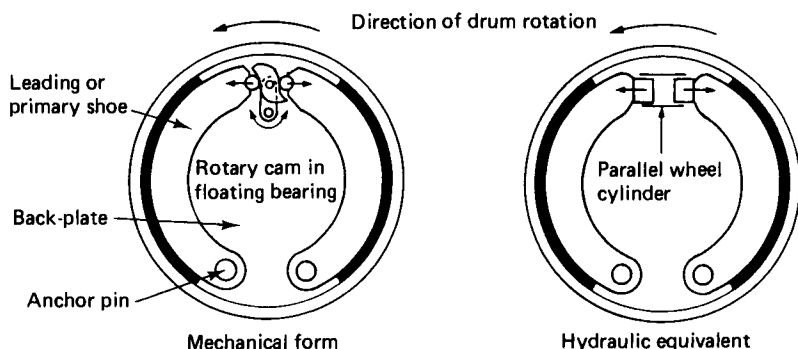


Figure D.8 Floating cam drum brake in mechanical and hydraulic forms. Shoe-to-shoe springs are omitted for clarity

**dry charged battery** Lead acid battery with charged plates but containing no electrolyte. A frequent state for storage prior to sale.

**dry clutch** Clutch which operates in air rather than in a bath of oil or other liquid.

**dry liner** See *dry sleeve*.

**dry sleeve (UK: dry liner)** Hard metal engine *cylinder liner* or insert that is not exposed to contact with cooling water.

**dry sump** Of an engine, when main lubrication is supplied from a remote reservoir, the sump (if incorporated) containing no oil while the engine is operating. A common feature of motorcycle engines.

**dual beam headlamp** Single headlamp unit that provides both main (upper) and dipped (lower) beams. See also *single beam headlamp*.

**dual bed converter** See *three-way converter*.

**dual control car** Passenger car with duplicated controls for emergency use by a driving instructor.

**dual-drive tandem** Tandem axle in which both axles are driven or live.

**dual fuel engine** Engine capable of running on two distinct types of fuel, such as a gas and liquid fuel.

**dual level system** Vehicle light system that incorporates lamps which can be switched between high and low intensity, particularly stop lamps and direction indicators.

**dual spacing** (1) Lateral distance from the centerline of one individual tire to the centerline of a dual tire arrangement. (2) The *track* (UK) or *tread* (US) of a dual tire axle as variously defined. Note that usage of this term varies. The reader is advised to define his meaning when using.

**dual tire** Having two wheels closely coupled per side on one axle.

**dual venturi carburetor** See *twin-choke*.

**Dubonnet suspension** Steering-suspension arrangement in which a *beam axle* carrying *kingpins* at its ends is rigidly attached to the vehicle. *Steering arms* from the kingpins carry swinging suspension arms, from which the wheels are mounted by *stub axles*.

**ductboards** Removable raised or hollow boards which support a cargo on the cargo floor of a commercial vehicle and allow circulation of air for ventilation and drainage. Also *duckboards*.

**dummy coupling** Air line sealing or blanking attachment for use on air brake lines of a towing vehicle when no trailer is attached. See also *contact coupling*.

**dump body** Tilting body of a dump or tipper truck.

**dump trailer** Semi-trailer or full-trailer equipped to discharge its cargo by tipping.

**dump truck** (1) A tipper truck. (2) An all-terrain construction vehicle with tipping hopper for earthmoving. A *dumper* (informal).

**dump valve** Valve that operates relay emergency valve of a trailer from the tractor unit in the event of failure of a trailer line.

**dumper** A *dump truck* (informal).

**duo servo brake** Brake in which *primary shoe* and *secondary shoe* are linked together so that there is only one abutment and not one for each shoe.

**duplex chain** Roller chain with two parallel sets of rollers, used as an engine camshaft drive. See also *timing chain*.

**Dyer drive** Positive engagement starter or cranking motor, usually for heavy-duty use.

**dynamic balancing** Balancing of components in rotation on a balancing machine rather than at rest, particularly of wheels and engine crankshafts.

**dynamic supercharging** Pressure charging of an engine using the kinetic energy of the induction air or the resonant properties of the inlet tract rather than the compression of the air by a mechanical device such as a turbocharger. See also *ram air induction*; *tuned intake pressure charging*.

**dynamo** (US: *dc generator*) Direct current rotating electrical generator. See also *generator*.

## E

**earth (US: ground)** Return electrical circuit.

**ECE Cycle** Standard European vehicle test cycle. See also *Euromix Cycle*.

**ECE test** Test of engine emissions quality in which diluted exhaust samples are collected in one sample bag.

**eccentric** (1) Any circular rotating element with an off-center axis. (2) The 'crankshaft' of a Wankel engine and certain rotary pumps.

**ECM** See *electronic control module*.

**economizer** Device that regulates the flow of fuel to a carburetor, particularly at maximum demand, rarely fitted as original equipment.

**effective rolling radius** The radius of a rigid hypothetical wheel with zero slip that, on rotation at the angular velocity of the actual wheel, would give to the vehicle its actual linear velocity. This radius is usually smaller than the actual radius to the undistorted tire periphery, particularly with radial ply tires. The linear value of the radius is calculated by dividing linear velocity by spin velocity.

**effective static deflection** (1) Deflection of a suspension system at a stated static load. (2) Static load of a loaded suspension system divided by the spring rate of the system at that load. See also *static tire deflection*.

**EGR** See *exhaust gas recirculation*.

**electric brake** (1) Service brake operated electro-mechanically rather than by hydraulic or mechanical means. (2) An *electric retarder*.

**electric retarder** Rotating electromagnetic transmission brake, effective only when vehicle is in motion.

**electric vehicle** Vehicle propelled by electric motor, drawing its current either from storage batteries or from overhead cables. See also *trolley bus*.

**electromagnetic compatibility** Extent to which vehicle electrical system is affected by external electromagnetic fields.

**electronic control module** Semiconductor unit for controlling ignition timing and other parameters in an engine management system. Also *ECM; module*.

**electronic ignition** Ignition system in which switching semi-conductors make and break the low tension circuit. Also *breakerless ignition* (informal).

**electronic regulator** Voltage regulator in which generated voltage is sensed and controlled by a Zener diode or other semi-conducting device. See also *control box; voltage regulator*.

**Elliot axle** Arrangement of axle whereby the axle beam terminates in a yoke or fork-end which holds the king pin, the axle pivoting on an eye-end within the yoke. See also *Lemoine; reversed Elliot*.

**elliptical spring** Spring comprising two *semi-elliptical springs* shackled back-to-back. The resultant form is more accurately described as lenticular than elliptical.

**EMC** See *electromagnetic compatibility*.

**emergency brake system** Any brake system capable of halting a vehicle in

the event of failure of the main or service braking system.

**emission** Any gas, vapor or particulate loss to atmosphere. See also *carbon monoxide; catalytic converter; evaporative emissions; exhaust emissions; nitrogen oxide; unburned hydrocarbons*.

**emission control** (1) Regulation, and by inference, reduction of toxic or pollutant content of a vehicle's exhaust. (2) A device, such as a *catalytic reactor*, for reducing pollution from an exhaust.

**emulsion** Partially vaporized and heavily enriched fuel-air mixture, prior to being introduced into the main venturi of a carburetor.

**emulsion block** See *emulsion tube*.

**emulsion tube** Combined main and *compensating jet* tubes in a carburetor with provision for drawing air into the fuel flow to create an emulsion at higher engine speeds, thus preventing over-richness and improving fuel distribution. Also *emulsion block*.

**end float** Longitudinal play in a shaft, intentional or otherwise. See also *pot joint*.

**end yoke** Cusp-shaped termination as of a *Cardan shaft* or *Elliot axle*.

**energy absorber** Device for absorbing energy. The term is mainly used for a device that absorbs the energy of impact, as for example an *energy absorbing steering column*.

**energy absorbing steering column** A steering column designed to progressively collapse on impact of the driver's thorax with the steering wheel, thus absorbing some of the energy of impact and reducing the risk of injury.

**engage** To bring about mechanical continuity, as in engaging a clutch or a gear in a change-speed gearbox. See also *select*.

**engine** The main power unit or motor of a vehicle, converting the energy of a liquid or gas fuel into mechanical energy. Motor and engine are synonymous in vehicle terminology when referring to a conventional internal combustion engine. The propulsive unit of an electric vehicle is generally called an electric motor, while an external combustion engine, for example one running on the Stirling cycle, may be referred to as a *Stirling engine* or Stirling machine. See Figure E.1.

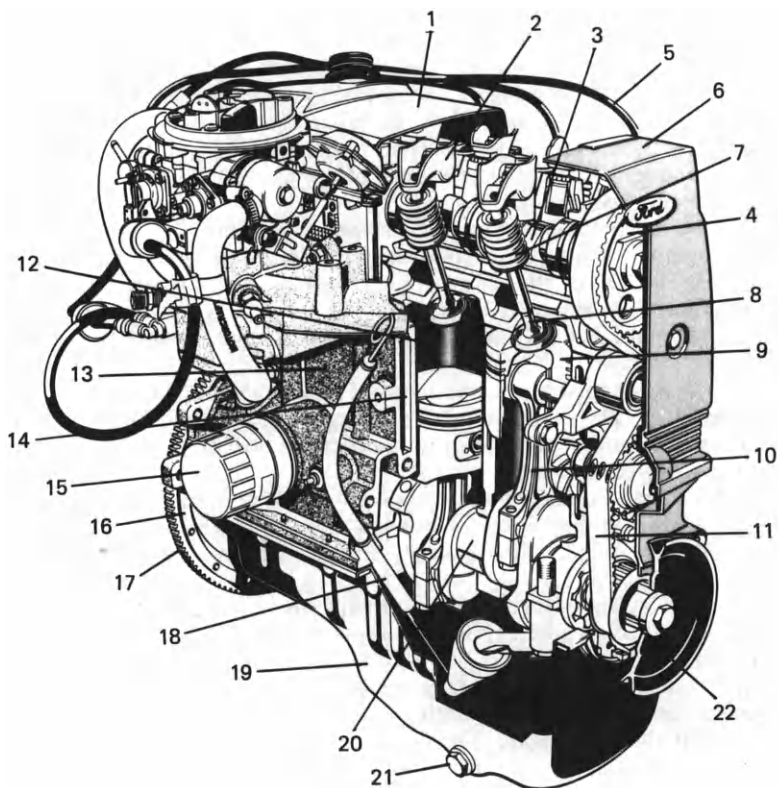
**engine brake** Auxiliary brake which uses the compression of inducted air by the engine's pistons as a means of absorbing energy. This system of auxiliary braking normally requires the overriding of the operating timing of the exhaust valves. Also called *Jake brake*, after manufacturer's trade name. See also *retarder; transmission brake*.

**engine identification number** Manufacturer's coded reference or identification number unique to each engine. Also *EIN*. See also *Vehicle Identification Number (VIN)*.

**engine management system** Arrangement of microprocessor controlled electromechanical devices for controlling a vehicle engine.

**engine map** Three dimensional graphic representation of engine control parameters, for example angle of ignition advance plotted against bases of throttle opening and engine speed.

**engine mounting** (1) Attachment points of an engine to a chassis or vehicle structure. (2) The means whereby an engine is supported. See *anti-vibration mountings*.



- |                                   |                           |
|-----------------------------------|---------------------------|
| 1 – Rocker arm cover (rocker box) | 12 – Combustion chamber   |
| 2 – Valve rocker arm              | 13 – Cylinder block       |
| 3 – Camshaft                      | 14 – Water jacket         |
| 4 – Camshaft drive                | 15 – Oil filter           |
| 5 – Spark plug lead               | 16 – Flywheel             |
| 6 – Timing belt cover             | 17 – Ring gear            |
| 7 – Valve spring                  | 18 – Dip stick (oil gage) |
| 8 – Poppet valve                  | 19 – Oil pan/sump         |
| 9 – Piston                        | 20 – Crankshaft           |
| 10 – Connecting rod               | 21 – Drain plug           |
| 11 – Timing belt                  | 22 – V-belt pulley        |

*Figure E.1* A Ford four-cylinder overhead-camshaft engine

**EP lubricant** Extreme pressure lubricant for use in high performance geared systems.

**EPA Highway Cycle** Standard test cycle issued by US Environmental Protection Administration.

**epicyclic gearbox (US: planetary transmission)** Gear system in which small pinion wheels run between an internally toothed annular wheel or ring gear and a central externally toothed wheel, often called a *sun wheel*. Input and output can be between any two of the three gears or gear sets, with one gear element constrained against rotation. The epicyclic principle is used in many automatic and pre-selector gearboxes.

**epitrochoidal engine** Rotary engine in which a section of the chamber forms an epitrochoid. The *Wankel engine* is an example of an epitrochoidal engine.

**equalizer beam** Pivoted beam joining the fore and aft springs of an interactive (reactive) tandem axle suspension. Also *equalizer*. See also *balance beam*; *four-spring suspension*; *walking beam*.

**equivalent braking force** Ratio (usually expressed as a percentage) of the total braking force of a vehicle to the gross weight (SAE definition).

**estate car (US: station wagon)** Passenger car with extended constant height body fitted with tailgate or rear doors to facilitate access and provide stowage for bulky items. A *shooting-brake* (UK archaic).

**ESV** See *experimental safety vehicle*.

**ethanol** Ethyl-alcohol fuel or fuel additive.

**ethyl alcohol** Fermentation product of starches and sugars used as a fuel or fuel additive. Also called *ethanol* and *alcohol* (informal).

**Euromix cycle** Standard vehicle test cycle that simulates driving partly in urban conditions and partly on the open road.

**evaporation losses** See *evaporative emissions*.

**evaporative emissions** Fuel vapors vented to atmosphere due to evaporation rather than combustion.

**excavator** Construction vehicle for earthmoving.

**excess air factor** Factor by which the air-fuel ratio of an inducted mixture exceeds that of the stoichiometric mixture, expressed by (trapped air-fuel ratio)/(stoichiometric ratio).

**excess fuel device** Device to provide an increased amount of fuel to an engine, as for starting, for example a *choke*.

**exhaust back pressure** Resistance that impedes the flow of the exhaust gases from engine to atmosphere, caused by the friction and other restricting factors in the *exhaust system*.

**exhaust brake** System of retarding a vehicle by constricting the flow of engine exhaust gases, and thereby increasing the retarding effect of the engine on overrun. See also *engine brake*; *transmission brake*.

**exhaust emissions** Substances vented into the atmosphere from an exhaust system.

**exhaust gas analyser** Instrument for scientifically identifying or analysing constituents of the exhaust gas, used mainly for research or validation.

**exhaust gas recirculation** Mixing of exhaust gas with intake air to increase the specific heat of the charge and thus reduce the formation of oxides of nitrogen. Often contracted to *EGR*.

**exhaust manifold** Heat resisting ducting that connects the exhaust ports of an engine to an *exhaust pipe*. See *manifold*.

**exhaust pipe** Pipe that conveys the exhaust gases away from the engine. See also *exhaust manifold*; *exhaust system*; *manifold*; *muffler*; *silencer*; *tail pipe*. See Figure E.2.

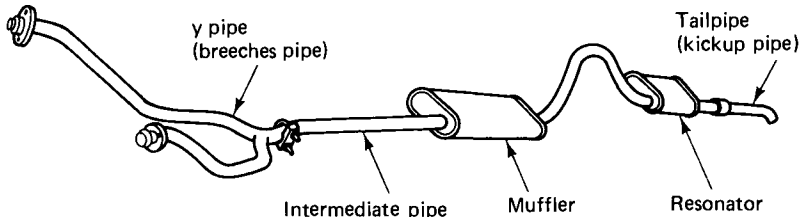


Figure E.2 Exhaust system terminology

**exhaust sensor** Gas sensor which monitors the gas (usually oxygen) content of the exhaust and which, by providing a signal for an electronic control unit, enables the mixture strength or ignition timing to be controlled to optimize emissions or engine performance.

**exhaust silencer** See *muffler*; *silencer*.

**exhaust stroke** Outward motion of a piston in an internal combustion engine that expels burnt gases from the cylinder.

**exhaust system** Assembly through which engine exhaust gases pass to atmosphere. The exhaust system may include *manifold*, *exhaust pipe*, *silencers*, *emission control devices*, *turbocharger*, devices for the monitoring, control or utilization of exhaust gases, and attachments and mountings of the system (Figure E.2).

**exhaust turbocharging** See *turbocharger*.

**exhaust valve** Valve that releases burnt gases from a cylinder. See *overhead valve*; *side valve*.

**expander** Drum brake mechanical or hydraulic mechanism that forces the shoes apart so that they contact the inner periphery of the drum and so provide the braking force. See also *cam-actuated brake*; *wedge expander*. See Figure D.8.

**expansion tank** (1) Tank or container in which engine cooling water boiled off from the main radiator condenses before returning to the radiator system. (2) Any tank or container that catches overflows resulting from expansion of gases, liquids or vapors.

**experimental safety vehicle** A prototype or test vehicle built to investigate or assess safety features. Also *ESV*.

**explosion** Very rapid combustion, characterized by a sonic wavefront and a sudden loud noise. Damaging to IC engines. See also *backfire*; *detonation*; *knock*; *pre-ignition*.

**extendible** Type of *semi-trailer* made so that it can be extended to carry long loads. Also *trombone* (informal).

**extension housing** Casing or housing enclosing an extended transmission mainshaft and sometimes accommodating the *gearshift lever (gear lever)* and associated mechanism.

**external combustion engine** Engine in which the fuel is burnt outside rather than within the cylinder, a working fluid such as air or steam being heated by the combustion, for example in the *Stirling engine* and Rankine (steam) engine.

**eye** Enclosed looped end of a *leaf spring* by which the spring is directly or indirectly attached to the vehicle. See also *shackle*.

## F

**F-head engine (UK: overhead inlet, side exhaust)** Engine having overhead intake valves and side exhaust valves (Figure F.1).

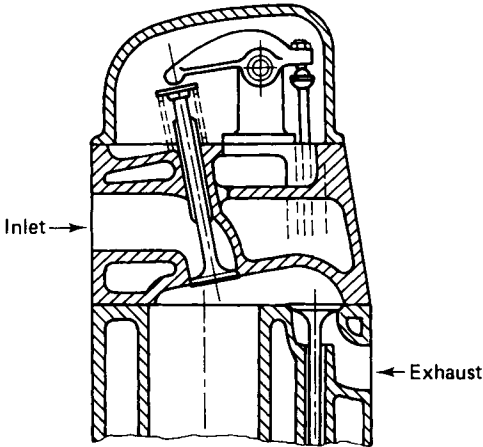


Figure F.1 F-head engine with overhead inlet and side exhaust valves

**fade** Reduction of braking effort resulting from overheating of friction surfaces, or other transient effect.

**fairing** Any panel that joins other panels with a smooth or fair curve, particularly where this may effect a reduction in *drag*.

**fan** Device with rotating blades for moving air. Those found in automotive applications include the conventional multi-blade propeller type, the cylindrical or tangential fan, and the centrifugal or radial fan.

**fan belt** Endless belt, usually of V or multi-V section, that transmits power from the engine to the cooling fan.

**fascia** Panel or molding immediately below windshield on vehicle interior, usually facilitating mounting of instruments, air vents and accessories. Not *facia*.

**fast idle** The high idle speed of a cold choked engine.

**fastback** Passenger car with shallow sloping back in which the rear screen is mounted.

**Federal bumper** Bumper specially designed to meet the US Federal Safety Regulations which require the absorption of the energy of a 5 mile/hour impact.

**Federal version** In the USA, a vehicle that meets Federal emission standards, but not necessarily the more stringent regulations of states such as California.

**feed pump** Pump that moves a fluid such as a fuel, at a controlled or metered rate.

**feed system** The pump, piping, valves, and other items that provide a controlled or metered supply of fluid, as from a fuel tank to an engine.

**fender** (1) (UK: wing) Any fixed side-panel of a motor vehicle that partially shrouds a road wheel. (2) Deflector plate or structure mounted at the front or rear of a vehicle near ground level.

**field of visibility** Spread or angle through which an indicating lamp can be seen by an observer. Also *driver's field of view*.

**fifth wheel** (1) Coupling table located towards the rear of a truck tractive unit, on which the weight of the forward end of a semi-trailer is carried. The fifth wheel provides freedom of articulation while acting as a positive towing linkage. See also *articulated vehicle*; *coupling hook*; *kingpin*; *wedge-lock*. See Figure F.2. (2) Towed calibrated wheel used to determine the true speed of a vehicle under test.

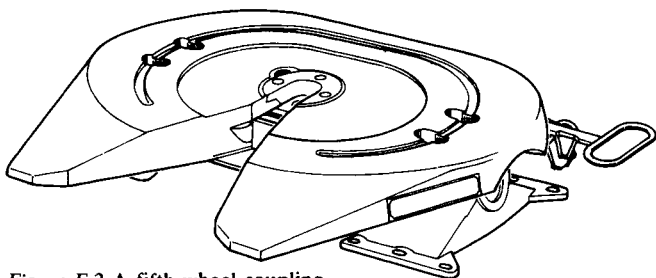


Figure F.2 A fifth wheel coupling

**filler cap** Manually removable lid or seal on the filler neck of a fuel tank, radiator or other reservoir.

**filter** Porous material, or device containing such material, for removing suspended particulate matter from a fluid, as for example an air filter, fuel filter or oil filter. Centrifuges and magnetic devices for removing metallic dust are sometimes, though inaccurately, referred to as filters. See also *by-pass filter*; *centrifuge*; *cyclone*; *full-flow filter*; *separator*.

**filter element** Usually replaceable porous component of a *filter*, often of pleated paper, ceramic or fine wire mesh.

**fin** (1) Thin metal plate protruding from a hot surface to improve the dissipation of heat, as from the cylinder of an air cooled engine. (2) Vertical aerofoil attached to the rear of a vehicle to improve directional stability.

**final drive** Final geared assembly in a vehicle transmission system, usually the differential.

**final drive ratio** Speed ratio between the propeller shaft and the driven wheel axle shaft.

**fineness ratio** Ratio of length to thickness, as of a vehicle. See also *aspect ratio*; *bluff body*.

**finger** Lever-type *cam follower* in an *overhead camshaft* engine for transmitting the motion of the cam to an intake or exhaust valve.

**finning** Arrangement of fins on a hot surface such as an engine, radiator or oil cooler (Figure A.1).

**fire appliance** A fire-fighting vehicle. Also *fire engine* (UK informal).

**firewall (UK: bulkhead)** Transverse panel between engine compartment and passenger compartment intended to inhibit spread of fire to the passenger compartment (Figure B.4).

**firing order** The numbered sequence in which the cylinders of a multi-cylinder engine fire. See also *distributor*.

**firing stroke** The working stroke of an engine. During this stroke the fuel is burned and energy imparted to the piston.

**five mile-an-hour bumper** See *Federal bumper; safety bumper*.

**fixed cam brake** Type of *drum brake* in which the *expander* mechanism is fixed to the *back plate* so that the movement of the two shoes is equal, though the pressure between lining and drum is unlikely to be so. Use of the term is not restricted to brakes with rotating cam mechanisms. See also *floating cam brake*.

**fixed choke carburetor** Carburetor with a constant size venturi, air flow being controlled by a throttle valve. Also *variable depression carburetor; fixed venturi carburetor; open choke carburetor*.

**fixed control** Method of testing the mechanical stiffness of a steering system by holding fixed one element of the steering train. See *fixed steering control*.

**fixed head** Engine in which the cylinder head and cylinders form one inseparable unit.

**fixed steering control** Method of track testing of vehicle in which the driver holds the steering wheel in a fixed angular position while the vehicle is subjected to disturbing forces such as lateral wind gusts. See also *free steering control*.

**flap** (1) Horizontal transverse *aerofoil*, usually with facilities for control or adjustment of angle of incidence, and usually for directing air flow over a vehicle rather than for generating lift. (2) Controllable rear part of an aerofoil for varying the lift or drag of the aerofoil.

**flame trap** Device for preventing the escape of burning gases, as for example from a crankcase or rocker cover.

**flasher unit** Electromechanical or electronic cyclic switch which causes *direction indicator* (turn signal) lamps to flash at an appropriate rate. See also *hazard warning lamps; turn signal lamps*.

**flat** Commercial vehicle with flat load-carrying platform, and usually without side panels or tail board (informal). A platform lorry or flatbed truck. Also *float*.

**flat battery** Discharged or partially discharged battery incapable of starting a vehicle or providing adequate lighting (informal).

**flat engine** Engine in which the cylinders are disposed in a horizontal plane, and particularly where they are horizontally opposed, as in a flat twin or flat four. See also *boxer engine; horizontal engine; horizontally opposed*. See Figure F.3.

**flat four** Engine with two pairs of horizontally opposed cylinders. Likewise flat twin, flat six, flat eight, etc.

**flat head** Engine combustion chamber, the head of which is flat rather than

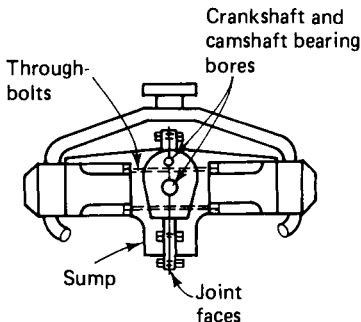


Figure F.3 A horizontally opposed flat engine

profiled, unlike for example a wedge or hemisphere.

**flat spot** (1) A transient reduction in torque of an engine on acceleration, often manifested as a hesitation. (2) A flat patch on a tire.

**flatbed truck (UK: platform lorry)** Truck with a flat *platform* to which cargo can be lashed. A *flat* (mainly US informal).

**flexible** Of an engine, exhibiting good torque characteristics throughout its speed range, and particularly the ability to pull at low speed. The informal antonym is *peaky*.

**flexible brake hose** High pressure hose to connect brake pipe line to wheel cylinder and allow for wheel movement.

**flexible joint** Joint or shaft coupling made of flexible material, such as fabric or rubber, fastened between two spiders and capable of transmitting torque through limited angular misalignment of shafts.

**flexible rack** Windscreen (windshield) wiper actuating mechanism consisting of a flexible rod usually wound with wire to form a simple rack to engage with the pinion wheels of the wiper drives.

**flinger** See *oil flinger*.

**flitch** Reinforcement to add strength and stiffness to a frame, for example a chassis member.

**float** (1) Buoyant part of a fluid metering or instrumentation system, for example a fuel gage or carburetor. See also *float needle*. (2) Low platform vehicle or trailer, but particularly for mounting displays in processions, or for conveyance of foodstuffs or drink, as for example a milk float. Also *flat*. A horsebox (Aust). (3) The buoyant member of any fluid level metering or gaging system, as for example a *fuel gage*.

**float bowl (UK: float chamber)** Part of the body of a *carburetor* in which the float rides, controlling the fuel level by actuating the *float needle* (Figure C.3).

**float chamber** See *float bowl*.

**float needle** Needle valve actuated by a float, as in a carburetor.

**floating caliper** Disc brake caliper in which the pinching action of the pads on the brake disc is achieved by energising one pad only, the caliper being free to 'float' so that the movement of one pad brings both pads into contact with the disc.

**floating cam brake** Drum brake in which the expander mechanism is not fixed to the back plate, thus enabling it to exert equal loading on the two shoes, though the movement will be unequal. Despite its name, this type of brake does not necessarily use a rotating cam. See also *fixed cam brake*.

**flooding** Condition that prevents starting of an engine when more fuel is drawn in than can be ignited.

**floor** (1) The base panel of a passenger car. Also *floor-panel*. (2) Cargo carrying surface of a truck or van. Also *loadfloor*. See also *platform*.

**floor shift** Gearshift system in which the gear selector lever is mounted on the vehicle floor or *transmission tunnel*, rather than on the steering column. *Stick shift* (US informal).

**fluid clutch** See *fluid flywheel*.

**fluid coupling** Hydrodynamic coupling by which power can be transmitted, though without the ability to multiply torque as of a *torque converter*.

**fluid flywheel** Fluid coupling in which power is transmitted from the driving to the driven rotating elements by hydrodynamic forces on vanes from a circulatory flow of oil in an annular chamber (Figure F.4).

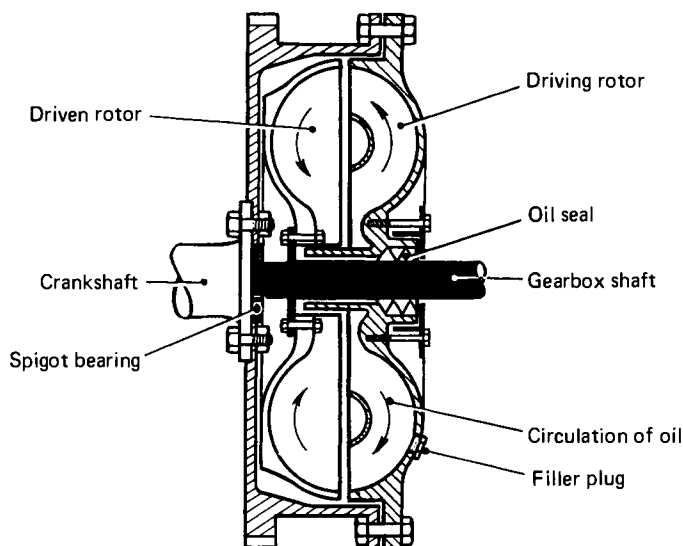


Figure F.4 Sectional view of a fluid flywheel

**flywheel** Massive wheel or disc attached, for example, to the crankshaft of an engine, to store energy of rotation and smooth the output from the irregular firing of the cylinders. In many automotive engines, the flywheel incorporates the *ring-gear* and acts as one friction face of the *clutch*.

**flywheel magneto** Magneto installed within flywheel, commonly used in small two-stroke engines.

**Foettinger coupling** A fluid *torque converter*.

**fog lamp** Supplementary lamp to provide illumination forward (or rearward) in conditions of poor visibility.

**follower** Part of a mechanism that is directly driven by a cam, and that imparts motion to the working components of that mechanism. See *finger*; *tappet*.

**foot brake** Brake operated by a pedal.

**footprint** The shape of the contact interface of a loaded tire with the ground.

**force control** (1) Mode of testing a steering system in which external forces not resulting from normal steering loads, are applied to elements of the steering train. (2) Mode of vehicle control wherein inputs or restraints are applied to the steering system in the form of forces independent of the displacement required.

**forced downshift** Manual overriding of lower gear selection in an *automatic transmission*. Also *kickdown*.

**forced lubrication** Lubrication by a pressure feed system.

**fork-lift truck** Industrial vehicle equipped with two forward-facing arms or prongs which can be mechanically raised and lowered, and on which heavy items can be lifted. See also *pallet truck*.

**forward control (US: cab-over-engine)** Controlled from the front of the vehicle, particularly of a commercial vehicle in which the cab and driver are located ahead of the engine and front axle, there being no *hood* or *bonnet*. Also *cab over engine* or *COE*.

**forward shoe** See *leading shoe*.

**fossil fuel** Hydrocarbon fuel derived from liquids or gases as the product of decomposition of vegetation from an earlier geological period.

**foundation brake** Brake mechanism excluding those parts that rotate with the braked wheel.

**four spring suspension** An *interactive suspension* for *tandem axle* heavy vehicles in which both axles are suspended on *leaf springs*, the two adjacent springs being linked by a pivoted beam called an *equalizer beam* (sometimes called *balance beam* or *walking beam*).

**four-stroke cycle** Thermodynamic cycle of engine operation which requires four strokes of the piston, the strokes usually being designated: (1) induction (inlet, or intake), (2) compression, (3) ignition (also called working, power or expansion stroke), (4) exhaust. Most vehicle engines operate on the four-stroke cycle. See also *two-stroke*. See Figure O.1.

**four wheel drive** Transmission system in which engine power is delivered to front and rear wheels of a vehicle. See also *full-time drive*; *part-time case*; *transfer case*.

**frameless construction** See *integral body construction*; *unitary construction*.

**free control** Method of mechanically testing of a steering system in which no external forces are applied.

**free-floating pin** Piston pin or gudgeon pin that is free to rotate in the *piston pin boss* and connecting rod *small end*.

**free inertia force** The primary force of unbalance in an engine.

**free power turbine** Gas turbine in which the turbine that provides the shaft power is not mechanically connected to the compressor and primary turbine stage.

**free steering control** Method of track testing of vehicle in which the driver releases the steering wheel when the vehicle is subjected to disturbing forces such as lateral wind gusts.

**free travel** Of brake or clutch mechanism, the amount of pedal movement before the mechanism is actuated. See also *play*.

**freewheel** Device that disengages the engine from the drive-train on *overrun*. Obsolete and illegal for motor vehicles in many countries. Occasionally called *one-way clutch*. See also *sprag clutch*.

**freeze (UK: seize)** Sudden adhesive or frictional locking of parts normally in lubricated sliding contact, due to surface welding or clamping, as of a piston in its bore.

**friction clutch** Clutch in which engagement is achieved by friction between rotating surfaces in contact under pressure, as in the conventional *single plate clutch*, *multi-plate clutch* and *cone clutch*. Progressive engagement and disengagement are achieved by varying the contact pressure, usually by means of a pedal-operated mechanism. See also *sprag clutch*.

**friction drag** Aerodynamic drag resulting from the friction between the moving air and the surface of a vehicle in motion.

**friction horsepower** That part of the total power of combustion of an engine that is spent on overcoming mechanical (or mechanical and fluid) friction. See also *brake power*.

**friction lining** High-friction wear resistant material as used in clutches and brakes.

**friction plate** Clutch disc to which high friction material is attached. The *driven plate* of a friction clutch (Figure C.4).

**front corner marker lamp** Lamp set on front corner of a trailer or semi-trailer, normally visible from forward to 90 degrees outboard.

**front wheel drive** Transmission system in which the engine power is delivered to the front wheels of a vehicle.

**fuel** Combustible form of energy for an engine, usually in liquid or gaseous form.

**fuel consumption** Rate of consumption of fuel by an engine, expressed in units such as miles per gallon or litres per kilometer. See also *specific fuel consumption*.

**fuel distributor** Device which meters and directs fuel to the *injectors* of a fuel-injection engine. See also *distributor pump*.

**fuel gage (UK: fuel gauge)** Instrument for indicating the amount of fuel in a fuel tank. *Gauge* (UK), though often misspelt.

**fuel injection** Injection of fuel under pressure, into the intake tract, directly into the cylinder, or indirectly into a cylinder pre-chamber. See also *direct injection*; *indirect injection*.

**fuel injector** Device whereby fuel is injected in metered quantities into an engine. See also *injection pump*.

**fuel pressure regulator** Pressure actuated diaphragm valve that maintains the pressure in a fuel system to a pre-set value above manifold pressure, particularly in a fuel injection system.

**fuel pump** Mechanical or electrical pump that draws fuel from a tank to provide the fuel supply for carburetor or fuel injection system.

**fuel sac** Cavity in a diesel fuel *injector* between the needle valve seat and the *spray holes* (Figure I.3).

**fuel system** Combination of fuel tank, fuel lines, pump, filter and vapor return lines, carburetor or injector components, and all fuel vents and evaporative emission control devices or systems.

**fuel tank** Reservoir or container from which an engine draws its fuel.

**fulcrum pin** See *kingpin*; *swivel pin*.

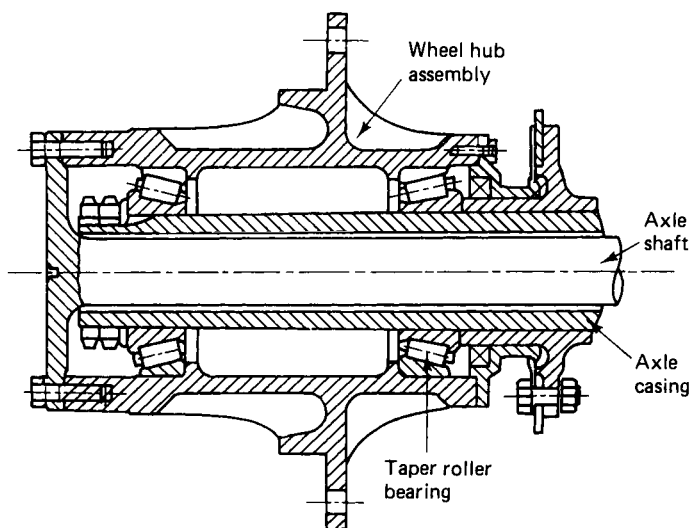
**full-flow filter** Filter through which the total flow of fluid passes, as opposed to the by-pass filter, which filters only part of the flow.

**full-load enrichment device** Carburetor system whereby fuel is supplied directly from *float chamber* to barrel or venturi at high load demand.

**full-time case** Transmission for a *four wheel drive* vehicle without facility for disengaging one axle, so that all wheels drive all the time (US informal).

**full trailer** An independent steerable trailer with at least two axles. A trailer so constructed that no part of its weight, except the towing device, rests upon the towing vehicle. See also *semi-trailer*.

**fully floating axle** Rear axle in which the axle halfshafts serve only to transmit torque to the wheel, the total vehicle weight and cornering loads being transferred directly from the wheel bearings to the axle casing. Also *full floating axle*. See Figure F.5.



*Figure F.5* Sectional view of a fully floating axle. The axle shaft (half shaft) and wheel hub, the axle casing remaining stationary

**fuse** Replaceable device which opens an electrical circuit with irreversible action when the current exceeds a predetermined value. See also *circuit breaker*.

**fuse box** Covered panel or container for vehicle electric circuit fuses.

**fuse rating** Indicated current capacity of a fuse, such that the fuse will fail at a specified percentage of rated current after a specified time.

## G

**garbage truck (UK: refuse vehicle)** Vehicle for collecting and compacting waste.

**gas exchange process** In a reciprocating engine, the process of emptying the cylinder of the spent charge and filling it with the incoming charge. See also *scavenging*.

**gas generator** (1) Device in which combustible gas is produced by burning a solid fuel. In times of acute shortage of liquid fuel vehicles have been converted to run on gas from a 'producer', burning a solid fuel such as coal or anthracite. This system was prevalent in Europe during the Second World War. (2) Gas-producing unit for starting a gas turbine, often in the form of a compact, simple gas turbine. (3) Simple gas turbine for providing gas for a mechanically independent power turbine driving a shaft. Also called *gasifier*. (4) A two-stroke pressure charged engine producing pressurized hot gas for expansion through a gas turbine.

**gas spring** Spring, particularly a suspension spring, using gas under pressure as a spring medium. See also *air bellows*.

**gas tank** (1) (UK: petrol tank) Vehicle installed gasoline fuel tank (US). (2) A vehicle-installed tank for *liquefied petroleum gas* or other gaseous fuel (UK).

**gas truck (UK: petrol tanker)** Gasoline delivery tanker (US informal).

**gas turbine** Internal combustion engine in which the energy released by burnt gas drives a turbine. The turbine is usually directly coupled to a compressor which increases the pressure of the air entering the combustion chambers, and in so doing increases the thermal efficiency. When used in aircraft propulsion the gas turbine is often informally called a 'jet engine'. This term is valid only when the jet thrust is the main agency of propulsion. In automotive applications the gas turbine drives the roadwheels through a transmission.

**gasifier** See *gas generator*.

**gasket** A static seal used to contain pressure and prevent leakage. In automotive terminology a gasket is usually a flat, compressible seal, as for example a cylinder head gasket.

**gasohol** Automotive fuel consisting of a nine part to one blend of gasoline and alcohol.

**gasoline (UK: petrol)** Light hydrocarbon fuel used in spark-ignition (SI) engines. Also *gasolene* (UK archaic), *gas* (US informal).

**gasoline engine (UK: petrol engine)** Internal combustion engine in which gasoline fuel is vaporised and mixed with air before compression and initiation of combustion by a spark. A spark ignition engine using *gasoline* (UK: *petrol*) as a fuel.

**gate** Mechanical constraint to gear lever movement to ensure accurate engagement and prevent possibility of partially engaging two gears at once.

**gather** See *toe-in*.

**gear and pinion steering** See *worm and sector steering gear*.

**gear cluster (UK: layshaft)** A countershaft or layshaft gear assembly. Also occasionally *cluster gear*.

**gear lever** See *gearshift lever* (UK informal).

**gear ratio** Ratio of angular velocities of pairs of meshing gears.

**gear train** Series of meshing gears designed to achieve a given overall gear ratio.

**gear wheel** Toothed wheel used to transmit power without slip.

**gearbox (US: gearcase, transmission)** Encased assembly of gears, but particularly a manual shift or pre-selector unit. UK terminology generally uses the term 'transmission' to refer to the drivetrain system from clutch to final drive, though sometimes preferring 'automatic transmission' to 'automatic gearbox'. See Figure G.1.

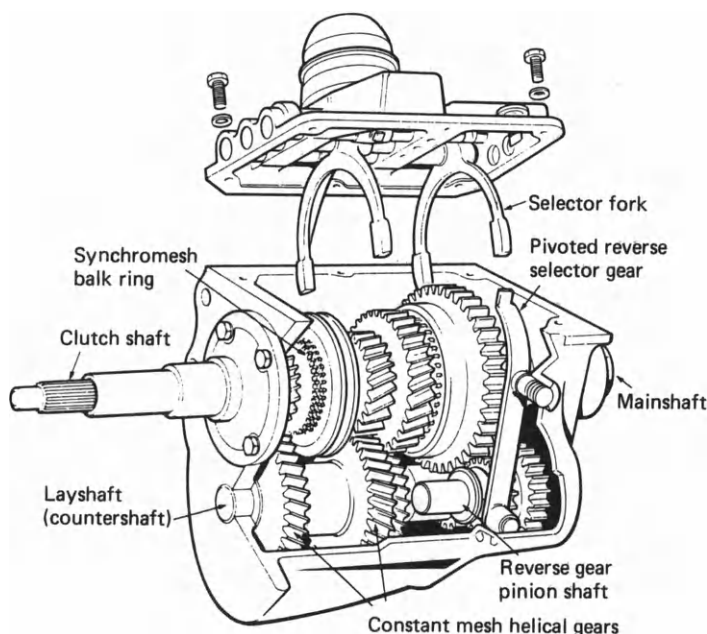


Figure G.1 A Ford four-speed synchromesh gearbox

**gearbox brake** Brake to slow the rotating components of a gearbox and so facilitate a faster gear change or shift.

**gearcase** See *gearbox*.

**gearshift lever** Lever for manually changing gear in a change speed transmission. Also *gear lever*. See also *column change*; *floor shift*.

**gearstick** Gearshift lever (informal).

**Gemmer steering gear** Proprietary steering gear of the *hourglass* or waisted *worm and roller* type.

**generator** Rotating electrical machine for producing current at a nominal voltage, such as an *alternator* or a *dynamo*.

**geometric displacement** Calculated displacement or capacity of a *Wankel engine*. See also *cell swept volume*.

**geometry** In context particularly of steering and suspension, the angular and linear relationships between the principle items and changes thereof in operation.

**gills** Flaps or louvers, often adjustable, to facilitate ventilation (Informal).

**gladhand** Multiple connector for pneumatic hoses, as for example between a tractor and trailer (US informal). See also *suzie*.

**glove box** Recess in or below the fascia for holding gloves or other small items.

**glow plug** (1) Electrically heated plug fitted to the cylinder head of a diesel engine. An element provides heat within the combustion chamber and aids starting in cold conditions. (2) A similarly installed plug that aids starting and becomes incandescent during the operation of an engine to initiate or aid combustion. See also *hot bulb ignition*; *semi-diesel*.

**goods vehicle** Vehicle licensed carry a cargo or payload, but particularly a vehicle equipped for and engaged in the distributive trades. A commercial vehicle, lorry or truck. The term is variously defined by licensing authorities.

**gooseneck** The pivoted coupling arm of a vehicle trailer.

**governed speed** Of an engine, the maximum speed of rotation as restricted by a *governor*. The *rated speed*.

**governor** A device that limits the maximum speed of an engine. Mainly found on diesel engines to prevent mechanical damage or operation at speeds that would give rise to unacceptable smoke emission.

**governor valve** Valve that controls air output from the compressor of an air brake system. See also *unloader valve*.

**grab** Sudden unduly high output from the brakes.

**gradeability** Measure of the ability of a vehicle to ascend an incline.

**Gran Turismo** A powerful touring car, often abbreviated to GT.

**grille** Decorative and protective grid at front of vehicle through which air passes to enter the engine compartment. Sometimes grill or radiator grille.

**groove** (1) Narrow void in tire tread pattern. See also *sipe*. (2) The recess in a piston in which a *piston ring* is located. See also *hot sticking*.

**gross axle weight** Specified maximum carrying capacity of an axle, measured at tire-road interface. Also *gross axle weight rating (GAWR)* in US.

**gross combination weight** Total weight of vehicle with equipment, fuel, driver and passengers, payload, and trailer. Also *GCW*.

**gross contact area** Total area of tire footprint or contact patch, including area of grooves or voids.

**gross power** The measured power output of an engine operating without power absorbing ancillaries such as electric generators, pumps and silencers. The power of a basic engine. See also *installed power*.

**gross train weight** Total weight of a commercial vehicle tractor and trailer combination.

**gross vehicle weight** Maximum legal weight at which a vehicle can be

operated. Curb weight plus payload. Also *GVW*.

**ground (UK: earth)** Return electrical circuit, or its attachment point as to chassis or battery.

**ground clearance** Vertical distance between level ground and lowest fixed item on the vehicle.

**ground effect** Aerodynamic effect of proximity of ground to vehicle.

**ground effect vehicle** Vehicle using the venturi effect between the underbody and ground to provide negative or positive aerodynamic lift.

**gudgeon pin (US: wrist pin)** Bearing pin that connects a *connecting rod* to a *piston*.

**gulp valve** Valve to introduce extra air to induction tract on acceleration to prevent over-richness of fuel-air mixture.

**gum** Adhesive product of poor combustion deposited in the cylinder or exhaust tract of an engine.

**guttering** Lipped edge at side of roof panel, by which rainwater is channeled away.

## H

**H engine** Engine with two sets of opposed cylinder axes geared to a central single driveshaft.

**H-point** Pivot point of the torso and thigh on two- and three-dimensional anthropometric devices or manikins used in defining and measuring vehicle seating accommodation.

**hackney** A taxicab. A hackney carriage. (UK, particularly in legal or official context).

**hairpin valve spring** Valve spring formed from wire or metal strip bent to form two levers emanating from a half-loop or coil.

**half elliptic spring** See *semi-elliptic spring*.

**half-floating axle** See *semi-floating axle*.

**half shaft** Shaft by which power is transmitted from *final drive* to one driven wheel. Also *half axle*.

**half-track** Vehicle, particularly a military vehicle, with traction provided by a powered chain track but steered by conventional wheels. Also *semi-tracked vehicle*.

**hand start** (1) To start an engine by manually cranking, or by manual operation of an automatic cranking mechanism such as a *recoil-starter*. (2) Mechanism by which an engine can be manually started.

**handbrake** Brake operated by a hand lever. A *parking brake*.

**handed lamp** Lamp with different inboard and outboard characteristics.

**hardtop** (1) Sports car with a fixed or rigid roof, as an alternative to a similar soft top model. (2) Passenger car with fixed rigid roof. A conventional saloon or sedan car.

**harmonic balancer** Rotating or oscillating counterbalance that counteracts the out-of-balance forces and/or couples in a reciprocating engine, or smooths the torsional fluctuations in an engine crankshaft. Numerous types have been devised, such as the Lanchester anti-vibrator, after inventor F.W. Lanchester. See also *vibration damper*.

**harmonic damper** See *harmonic balancer*.

**harmonic induction engine** Induction system in which the length of the inlet tract is chosen to improve volumetric efficiency over a narrow speed band. Also *tuned induction*. See also *ram air*.

**harness** (1) See *wiring harness*. (2) A safety restraint of webbing for vehicle occupants, and particularly one with individually anchored sections for lap and both shoulders. See also *lap and diagonal belt*.

**hatchback** Passenger car with hinged lifting back access door or *tailgate* encompassing the back light or rear screen.

**Hayes transmission** Infinitely variable transmission of the toric type in which the ratio change is brought about by caged wheels running within toroidal tracks or races and so pivoted that the ratio of rolling diameters between the driving and driven races can be varied. Also called *Austin Hayes gearbox*. The transmission replaced the gearbox, but not the clutch,

in certain vehicles in the 1930s. The principle is similar to that of the *Perbury drive*.

**hazard warning lamps** Flashing lamps, mounted one on each corner of a vehicle, to indicate presence, particularly in event of breakdown or accident.

**hazing** Reduction of transparency of windshield or windscreen through ineffective operation of a wiper blade.

**head** See *cylinder head*

**head board** Vertical barrier attached to the forward end of the platform of a truck.

**head gear** Primary reduction gear pair providing a speed reduction of the layshaft or countershaft in a heavy vehicle transmission.

**head restraint** Cushioned headrest or pad firmly supported behind an occupant's head to minimize whiplash injury in impact.

**head-up display** Instrument display reflected in windshield (windscreen), to give driver view of essential instruments without deflecting gaze to instrument panel.

**header tank** Vessel that contains a liquid at a higher level than the main tank, so that the level or static head of pressure can be maintained.

**heading angle** Angle by which the longitudinal axis of a moving vehicle deviates from its true direction of motion. See also *yaw angle*.

**headlamp** Lamp to provide upper (main) or lower (dipped) beam illumination ahead of the vehicle. See also *dipped beam; main* or *upper beam*.

**headlamp beam switch** Driver controlled device for selecting upper (main) or lower (dipped) headlamp beam circuit. See *dipper switch; semi-automatic beam switch*.

**headlight** The beam of light from a headlamp.

**headlining (US: roof lining)** Fabric roof lining or ceiling of a vehicle body.

**headrest** Upward, usually adjustable, extension of a seat back, for supporting the head of a vehicle occupant. See also *head restraint*.

**heat control valve** Valve that regulates the flow of exhaust gas so that some of its heat content is passed to the intake manifold, thereby helping to vaporize the fuel mixture on starting or for operation in conditions of extreme cold.

**heat dam (UK: slotted piston)** Annular slot or insert in piston to minimize flow of heat from crown to other parts of piston.

**heat engine** Engine deriving energy from the heat of combustion of a fuel, whether burned internally or externally. See also *external combustion engine; internal combustion engine*.

**heat fade** See *fade*.

**heat range** Range of temperature for optimum operation of a spark plug. See heat range index. See also *hot plug*.

**heat range index** Standard for the designation of the range of operating temperature for spark plugs.

**heated intake** System whereby the induced air or air/fuel mixture in an engine is heated to reduce emissions on starting or to facilitate operation in conditions of extreme cold. See also *hot spot*.

**heavy goods vehicle** Vehicle intended for heavy haulage or conveyance of

goods and in most countries designated by exceeding a certain unladen weight and requiring of the driver special training and license. Also **HGV**.

**heelboard** Lower part of front bulkhead, firewall or scuttle, particularly where installed as a separate structural item.

**helmet connector** Connecting cap for a battery with tapered terminals.

**helper spring** Additional spring on a suspension system that operates only at large deflection of the main spring. See also **chassis stop**.

**hemi** Hemispherical head of an engine (slang).

**hemispherical head** Engine cylinder head of true or flattened hemispherical form. See also **cross flow**; **cross scavenging**.

**high beam** Headlamp main beam.

**high lift cam** Special cam profile on engine camshaft to increase valve lift, usually for sporting or competition use.

**highway cycle** Any standard vehicle test cycle that simulates driving on the open road and predominantly in higher gears. See also **EPA Highway Cycle**.

**hitch** Articulating coupling whereby a trailer is attached to a tractor unit. A simple ball and socket coupling.

**homofocal headlamp** Headlamp with segmented reflector to give different focal lengths. Also **homofocal headlamp**.

**hood** (1) (UK: bonnet) Hinged or removable body panel by which access is gained to the engine compartment of a vehicle. (2) (US: soft-top) Folding fabric top of a convertible.

**Hooke's joint** Simple type of universal joint in which the shaft ends are connected by yokes disposed at right angles and communicating torque by way of a cruciform bearing mounting. Sometimes Hooke joint. Also **Cardan joint**. See Figure H.1.

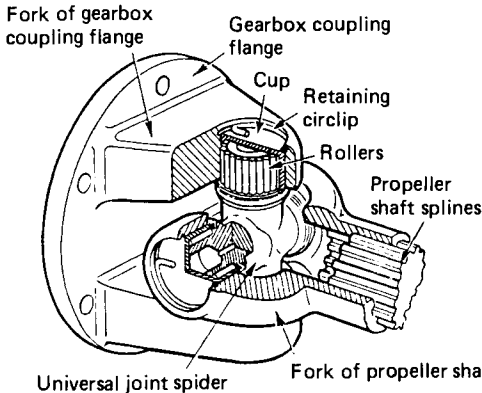


Figure H.1 Flange-mounted Hooke's joint on a driveshaft (propeller shaft)

**hop** See **wheel hop**.

**hop up** (UK: soup up, tweak) To tune or modify an engine for performance (US slang).

**horizontal engine** Engine in which the cylinder axes are in the horizontal

- plane, as for underfloor mounting in a bus or coach. A *flat engine* or *boxer* (informal). See also *horizontally opposed engine*.
- horizontally opposed engine** Of an engine, having the cylinders set in a horizontal plane at either side of the crankshaft. A boxer engine (informal). See also *flat engine*; *horizontal engine*.
- horn** Audible warning device, usually electrically operated.
- horse-box** Van for the conveyance of a horse or horses. A float (Aust).
- horsepower** The customary non-metric unit of power, equivalent to 0.7457 kilowatts, defined by a rate of working of 33,000 foot-pounds per minute. See also *brake power*; *indicated power*.
- horseshoe vortex** Vortex occurring between the vortices of a vortex pair in the wake of a moving vehicle and comprising the transverse and trailing vortices.
- hot bulb ignition** Ignition system employing a hot or incandescent element, externally heated for starting and in some cases receiving external heat to sustain operation. See also *semi-diesel*.
- hot plug** (1) Spark plug that operates at a high temperature in relation to the combustion temperature, thus minimizing the risk of plug fouling in a low compression engine. (2) Thermally insulated lower half of a combustion chamber usually having a tangential throat to generate *swirl* within the combustion chamber to aid combustion.
- hot-rod** Production car individually modified to give an outward appearance of opulent power, either for road use or for racing.
- hot-shift PTO** Power take-off device which can be remotely engaged by hydraulic, pneumatic or other powered means. A *power shift PTO*.
- hot soak losses** Fuel vapors emitted during a specified period beginning immediately after the engine is turned off.
- hot spot** (1) Point of contact between intake and exhaust manifolds to transfer heat to the fuel mixture and thereby promote vaporization. See also *heated intake*. (2) Any overheated point on an item.
- hot-start enrichment** Enrichment of fuel mixture for starting a hot engine, usually applicable only to gasoline engines with electronic fuel injection.
- hot sticking** Adhesion of *piston ring* to *groove* caused by formation of deposits at higher temperatures. See also *cold sticking*.
- Hotchkiss drive** Rear wheel drive transmission system in which a live beam axle and differential assembly are coupled by a universal joint to a propeller shaft, which is in turn coupled by a universal joint to a gearbox. The axle is normally mounted on *semi-elliptical leaf springs*. See Figure H.2.

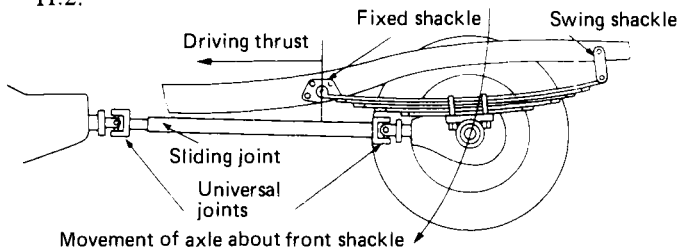


Figure H.2 A simple Hotchkiss drive arrangement

**hourglass worm and roller steering gear** Steering gear in which a waisted worm gear attached to the steering column imparts angular motion to a toothed sector or roller. See also *Gemmer steering gear*; *Marles steering gear*.

**hub** The center assembly of a wheel containing the wheel bearings.

**hub cap** Cap fitted to the outer end of a hub to protect bearings.

**hub plate** Splined central element of a clutch *driven plate*.

**hub reduction** Reduction gearing, usually epicyclic, located within a wheel hub, normally to provide an additional set of ratios in a heavy vehicle.

**hunting** Variation of speed of an engine about a mean when governed or at a constant fuel delivery setting.

**hush kit** Post-assembly kit of noise suppressing materials and components, usually for fitting to a commercial or public service vehicle.

**hybrid engine** Engine combining two principal modes of operation, such as that of diesel and spark ignition engines, or an internal combustion engine operating with an electro-mechanical drive.

**hybrid vehicle** Vehicle employing two distinct but interdependent forms of propulsion, such as an electric motor and an internal combustion engine, or electric motor with battery and fuel cells for energy storage.

**Hydragas suspension** Proprietary suspension system in which a gas spring is actuated through a diaphragm by fluid under pressure, fore and aft springs on each side of the vehicle being hydraulically linked to share load and minimize pitch.

**hydraulic brake** Brake actuated by hydraulic pressure.

**hydraulic clutch** See *fluid flywheel*.

**hydraulic damping** Damping by the viscous flow of a fluid through a constricted orifice. See also *shock absorber*.

**hydraulic head assembly** The pumping, metering and distributing elements of a distributor type fuel pump. See also *distributor pump*.

**hydraulic lifters** Small hydraulic actuators which operate the intake and exhaust valves of an engine, either directly or through a mechanical linkage. See also *hydraulic tappet*.

**hydraulic retarder** Transmission mounted device using fluid friction to retard the speed of a vehicle or assist the service brakes.

**hydraulic tappet** Self-adjusting oil filled tappet that compensates for wear in the *valve train* (Figure H.3).

**hydraulic transmission** Transmission employing a hydraulic torque converter.

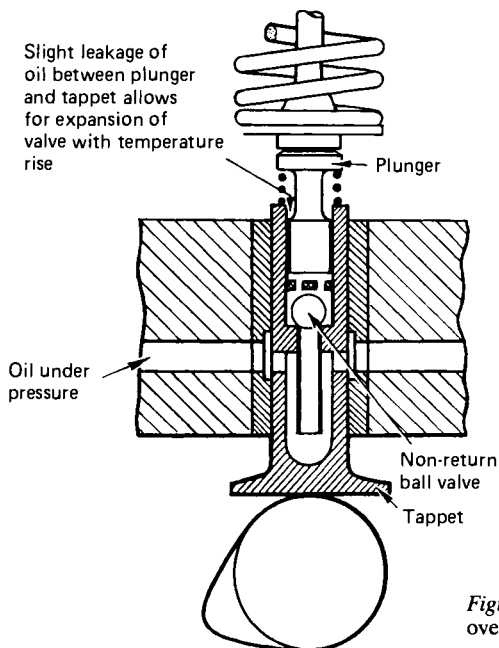
**hydro-mount** Viscous fluid anti-vibration mounting, particularly for engine mounting.

**hydrocarbon** Chemical compound that contains only, or principally, carbon and hydrogen. The principal constituent of liquid fossil fuels.

**hydrocarbon emissions** Unburned or partially burned hydrocarbon fuels exhausted to atmosphere from an engine. Often contracted to HC. One of the principal automotive atmospheric pollutants. See *THC*.

**hydrodynamic drive** See *hydrokinetic transmission*.

**hydrokinetic transmission** Power transmission system, such as a torque converter, in which power is transmitted primarily by the motion of a fluid in an enclosed recirculatory path, rather than by static pressure. Also *hydrodynamic drive*.



*Figure H.3* Hydraulic tappet for an overhead valve engine

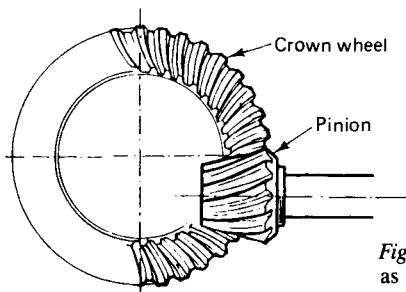
**Hydrolastic suspension** Proprietary interactive suspension system in which loads are reacted by deformation of a rubber diaphragm spring within a sealed fluid-filled chamber, the consequent change of volume of the fluid filled cavity being communicated to the suspension of the second wheel on the same side.

**hydropneumatic suspension** Suspension employing hydraulically loaded gas springs, often with hydraulic coupling between axles.

**hydrostatic transmission** Drive by means of hydraulic motors, particularly where the drive is to each wheel of an off-highway vehicle.

**hypoid axle** Driving axle incorporating a hypoid differential gear.

**hypoid gear** Bevel gear with the axes of the driving and driven shafts at right angles, but not in the same plane, giving some sliding action between teeth. Widely used in *differentials*. See Figure H.4.



*Figure H.4* Hypoid crown wheel and pinion, as from a back axle final drive

## I

**I-head engine** (UK: **overhead valve engine**) Engine with intake and exhaust valves in head.

**IAC** See *idle air control*.

**IC engine** An *internal combustion engine*.

**identification lamps** Lamps used in clusters at front or rear top to identify specific classes of large vehicles.

**idle air control** Valve for controlling air flow in induction system when engine is idling. Also *IAC*.

**idle circuit** See *idle system*.

**idle speed** Rotational speed of an engine on no-load and minimum throttle setting. *Tickover* (informal).

**idle system** Arrangement of jet and tubes in carburetor to enrichen the fuel supply when engine is idling. Also *idle circuit*.

**idler** (1) Any gearwheel between a driving and driven gear in a gear train, the shaft of which serves only to bear and locate the gear, and is therefore 'idle'. The idler gear may serve to reverse the sense of rotation of the driven wheel, so that it rotates in the same direction as the driving wheel. (2) An intermediate or tensioning pulley in a belt drive.

**idler arm** (1) Slave drop arm actuated by a tie rod or center track rod from the steering box drop arm. The idler arm transmits steering action via a further tie rod or track rod to the steered wheel furthest from the steering box. The other steered wheel is driven directly via a tie rod or track rod from the steering box drop arm. (2) Any passive arm or lever that serves primarily to retain the geometry of a mechanical system, rather than to transmit load or effort.

**idling** Of an engine, running at idle speed or tickover.

**idling jet** See *slow running jet*.

**idling shaft** (1) A *layshaft* or *countershaft*. (2) Shaft of an idler wheel or gear.

**IFS** Independent front suspension.

**igniter** Electronic ignition module that acts as a voltage booster or amplifier.

**ignition** Initiation of combustion. See also *compression ignition engine; ignition system; spark ignition*.

**ignition coil** Induction coil or voltage transformer that provides the high tension voltage for the spark in spark ignition engines.

**ignition delay** Time interval between the spark and the initial release of heat energy of combustion in a spark ignition engine or between the start of injection and the start of ignition in a diesel engine. Also *ignition lag*.

**ignition lag** See *ignition delay*.

**ignition switch** Electrical switch by which the ignition system of a vehicle is caused to function. Usually operated by a key which can also be turned to complete the starter motor circuit to initiate starting.

**ignition system** Electrical system devised to produce accurately timed sparks at the spark plugs of an engine, and consisting of a battery, induction coil, capacitor, distributor or module, spark plugs and the relevant switches and wiring. An alternative ignition system uses the *magneto*. See Figure I.1.

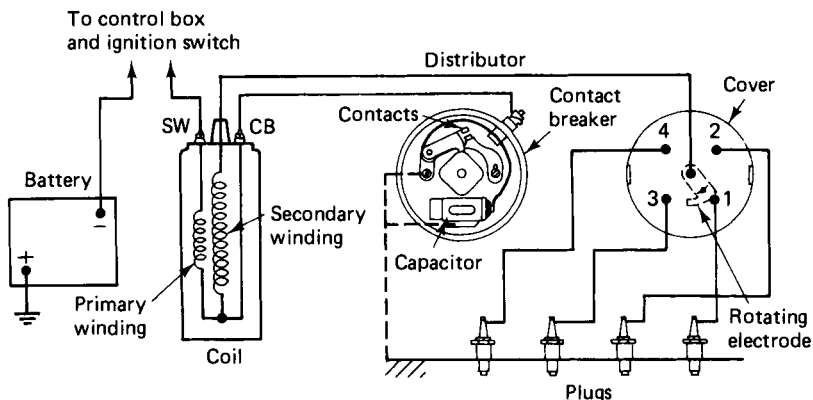


Figure I.1 Items of a conventional (non-electronic) ignition system

**ignition timing** Timing of the spark relative to piston top dead center in a spark ignition engine. Usually expressed in degrees of advance. See *advanced ignition*; *retarded ignition*.

**IHP** Indicated horsepower. See *indicated power*.

**IMEP** Indicated mean effective pressure.

**impeller** (1) The power input member of a torque converter. Also *pump* (informal). (2) The gas driven or driving rotor of an exhaust gas *turbocharger*.

**in-car entertainment** Sound reproduction system consisting for example of radio, tape or compact disc player specially devised to facilitate operation by the driver, and to be unaffected by vibration. Also television and video in goods vehicle sleeper cabs and passenger coaches. Also *ICE* (informal).

**in-line engine** Engine with all cylinders in one plane of the crankshaft axis.

**in-line power steering** Power assisted steering system in which the powered steering effort is applied within the steering box or rack, forming an integral powered unit. See also *offset power steering*.

**inboard brakes** Brakes located close to the vehicle center-line (as for example on the differential of a de Dion transmission) rather than at the wheel hub, the retarding torque being transmitted to the wheels by way of the axle shafts or half-shafts.

**inboard starter** Inertia or *Bendix starter* on which the drive pinion moves towards the motor body to engage. See also *starter motor*.

**inclined engine** In-line engine in which the cylinders are set at an angle to the vertical. *Sloper* (informal).

**independent front suspension** Front suspension system in which the

deflection of one steered wheel is not directly transmitted to the other.

Also *IFS*. See also *MacPherson strut*; *unequal wishbone suspension*.

**independent rear suspension** Rear suspension system in which the deflection of one rear wheel is not directly transmitted to the other (Figure I.2).

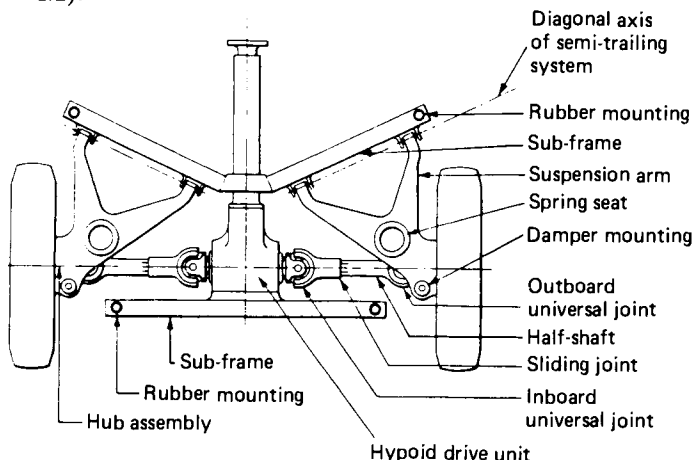


Figure I.2 A semi-trailing arm independent rear suspension

**indicated mean effective pressure** Average pressure exerted within the cylinder of an engine during the working cycle, equal to the mean height of the *indicator diagram*. See also *indicated power*.

**indicated horsepower** See *indicated power*.

**indicated power** (1) Engine power calculated from an indicator diagram. (2) Power developed in the cylinders rather than at the shaft. The sum of brake power and power lost to friction and pumping. See *pumping losses*.

**indicated thermal efficiency** Ratio of indicated work available at the piston to the ideal work available from combustion. Effectively the thermal efficiency assuming zero friction and pumping losses. See also *brake thermal efficiency*.

**indicator** (1) Instrument for visually recording engine cylinder pressure during a working cycle. (2) Direction indicator or turn signal lamp. See also *trafficator* (UK informal).

**indicator diagram** Mechanically or electronically produced map of cylinder pressure plotted against stroke or degrees of rotation for the power stroke or complete cycle of an engine. See also *indicator*.

**indirect injection** Fuel injection into a prechamber or cell, in which ignition is initiated before the burning mixture enters the main combustion chamber. Often shortened to ID. See also *air cell*; *direct injection*; *Comet head*; *Lanova air cell*; *prechamber*.

**induced drag** Form of aerodynamic *drag* resulting from the generation of a vortex system, and therefore primarily from the body shape of a vehicle or aerofoil. Also *vortex induced drag*.

**induction manifold** See *intake manifold*.

**induction port** See *intake port*.

**induction stroke** The stroke of the piston in an IC engine in which working fluid is drawn into the cylinder. Also *intake stroke* and *suction stroke*.

**induction system** That part of a spark ignition engine in which the fuel and air are mixed and brought into the *combustion chamber*, including for example air filter/cleaner, carburetor or fuel injection system, intake manifold, pressure charger, intake port and valves. In a diesel engine the fuel system would not normally be considered part of the induction system.

**inertia drive** See *Bendix drive*.

**inertia pinion** See *Bendix drive*.

**inertia reel** Seat belt reeling mechanism that locks to provide constraint on sudden deceleration.

**infinitely variable transmission** Transmission in which a smooth or continuously variable change of ratio between input and output shafts is possible, either automatically or by manual control. Also *continuously variable transmission*. See also *Hayes transmission*; *Perbury drive*; *Variomatic transmission*.

**injection pump** Device that supplies fuel under pressure to the injector of a fuel injection system. See also *continuous spray pump*; *distributor pump*; *jerk pump*.

**injector** Device for introducing fuel under pressure into either the intake or combustion system of an engine. See also *fuel injection*; *injector nozzle*; *pintaux nozzle*; *pinle*. See Figure I.3.

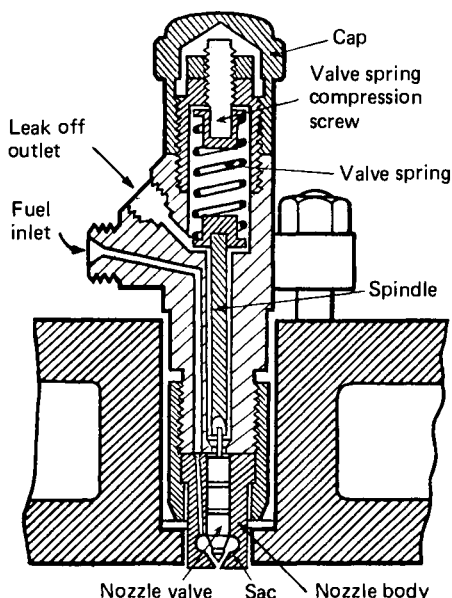


Figure I.3 A single nozzle diesel fuel injector

**injector nozzle** Fine sprayer or atomizer through which fuel is injected into an engine. See also *pintaux nozzle*; *pintle*.

**inlet manifold** See *intake manifold*.

**inlet valve** See *intake valve*.

**inner dead center** See *bottom dead center*. A more appropriate but less frequently used term than bottom dead center, particularly when referring to a *horizontal engine*.

**inner tube** Sealed rubber annulus which seats on a wheel rim and transmits the pressure of inflation to the tire carcass.

**installed power** Power of engine with ancillaries, such as the generator, being driven. The net power.

**instantaneous piston speed** Piston speed at any specified point in its stroke or crankshaft angle. See *average piston speed*; *piston speed*.

**instantaneous suspension center** Projected geometric center of movement of suspension in bump or rebound mode at a stated point.

**instrument panel** Panel on which a vehicle's instruments are mounted. Also *dash panel (US)* and *dashboard (UK)*, particularly if instruments are mounted directly onto this item. See also *binnacle*; *fascia*.

**intake depression** Mean reduction in static pressure below ambient in an engine air intake system, usually measured adjacent to the flange of the engine manifold or turbocharger.

**intake manifold** Manifold which distributes working fluid to intake ports. Also *induction manifold*. See also *induction system*; *manifold*.

**intake port** Passage through which the induced air or air/fuel mixture passes to the intake valve of an engine. Also *induction port*; *intake port*.

**intake stroke** See *induction stroke*.

**intake valve** Valve that controls the admission of working fluid into the cylinder of an engine. Also *inlet valve*.

**integral body construction** Form of construction in which there is no separate chassis, suspension and drive loads being reacted through the panels and structure of a torsionally stiff body. A *monocoque* structure. Also *unitary construction*.

**interactive suspension** Tandem axle suspension in which the individual axles are mechanically, pneumatically or hydraulically linked so that axle and suspension loads are shared on uneven surfaces. See *four spring suspension*; *tandem axle*.

**inter-axle differential** Differential linking tandem axles, or between the axles of a *four wheel drive* vehicle. See also *transaxle*; *transfer box*.

**intercooler** Heat exchanger that removes heat from pressure charged air.

**intercooling** Cooling of pressurized air from a supercharger prior to admission to the cylinder. Cooling increases the mass of air induced.

**interleaf cushion spring** Flat section spring that provides axial cushioning and therefore smoother engagement of the friction lining of a *clutch*. See also *torsional drive spring*.

**interlock** In a change speed gearbox, a device that prevents the engagement of two gears simultaneously. See also *gate*.

**intermediate gear** Any gear between top and bottom gear.

**intermediate plate** See *interplate*.

**intermediate rod** See *relay rod*; *track rod*.

**intermediates** Lightly treaded tires for racing in wet or dry conditions (informal).

**internal combustion engine** Engine in which energy is provided by combustion within a working chamber causing direct mechanical displacement of a piston, rotor, turbine, or other mechanical element. The gasoline (petrol) engine, diesel, wankel and gas turbine are internal combustion engines. Often abbreviated to IC engine. See also ***external combustion engine***.

**internal-expanding brake** A drum brake with internal shoes.

**interplate** Disc that separates the two driven plates of a twin plate clutch. Also ***intermediate plate***.

**iso-octane** Hydrocarbon used in determining the octane rating of fuels. See also ***Motor Octane number; Research Octane number***.

## J

**jack** Portable or mobile device for lifting a vehicle.

**jack knife** Loss of control in an articulated vehicle in which the tractor rotates about its vertical axis, even until it contacts the trailer. The jack knife usually results from the locking and subsequent sliding of the tractor driven wheels, and should not be confused with *trailer swing* or *trailer sway*. See Figure J.1.

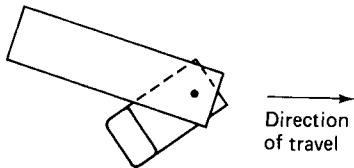


Figure J.1 Jack knife of an articulated vehicle

**jack-up** Lifting of a vehicle body on cornering, particularly where instigated by a suspension geometry with a high roll center.

**jackshaft** (1) Small shaft within a machine for transmitting rotary motion, as for example to a distributor. (2) A rotating shaft joining two other shafts. See also *quill drive*.

**Jake brake** See *engine brake*.

**jamb switch** Push-button light switch operated by opening and closing of door or hatch, and normally located in the jamb of the door. Also, but incorrectly, jam switch.

**Jaray car** Car body shape derived from a combination of aerodynamic 'teardrop' shapes, and characterized by a rounded front end and wedge-shaped tail form, after the German aerodynamicist P. Jaray (Figure J.2).

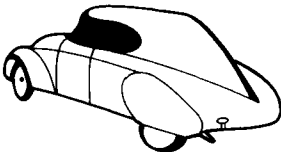


Figure J.2 Characteristic shape of a Jaray car

**Jeantaud steering** Steering system in which the projected axes of the steered wheels meet at the projected axis of the back axle, though at only one steer angle, a geometric property also patented by Ackermann, by whose name the system is usually known in English-speaking countries.

**jerk pump** Diesel fuel injection pump. Informal name for the in-line plunger type pump.

**jet** An accurately drilled hole through which liquid can pass at a controlled rate, as in a carburetor.

**jounce** Bump travel of a wheel suspension (US).

**journal** Part of a rotating shaft that is supported by a bearing.

**judder** (1) Low frequency vibrations from brake or clutch assembly, the frequency being related to rotational velocity. (2) See *clutch judder*. Also *clutch shudder*.

**jump lead (US: jumper cable)** Heavy duty electrical leads whereby a vehicle with a discharged battery may be connected to an external charged battery, as for example the battery of another vehicle.

**jump start** To start the engine of a vehicle with a discharged battery by using jump leads from a charged battery.

**jumper cable** See *jump lead*.

## K

**Kadenacy effect** In two stroke motors, the creation of a partial vacuum by the sudden release of exhaust gases through exhaust ports. A means of improving exhaust scavenging. After researcher Michael Kadenacy.

**Kamm-back** Blunt but tapered termination of a vehicle, designed to reduce vortex formation, after the German aerodynamicist W.Kamm.

**kerosene** Petroleum fuel consisting mainly of paraffins and isoparaffins, and of low octane rating. Mainly used for gas turbines. Also *kerosine*.

**Kettering ignition system** Commonly used inductive *ignition system*, comprising induction coil, breaker contacts, capacitor and battery, after originator Charles Kettering.

**kick-up pipe** See *tail pipe* (US informal).

**kick start** Pedal lever and ratchet mechanism for starting an engine, as for example a motorcycle.

**kickdown** (1) System that enables a driver to select a lower gear than the one automatically engaged by an automatic transmission, for example when accelerating rapidly. Operated by depressing *accelerator* pedal fully.

(2) The act of using the kickdown facility. Also *forced downshift*.

**kingpin** (1) Vertical or inclined shaft about which a steered wheel assembly pivots. Also *fulcrum pin*; *knuckle pin*; *pivot pin*. (2) Main fastening member between a *fifth wheel* and a *semi-trailer*.

**kingpin angle** See *kingpin inclination*.

**kingpin axis** See *steering axis*.

**kingpin centers** Transverse distance between intersection points of kingpin axes and steered wheel axes.

**kingpin inclination** (1) Angle of inclination of the steering axis (or kingpin axis) to the vertical longitudinal plane (UK). (2) Angle in front elevation between the steering axis and the vertical. Also *kingpin angle*; *swivel angle*; *steering axis inclination*. Terminology remains although kingpins are now rarely used in passenger cars. See Figure C.2.

**kingpin offset** (1) At ground, the horizontal distance in front elevation between the point where the *steering axis* intersects the ground and the *center of tire contact*. (2) At wheel center, horizontal distance in front elevation between wheel center and *steering axis*. See Figure C.2.

**knock** (1) Noise resulting from the spontaneous ignition of a portion of the air-fuel mixture in an engine cylinder and occurring ahead of the normal spark-initiated advancing flame front. (2) Detonation of the fuel mixture in an engine cylinder or the noise thereof. See also *detonation*; *diesel knock*; *ping*; *pinking*; *pre-ignition*; *runaway knock*; *spark knock*; *surface ignition*.

**knock rating** Octane rating (informal).

**knock sensor** Instrument which detects the onset of detonation in an IC engine. See also *Motor Octane Number*; *Research Octane Number*.

**knuckle pin** See *kingpin*.

**Krypton test** Proprietary instrumented diagnostic and performance test for IC engines.

**Kumm transmission** Type of *continuously variable transmission* using a flat belt and expanding pulleys. See also *Variomatic transmission*.

## L

**L-head engine (UK: side valve engine)** In-line engine in which inlet and exhaust valves are on the same side of the cylinder block and set within the block, with *poppet valves* stem downwards. Obsolete for most automotive uses. See also *F-head*; *I-head*; *side-valve*. See Figure S.5.

**ladder chassis** Chassis in which parallel side members are joined at intervals by transverse beams, giving the appearance of a ladder.

**Lambda sensor** Electro-chemical sensor that relays data on oxygen content of exhaust gases to an electronic engine management system, and thus enables corrections to be made for divergence from *stoichiometric* mixture relationship.

**laminated glass** Safety glass in which a transparent plastic film is sandwiched between plates of glass, thus reducing splintering and resisting penetration by occupant. See also *toughened glass*.

**lamp** Lighting unit consisting of lens, reflector, filament or light source and housing.

**landing gear** Retractable or removable supports for the front end of a semi-trailer, sometimes with small wheels to provide limited mobility. Also *landing legs*. See also *dolly*; *sandshoe*. See Figure L.1.

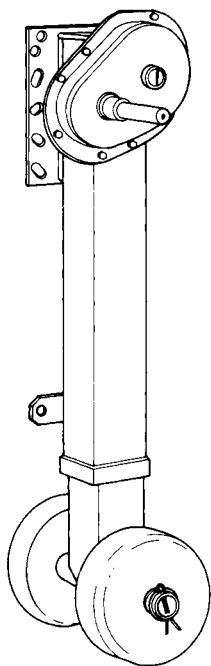


Figure L.1 A leg of a semi-trailer landing gear

**landing legs.** See *landing gear*.

**Lanova air cell** Narrow throated cavity located in the head of certain types of diesel engine, normal to the cylinder axis and on the opposite side of the combustion chamber to the injector where it entraps and stimulates ignition of part of the injected charge. The Lanova air cell is not strictly a *pre-combustion chamber*.

**Lanova head** Cylinder head incorporating a Lanova air cell.

**lap and diagonal belt** Active occupant restraint system in which a continuous fabric belt is fastened normally to near the centerline of a vehicle to provide horizontal restraint at hip level and diagonal restraint from outer shoulder across the thorax.

**lap belt** Safety belt that affords constraint on frontal impact across the occupant's lower waist or hip.

**lash** See *play*.

**lateral control force** See *cornering force*.

**lateral offset** Lateral distance at ground level between steering axis and center of tire contact. See also *center point steering*.

**lateral runout** Oscillation of the plane of symmetry of a rotating road wheel as a result of static misalignment. See also *shimmy*, which is a dynamic oscillatory condition and *waddle*. *Wheel-wobble* (informal).

**Layrub joint** Proprietary universal joint using rubber bushes mounted on an intermediate carrier. Also *Layrub coupling*.

**layshaft (US: countershaft)** Shaft in a gearbox running parallel to the main shaft and carrying the paired gear wheels or pinions that effect the changes in gear ratio.

**LDC** See *bottom dead center*.

**lead** (1) Tendency of a vehicle to deviate to left or right, for example as a result of steering misalignment, asymmetric loading or inequality of tire pressures. (2) Lead compound anti-knock additives for gasoline (informal). See *tetra-ethyl lead*.

**lead-acid battery** Battery consisting of lead-acid cells in series, normally twelve volts for passenger cars and light commercial vehicles.

**lead-free** Of gasoline or petrol, containing no lead-compound *anti-knock additives*.

**leading arm** Suspension linkage which supports the wheel axle on a forward facing sprung lever.

**leading shoe (US: primary shoe; forward shoe)** Shoe of a *drum brake* system in which the actuated end of the shoe 'leads', facing the normal direction of rotation (Figure C.1).

**leaf spring** (1) Spring built from superimposed narrow, flat sectioned plates or blades which resist load in bending. (2) Spring consisting of one tapered member in bending, also called *single leaf*. See also *quarter elliptic*; *semi-elliptical leaf spring*. See Figure L.2.

**lean-burn engine** Engine capable of running on a fuel-air ratio that is significantly lower than *stoichiometric*.

**lean mixture** Inducted air/fuel mixture containing an excess of air. A *weak mixture*.

**leaned** Having the ratio of air to fuel in an inducted mixture increased, so that the charge is weaker. US informal.

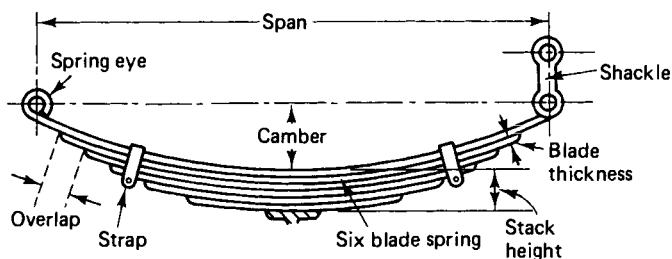


Figure L.2 Semi-elliptical leaf spring nomenclature

**left-hand drive** Driving position on left of vehicle, as generally adopted in countries where vehicles drive on the right.

**Lemoine** Stub axle and kingpin configuration for *beam axles*. See also *Elliot axle*.

**lever type shock absorber** Suspension vibration damper in which the suspension input is reacted by lever arm from a chassis-mounted hydraulic damping unit.

**license plate lamp (UK: registration plate lamp)** Lamp to illuminate the license plate at the rear of a vehicle.

**lift** (1) Of a poppet valve, the distance by which the valve is raised from its seated position when fully opened. See also *cam*. (2) Vertical component of aerodynamic forces, as for example over a moving vehicle or a *wing*. Normally considered positive upwards, a downward component usually being called *negative lift*. See also *aerofoil*; *airfoil*. (3) A commercial vehicle *tail lift* (Informal).

**lift axle** Axle of a tandem axle undercarriage with mechanism for raising above ground contact when the vehicle is unladen or lightly laden. Also *lifting axle*.

**lift gate (UK: tail lift)** Power operated tailgate, particularly of van or box-body commercial vehicle, which converts into a platform whereby cargo can be lifted from street level to vehicle cargo floor level. Also *lift tail gate*.

**lift pump** Low pressure feed pump transferring fuel from tank to *carburetor* or *fuel injection pump*.

**lift tail gate** See *lift gate*.

**lifter** Arm or other actuating mechanism that lifts or opens a poppet valve. A *valve lifter* (US informal). See also *roller lifter*.

**lifting axle** See *lift axle*.

**light** (1) Window in a vehicle passenger compartment. Also used in context of the number of windows, for example six-light, being a passenger car with three separate windows on each side. See also *backlight*; *quarter light*. (2) Beam of light given off by a lamp (but not an alternative word for lamp).

**light van/truck** Vehicle of restricted weight (typically under 3 tons in the UK, or as specified by the regulating authority), which may be legally driven by a person not holding a commercial vehicle licence.

**limit cycle control** Closed-loop engine control system in which a feedback signal is sent only when a preset limit of the measured parameter is exceeded. See also *proportional control*.

**limited slip differential** Differential in which the rotational speed differential between the two output shafts is mechanically limited to prevent wheel spin on difficult terrain. Mainly used on vehicles where an off-highway capability is important, or on commercial vehicles and passenger cars to improve traction on ice and snow. See also *locking differential*.

**liner (US: sleeve)** Hard metal insert in engine cylinder block, in which piston runs. Also *cylinder liner*. See also *dry liner*; *sleeve valve*; *wet liner*.

**lining** (1) Friction material attached to the shoe of a *drum brake*. (2) The pliant and decorative inner surface of a vehicle interior, as in *headlining*.

**linkage power steering** Power assisted steering system in which a conventional manual system is aided by hydraulic (or pneumatic) effort applied directly to a steering linkage such as an *idler arm* or *track rod*. See also *offset power steering*.

**liquefied petroleum gas** Liquefied gases, usually either of propane or butane or a mixture of the two, which may be used as a vehicle fuel in modified spark ignition gasoline engines. Also *LPG*. See also *Autogas*; *compressed natural gas*.

**liquid-cooled** Cooled by conduction and convection to the passage of a liquid, such as water. See *cooling system*; *radiator*.

**live axle** Axle that transmits power to a pair of wheels. Also *driving axle*. See also *fully-floating axle*; *non-floating axle*; *semi-floating axle*.

**LNG** Liquefied natural gas, for example methane. See also *compressed natural gas*.

**loadbase** Distance between the centerline of the front wheels of a commercial vehicle and the transverse centerline of the load if evenly distributed, or the center of gravity of its load (Figure L.3).

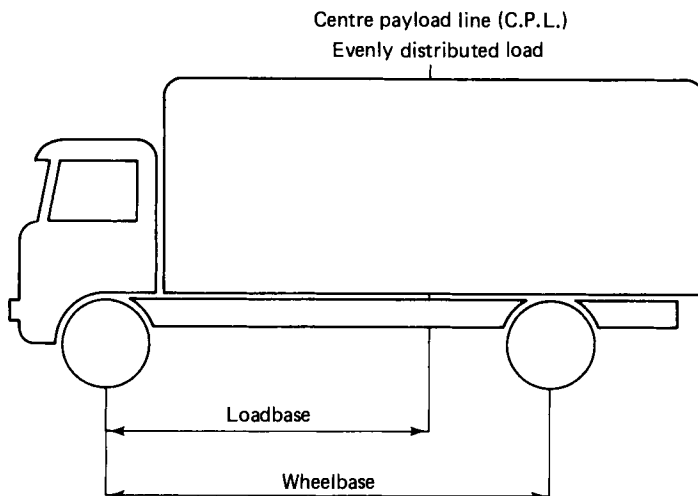


Figure L.3 Definition of loadbase and wheelbase

**load distribution** (1) Load apportioned to each axle of a vehicle. (2) The ratio of load distribution between axles.

**load floor** The cargo-carrying floor of a commercial vehicle or trailer. See also *cargo floor*; *bottom board*.

**load overhang** See *overhang*.

**load proportional brake control** System or device that regulates the input force to the brakes on an axle in proportion to the load on that axle.

**load sensing valve** Valve that adjusts the brake performance of a vehicle to the axle load, as for example to reduce risk of locking of rear wheels of an unladen semi-trailer.

**load space lamp** Door-actuated illumination of baggage compartment of a car.

**load torque** Torque at transmission output shaft necessary to maintain a vehicle in motion at a steady speed. Mainly US usage. See also *drive torque*.

**load transfer** Effective increase or decrease in axle load due to acceleration or braking, or lateral weight transfer across axle on cornering.

**lobe** Part of a profile cam that extends beyond the base circle, and that brings about the lift of a follower or *tappet*.

**lock** (1) Angle of rotation about *steering axis* of steered wheels. See also *angle of lock*; *steering angle*. (2) Maximum angle to which steered wheels can be turned, as in context of *lock-to-lock*. (3) Mechanism for securely closing a door or hatch, or for otherwise ensuring security, as against theft.

**lock actuator** Device to keep a *parking brake* applied independently of air pressure in an air brake system.

**lock synchronizer** Change speed gear synchronizer mechanism that positively locks paired gears, usually by means of a dog clutch. The conventional *synchromesh* mechanism.

**lock-to-lock** Maximum rotation left to right of steered wheels about their *steering axes*.

**lock-up** Direct drive mode in which the driving and driven elements of a *torque converter* are mechanically coupled so that the complete unit, with casing, rotates at engine speed, thus eliminating fluid friction losses in the converter and increasing fuel economy. Also *lockup*.

**lock-up clutch** Clutch that directly couples the *torque converter* output to the engine drive in an *automatic transmission*, as in *direct drive* mode.

**locking differential** Differential with facility for mechanically locking together both half shafts so that equal torque is applied to left and right hand driven wheels, the differential action no longer functioning. Particularly used on heavy vehicles and *off-highway vehicles* for operation on rough or low-friction terrain. See also *limited slip differential*. See Figure L.4.

**locomotive** Heavy road tractive unit, normally for drawing up to three trailers. See also *road train*. (Terminology rarely used except in legal context).

**log manifold** Cylindrical inlet manifold with branches for inlet tracts and flanged protrusions for the attachment of two or more carburettors, thus giving it the appearance of a log. Normally associated with in-line six or eight cylinder engines.

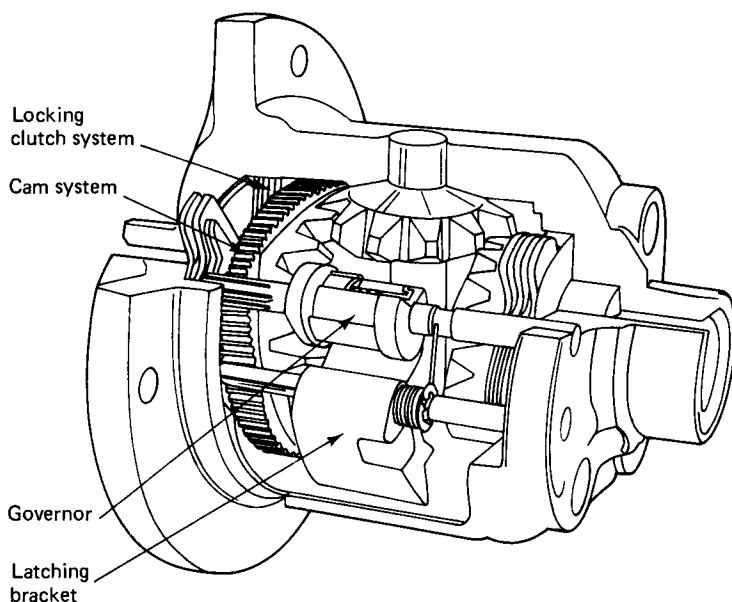


Figure L.4 Cutaway drawing of an Eaton locking differential

**logging vehicle** Vehicle for conveying logs and lumber. A *logger* (informal).

See also *pole trailer*.

**longeron** A primary longitudinal member of a vehicle body structure. See also *cantrail*; *sill*.

**loom** Assembled wiring system of a vehicle, particularly as a unit prior to installation. Also *wiring harness*.

**loop-scavenging** Scavenging of a *two-stroke engine* by vertical circulation within the cylinder and to the exhaust port of burnt gases ahead of the incoming charge. See *cross scavenging*; *Schnuerle system*.

**lorry** (US: *flatbed truck*) Heavy goods vehicle, particularly an open or *platform lorry*. Mainly UK usage.

**louver** Opening for ventilation consisting of parallel slats. Also *louvre*, particularly in UK.

**low-bed trailer** (UK: *low-loader*) Open truck trailer constructed to provide a low platform height.

**low-boy** A low-bed trailer (US informal). Also *lo-boy*.

**low loader** Platform truck so equipped that the tilting of the platform or the lowering of an extension ramp, facilitates direct loading from street level. See also *beaver tail*.

**low profile** Of low height in relation to width, but notably of tires with wide *tread* and shallow *sidewall*.

**lower beam** (UK: *dipped beam*) Headlamp beam to illuminate the road ahead of a vehicle without causing undue glare to other drivers. Also *meeting beam*. See also *main beam*; *upper beam*.

**lower dead center** See *bottom dead center*.

**LPG** Liquefied petroleum gas, normally a mixture of butane and propane.

Also *Autogas*, a trade name though extensively used as a generic term for LPG in automotive applications.

**lug** Un-siped block feature of tread pattern, usually of off-road tires.

**lug-type terminal post** Flat rectangular section terminal post to which mating lug is bolted.

**luggage boot (US: trunk)** See *boot*.

**lugnut** A wheelnut (US).

**luton** Van in which the van body is of greater height than the driver's cab and extends forward above the cab. See also *box-van*; *panel body*. See Figure L.5.

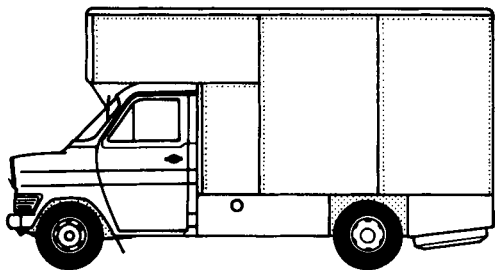


Figure L.5 A luton van

## M

**MacPherson strut** Telescopic independently sprung suspension member incorporating damper, and fixed at its upper end to the body shell or chassis, the lower end being located by linkages which counteract transverse and fore and aft movement. The original system used an *anti-roll bar* for longitudinal location. Usually incorporated in a steered front suspension system. See Figure M.1.

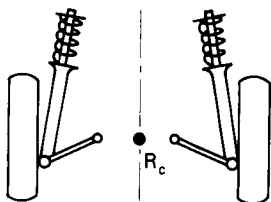


Figure M.1 MacPherson strut suspension, showing position of roll center

**MAF** Mass air flow, particularly in relation to engine induction.

**MAF sensor** Telemetric device for measuring or monitoring the mass flow of air into an engine.

**magnetic plug** Plug fitted in the oil pan or sump to collect ferrous debris.

**main bearing** Journal bearing that locates and supports the *crankshaft* in the *crankcase*.

**main beam (US: driving beam; high beam)** Full beam of a headlamp, for use when no traffic is approaching. Also *upper beam*.

**main jet** Principal jet in a carburetor through which the greater proportion of fuel flows in normal steady-state operation.

**main metering system** Of a carburetor, the *float chamber* or other fuel source, with the main *discharge tube* or jet and venturi, excluding compensating, idling and other systems.

**manifold** System of ducts or pipes that divides a flow and conducts it to more than one point of delivery or that unites a flow from a number of sources for delivery at one point. See also *exhaust manifold*; *intake manifold*. See Figure P.5.

**manifold absolute pressure** The mean gas absolute static pressure in an engine *induction manifold*, usually measured by a mercury manometer. Also *MAP*.

**manifold depression** Difference between the mean static pressure within an engine *induction (intake) manifold* and ambient pressure. Although the difference is usually negative (a depression) in a naturally aspirated engine, it will normally be positive in a supercharged engine. Use of the term *manifold pressure* avoids this anomaly. Used as a means of controlling *ignition timing*, and of augmenting brake pedal effort. See also *servo*.

**manifold pressure** See *manifold depression*.

**manual brake system** Mechanical or hydraulic brake system in which driver effort is unassisted by servo.

**manual shift** See *manual transmission*.

**manual steering** Steering in which the effort of the driver is unassisted by mechanical power. See also *power steering*.

**manual transmission** Transmission in which gears are changed by a driver-operated lever mechanism. See also *column change*; *crash gearbox*; *gearshift lever*; *selector mechanism*; *synchromesh*.

**marker lamp** Any lamp that indicates a vehicle's position, but particularly a light on a trailer or combination where front or rear lamps might not be seen. Also *position lamp*. See also *side marker lamp*.

**Marles steering gear** Proprietary *hourglass worm and roller steering gear*.

**Marles-Weller steering gear** Proprietary *worm and peg steering gear*.

**masked valve** Poppet valve recessed into its seat so as to give more efficient operation.

**mast jacket** Tube in which a *steering column* turns (US obsolesc).

**master cylinder** (1) Primary source of pressure in an hydraulic system such as a brake or clutch system, containing the piston by which pressure is applied and connected to a source of hydraulic fluid. (2) Primary unit for dispensing hydraulic fluid under pressure in a hydraulic system. See Figure M.2.

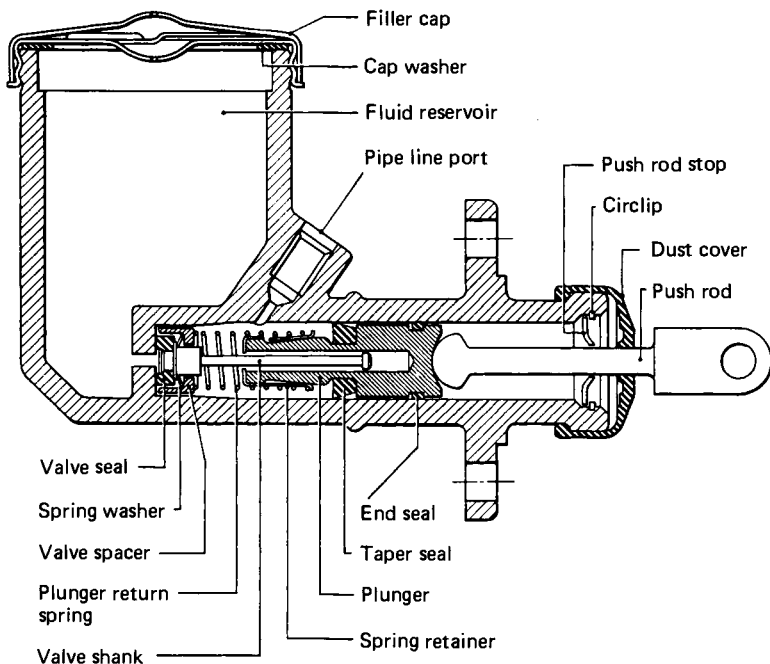


Figure M.2 A brake master cylinder

**Maxaret brake** Proprietary *anti-lock brake system*, originally developed for aircraft but subsequently modified for road vehicles.

**maximum brake power** Maximum measured power of an IC engine, as measured on a *dynamometer* or brake.

**mean effective pressure** The mean pressure in an engine cylinder during the working or power stroke. See also *brake mean effective pressure; indicated mean effective pressure*.

**mean piston speed** Effective distance travelled by a piston per unit time, given by the formula  $S = 2LN$ , where  $S$  is the piston speed,  $L$  is stroke and  $N$  is the number of revolutions per unit time. Also called *average piston speed*. Use of the unqualified term *piston speed* risks confusion with instantaneous piston speed.

**mechanical efficiency** The ratio of delivered shaft power of an engine to the power developed within the cylinders as expressed by *indicated power*. A measure of the friction and pumping losses within an engine.

**mechanical trail** See *caster offset*.

**mechanical transmission** Transmission using mechanical rather than hydraulic or electrical principles.

**medium speed diesel** Diesel engine with an operating speed in the range 250 to 1000 rev/minute. Term mainly used in marine or industrial engine connotation. Most automotive engines are classed as high-speed.

**meeting beam** See *dipped beam*. Also *lower beam*.

**metering rod** Valve consisting of variable section rod and orifice by which flow of a fluid can be metered, as from the *float bowl* or chamber of a carburetor. Similar to a needle valve.

**methane** Hydrocarbon constituent of natural gas, also produced by sludge digestion. An alternative fuel for spark ignition engines, though requiring storage in liquid state at low temperature unless compressed to form *CNG*.

**methanol** Methyl-alcohol fuel or fuel additive.

**mid-engine** (1) Engine located within or immediately behind the passenger compartment of a passenger car. (2) Engine located within the wheelbase and beneath the floor of a public service or commercial vehicle. See also *forward control; normal control; rear engine*.

**mileometer (US: odometer)** Mechanical or electrical meter for indicating distance travelled.

**mineral oil** Light hydrocarbon distillate lubricating oil. Term usually distinguishes from vegetable oil, such as castor oil.

**misfire** Failure of a fuel charge to fire or ignite in the proper way.

**mixing chamber** See *barrel*.

**modulator valve** Valve within an automatic transmission that responds to changes usually in manifold depression via a vacuum modulator, and driveshaft rotational speed, to provide a signal in the form of hydraulic pressure or torque which actuates a boost valve in the pressure regulator to modify line pressure from the hydraulic pump. Also *vacuum modulator valve*.

**module** Semi-conductor control for electronic ignition circuit (informal). See *electronic control module*. See also *breakerless ignition; electronic ignition*.

**molybdenum disulphide** Black powdery solid sometimes added to lubricants to reduce friction.

**monobloc construction** Of a reciprocating engine, having the cylinders cast in a single block through which cooling water can flow continuously. Also used of an engine in which the *cylinder block* and *crankcase* are made as one unit.

**monochromatic lamp** Lamp, the surface of which may be colored (as for example with vehicle body color) when unlit, but which allows a white or colored light to show through when lit.

**monocoque** A structure, as for example a car body, consisting of a torsionally rigid shell. See also *integral construction*.

**moped** A light motorcycle equipped with pedals for starting and assistance in hill-climbing.

**MoT test** Compulsory British annual vehicle condition survey, instigated by the Ministry of Transport, the now superseded government authority that initiated the test.

**motion transmissibility** Ratio of wheel hub velocity to tire footprint velocity.

**motor** (1) A prime mover. The *engine* of a vehicle. (2) A motor car or automobile (mainly UK informal). (3) To drive or travel by car.

**motor caravan (US: motor-home)** A rigid motorized vehicle with residential leisure facilities. See also *camper*.

**motor home** See *motor caravan*.

**Motor Octane Number** Octane number derived from one of the standard comparative tests using the *Cooperative Fuel Research (CFR) engine*. The Motor Octane test is representative of more severe driving conditions than the *Research Octane* test. It may return a lower octane rating for a given fuel than the Research Octane test, but does not necessarily do so. Also *MON*.

**motor scooter** Motor bicycle with small wheels, and usually with leg shields and open foot platform formed as a unit to give weather protection and ease of mounting.

**motor spirit** Petroleum fuel for spark ignition motor vehicle engines. Also *gasoline*; *petrol*. Obsolete except in legal usage.

**motor stall torque** Maximum torque that a motor can maintain for two cycles under specified conditions (SAE definition).

**motorcycle** Two-wheeled powered vehicle steered by handle-bars and not equipped with pedals or other means whereby rider can assist motion. See also *motorcycle combination*; *moped*.

**motorcycle combination** Motorcycle equipped with a sidecar or buddy-seat, thus making the combination a three-wheeled vehicle.

**Motor Method** A standard test for fuel octane rating. See also *research method*.

**Moulton suspension** Combined gas or rubber and fluid coupled suspension of type devised by A.Moulton. See also *Hydrolastic suspension*; *Hydragas suspension*.

**mounting ring** Fitting, with facilities for aiming adjustment, on which a headlamp or its light unit is mounted.

**moving van (UK: removal van)** Large capacity van for removal of household effects. See also *pantechnicon*.

**mudflap** Usually flexible lower extension to a mudguard to divert road spray from tires.

**mudguard** Narrow curved panel mounted over or behind a wheel, to deflect tire-generated spray and roadstones. See also *mudflap*.

**mudwing** Mudguard, particularly for the rear wheels of a commercial vehicle.

**muff coupling** Coupling consisting of two half sleeves keyed to a shaft and bolted together.

**muffler (UK: silencer)** Primary silencing element in an *exhaust system*.

**multi-fuel engine** IC engine capable of running on more than one type of fuel, as for example LPG and gasoline.

**multi-leaf spring** See semi-elliptical spring.

**multi-plate clutch** Clutch with more than one driven plate. See also *interplate*.

**multi-point injection** Fuel injection system in which the fuel is injected into each individual cylinder, rather than into the inlet tract. See also *downstream injection; throttle-body injection*.

**multi-stage** Of a gas turbine or turbocharger, having more than one row or stage of working blades.

**multi-throw crankshaft** Shaft with cranks set at equal angles of less than 180 degrees.

**multiple-disc clutch** See *multi-plate clutch*.

**mushroom valve** Valve with narrow stem surmounted by a disc-shaped head, resembling an elongated mushroom. The conventional intake and exhaust valve configuration. *Poppet valve* is the favored term.

## N

**naca duct** Aerodynamically profiled shallow duct, developed by former National Advisory Committee for Aeronautics (US). See also *air scoop*.

**nacelle** A protective or streamlined cowling.

**narrow V engine** Engine of V configuration with cylinder axes at less than 60 degrees to each other, and in some cases at an angle so small that the cylinders are staggered to avoid interference, as for example in some engines by Lancia.

**naturally aspirated engine** An engine that takes in air at ambient pressure. A non-supercharged engine.

**nave** Hollow or dished center part of a road wheel on which the rim is mounted.

**nave plate** A circular plate covering the nave of a road wheel and thus concealing the hub cap and wheel nuts. Often a decorative feature.

**NDIR** See *non-dispersive infrared*.

**nearside** Side of a vehicle normally nearest to the kerb (curb).

**needle bearing** Rolling-element bearing in which the rollers are small diameter needle-like elements. Often used as a crankpin end bearing in small two stroke engines.

**needle valve** (1) Valve by which fluid flow rate is controlled by the degree of insertion of a tapered needle into a fixed diameter orifice. This type of valve can provide a fine gradation of flow. (2) Valve in which a blunt conically ended needle seats on a fixed diameter orifice. With this type of valve there is little or no gradation of flow, control being limited to full, with needle lifted, or none, with needle seated. See Figure C.3.

**negative camber** Wheel camber in which wheel slopes inward toward the top.

**negative lift** Downward aerodynamic force, as provided by an *aerofoil* (*airfoil*) set at a negative angle of attack, for example to increase traction at speed in a car designed for high speeds.

**negative offset steering** Steering/suspension geometry in which point of intersection of kingpin axis with ground lies outside the center of the tire contact patch or plane of the wheel. See also *center point steering*.

**net contact area** Area enclosing pattern of the tire tread *footprint*, excluding the area of grooves or other depressions.

**net power** Brake power of a fully equipped engine.

**neutral** Transmission idling position when no gear is engaged.

**neutral steer** (1) Having neither *oversteer* nor *understeer*. (2) At a given trim, having the ratio of steering wheel angle gradient to the overall steering ratio equal to the Ackermann steer angle gradient (SAE definition).

**neutral turn** Turn executed by a *tracklaying vehicle* in which one track only is driven, the drive to the second track being in neutral.

**Newton automatic clutch** An automatic *centrifugal clutch* in which the

centrifugal force on hinged weights overcomes a spring load to effect engagement. No clutch pedal is required, as engagement is a function of speed of rotation.

**nibbling** See *ridging*.

**nickel alkaline battery** Storage battery with nickel hydrate positive plates and an alkaline electrolyte.

**nife battery** See *nickel alkaline battery*.

**nip** Gap at mid-point between adjacent leaves of a loosely stacked *leaf spring*.

**nitro** Nitro-methane (informal).

**nitro-methane** Liquid hydrocarbon fuel used, sometimes with the addition of methyl-alcohol, in sprint competitions.

**nitrobenzine** An organic fuel additive, highly poisonous .

**nitrogen oxides** Compounds of nitrogen and oxygen produced during combustion, particularly at higher temperatures, and conforming to the general formula NO<sub>x</sub>.

**nondispersive infrared** Analytical test method used mainly to determine carbon monoxide, carbon dioxide, nitric oxide and hydrocarbon content of exhaust gases.

**non-floating axle** Live axle in which the axle shaft carries all chassis and torsional driving loads. See also *fully-floating axle*; *semi-floating axle*.

**non-powered axle** Axle to which no power is transmitted. A dead axle.

**non-reactive suspension** Tandem axle suspension in which driving and braking torques and axle loads on bump are equalized by mechanical linkage or other form of interaction. Usage of this term is confused (and confusing). It is sometimes taken to imply a tandem axle suspension where there is no equalization or compensation. See also *reactive suspension*.

**normal control (US: cab behind engine)** Vehicle configuration, particularly of commercial vehicles, in which the engine is located forward of the cab, and is usually separated from the cab by a transverse bulkhead or firewall. See also *forward control*.

**normalized tire force coefficient** See *cornering stiffness coefficient*.

**notchback** Passenger car in which a sloping rear screen terminates in a short nominally horizontal extension.

**notchy** Of a gear shift (gearchange) movement, requiring awkwardly precise movement as if locating a notch, rather than slipping easily into gear. Informal.

**NO<sub>x</sub>** See *nitrogen oxides*.

**number plate (US: license plate)** Plate at front and rear of registered or licensed vehicles giving the vehicle's unique identification number and code.

**number plate illuminating lamp (US: license plate lamp)** Lamp to illuminate registration plate or license plate. Also *registration plate lamp*.

**nut and lever steering** See *worm and nut steering*.

## O

**occupant restraint system** System for retaining a vehicle occupant in his seat on impact, thus greatly reducing the risk of impact with or penetration of the windscreen (windshield), or physical injury resulting from contact with other items of the vehicle interior. See *active restraint*; *air bag*; *lap and diagonal belt*; *lap belt*; *passive restraint*.

**octane number** Measure of the anti-knock properties of a fuel derived from comparative tests using a standard variable compression engine, generally the *Cooperative Fuel Research (CFR) engine*. The anti-knock properties of the fuel under test are compared with those of a fuel comprising iso-octane (given an arbitrary rating of 100) and heptane (rated at zero). The volumetric percentage of iso-octane is taken as the octane rating of the fuel under test. Various test procedures are in use, though predominantly the Research Method (giving Research Octane number or RON), and the Motor Method (giving Motor Octane number or MON). American pump ratings are based on an average of *Research Octane Number* and *Motor Octane Number* whereas European pump ratings quote Research Octane Number (which usually gives a higher value for comparable anti-knock properties). See also *Antiknock Index*; *detonation*; *Distribution Octane Number*; *knock*.

**odometer (UK: mileometer)** Instrument that displays distance travelled by a vehicle.

**off-highway vehicle** Vehicle, as for example for construction or agriculture, intended mainly for operation on unmade surfaces or rough terrain. Such vehicles may be designed also for use on public highways.

**offset power steering** Power assisted steering system in which the powered steering effort is applied to the *drop arm* or *pitman arm* at the *steering box*. See also *in-line power steering*; *linkage power steering*.

**offside** Side of a vehicle furthest from the kerb (curb) in normal driving. Usually the driver's side.

**OHC** See *overhead camshaft*.

**OHV** See *overhead valve*.

**oil bath lubrication** Lubrication by intermittent or continuous immersion in a bath of oil, or by an oil disc or *oil flinger*.

**oil control ring** Piston ring which removes excess oil from cylinder walls of an engine and returns it via oilways in the piston to the main flow of oil. Usually the furthest from the *crown* of the piston rings. Also called *oil ring*; *oil-scraper ring* and *scraper ring*. See Figure P.2.

**oil cooler** Device to prevent overheating of engine or gearbox (transmission) lubricating oil by natural or forced air convection or radiation, often on the principle of an engine cooling *radiator*.

**oil disc** See *oil flinger*.

**oil engine** Compression ignition engine, so called because of the oily (viscid) nature of its fuel (obsolete term).

**oil filter** Device which removes suspended particulate matter from lubricating or hydraulic oil. Most engine oil filters filter through a paper, synthetic or ceramic element that traps particles in minute interstices. See also *centrifugal filter*.

**oil flinger** Rotating disc the periphery of which is immersed in lubricating oil, which is spread by centrifugal action and conducted by oilways to bearings or other surfaces requiring lubrication. A now obsolete method of engine lubrication. Sometimes called *oil slinger* or *oil disc*.

**oil gage (UK: dipstick)** (1) Graduated rod to indicate oil level in engine oil pan (sump) or transmission. (2) An oil pressure meter.

**oil immersed clutch** Clutch in which the plates run wholly or partially immersed in oil, normally to aid cooling. A feature of various types of *multi-plate clutch*.

**oil pan (UK: oil sump; sump)** Bath-shaped reservoir fitted beneath the *crankcase* or *cylinder block* of an engine, and forming a container to which the lubricating oil returns by gravity (Figure E.1).

**oil passage (UK: oilway)** Passage or conduit through which lubricating oil flows, in some cases under pressure, as in engine or other mechanism.

**oil pressure** The pressure of the oil delivered by the *oil pump* in an engine lubricating system.

**oil pump** Pump for distributing lubricating oil under pressure to the bearings and other lubricated surfaces of an engine or other machinery.

**oil ring** See *oil control ring*.

**oil-scraper ring** See *oil control ring*.

**oil slinger** (1) Flange or collar fitted to a shaft to disperse excess oil by centrifugal force. (2) An oil flinger or disc.

**oil sump (US: oil pan)** Bath-shaped reservoir fitted beneath the crankcase or cylinder block of an engine, and forming a container to which the lubricating oil returns by gravity. Usually contracted to *sump*. See Figure E.1.

**oilway (US: oil passage)** Passage or conduit through which lubricating oil flows, in some cases under pressure, as in engine or other mechanism.

**omnibus** Public service vehicle designed to carry fare paying passengers. Also *bus*; *motor bus*.

**one-way clutch** Mechanical clutch, such as a sprag clutch, that engages when torque is applied in one direction of rotation only. When torque is not applied the driven member rotates freely. An *overrunning clutch* or *freewheel*.

**opacimeter** Instrument for measuring the density of smoke or visible particulate emissions, as from an engine exhaust.

**open body** Vehicle without roof. An open car, such as a traditional *sports car*.

**open cycle turbine** Gas turbine operating cycle in which air enters from atmosphere and (with combustion products) is discharged to atmosphere. See also *closed cycle turbine*.

**open-loop engine control** Control of engine parameters such as ignition timing and air-fuel mixture by pre-set, often mechanical or pneumatic, control such as *centrifugal ignition advance*.

**open period** The period, usually measured in degrees of angle or radians,

during which an engine valve remains open. See also *blowdown; pumping loop*.

**open-top** A lorry or truck with no permanent cover to its cargo platform (mainly US informal).

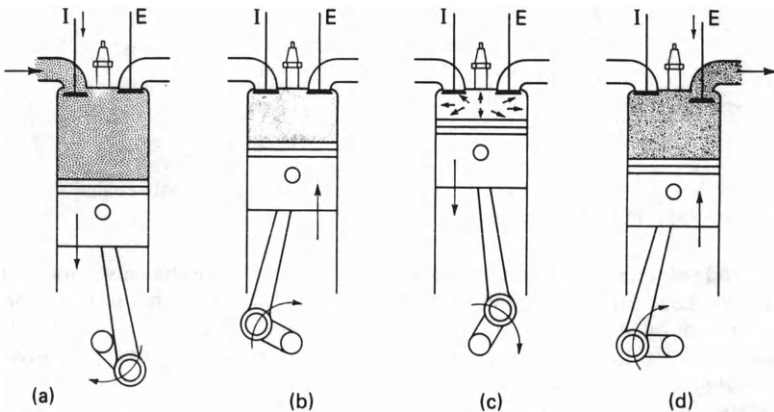
**opposed cylinder engine** Engine in which cylinders are disposed at opposite sides of the crankshaft, usually horizontally. Informally designated by the number of cylinders as flat twin, flat four, etc. Also (informally) called *boxer engine*. See also *flat engine*.

**opposed piston engine** Reciprocating engine in which pairs of pistons operate in each cylinder, the combustion chamber being formed between the piston crowns. Rare in current automotive use.

**opposite lock** Steering input in opposite direction to current sense of turn, as in correcting a rear wheel skid.

**oscillating warning lamp** Lamp in which the beam or beams oscillate through fixed angles.

**Otto cycle** The four stroke spark ignition engine cycle, patented in 1876, comprising induction (intake), compression, expansion (power), and exhaust strokes, the fuel and air mixture being compressed before combustion is initiated by an electrical spark or other means. After inventor N.A. Otto. See Figure O.1.



*Figure O.1* The four operations of the Otto or four-stroke spark ignition cycle: (a) induction, (b) compression, (c) ignition followed by the working stroke, and (d) exhaust

**outer dead center** See *top dead center*.

**output ballast resistor** See *ballast resistor*.

**oval piston** Engine piston manufactured to slightly elliptical cross section to counteract the effects of thermal distortion. See also *cam-ground piston*.

**over-run fuel cut-off** See *overrun cutoff*.

**overall steering ratio** Rate of change of steering wheel angle to that of steered wheels, at a particular angle and assuming no play or mechanical losses in the system.

**overdrive** An auxiliary gearbox or transmission, usually of semi-automatic *epicyclic (planetary)* type, located between main gearbox (transmission) and rear axle, and employed to reduce engine speeds for economical cruising. The overdrive can usually be switched into and out of operation by electrical or mechanical control. See also *splitter transmission*.

**overhang** (1) Longitudinal distance that a vehicle extends beyond each wheel axis. (2) Longitudinal distance that the load of a goods vehicle extends beyond the end of the vehicle. Also *load overhang*.

**overhead camshaft** Of an engine, having the camshaft located in the cylinder head and operating the valves directly or indirectly from above (Figure O.2).

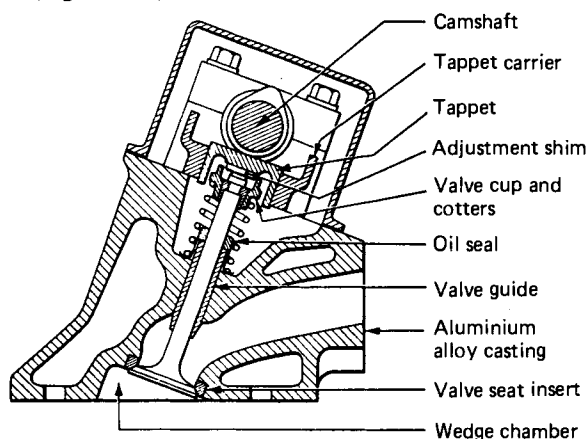


Figure O.2 Section through cylinder head of an overhead camshaft engine with a wedge-shaped combustion chamber

**overhead valve engine (US: I head engine)** Engine having the valves located at the head of the combustion chamber, opposite to the piston, and operated by a mechanism of rockers and push rods from a camshaft mounted in the cylinder block. See also *side valve engine; overhead camshaft*. See Figure O.3.

**overlap** See *valve overlap*.

**override (US: bumper guard)** Short vertical bar attached, usually one either side, to a vehicle bumper to prevent interlocking of bumpers in minor collisions. Also *Mae West* (US slang).

**overrun** Motoring of an engine of a moving vehicle through the transmission system, with throttle control closed, as when descending a steep hill.

**overrun cutoff** Valve, sometimes located in a carburetor, that blocks flow of fuel on overrun.

**overrunning clutch** Mechanical device that disengages the engine on overrun, and so acts as a freewheel. A feature of the mechanism of many types of automatic transmission. See also *freewheel; one-way clutch; sprag clutch*.

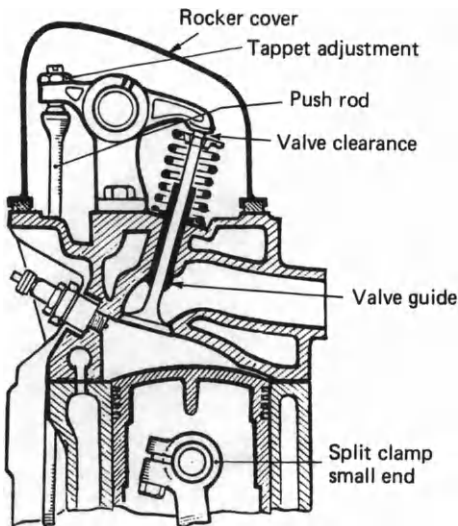


Figure O.3 Section through cylinder head of an overhead valve or I head engine

**overrunning clutch starter motor** Starter motor in which engagement of the pinion with ring gear is brought about by lever action from a solenoid or by manual operation. An overrunning clutch or freewheel prevents the engine ring gear driving the starter motor before disengagement. See also *pre-engaged starter*.

**overslung worm transmission** Worm and worm wheel final drive in which the worm is set above the worm wheel. Used in commercial vehicles and where ground clearance is important, though now obsolescent. See also *underslung worm transmission*.

**overspeed governor** Device that limits the speed of an engine, and particularly of a commercial vehicle diesel engine, usually by limiting the maximum supply from the *fuel injection system*.

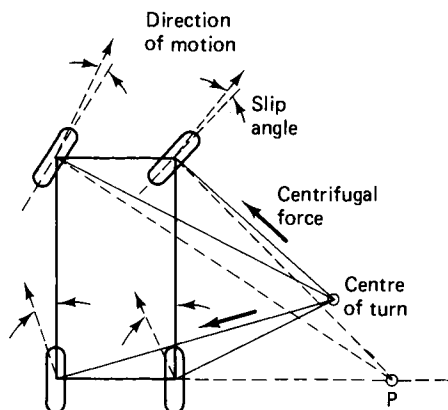
**overspeed protection** Limiting the maximum speed of operation of an engine in order to prevent mechanical or thermal damage, or operation at intolerable levels of noise, exhaust emission, or fuel consumption. See also *overspeed governor*.

**overspeeding** Of an engine, exceeding design speed, or a speed limited by emissions, noise or other regulations.

**oversquare engine** Engine having a cylinder bore larger than its stroke. See also *square engine*; *undersquare engine*.

**oversteer** (1) Response of a vehicle if the ratio of steering wheel angle gradient to overall steering ratio is less than the Ackermann steer angle gradient (SAE definition). (2) Over-response to steering input, as by generation of excessive slip angle on rear wheels. (3) Response of vehicle to steering input, characterized by an incremental increase in yaw rate

which necessitates a decrease in steer angle to maintain the intended radius of turn. See Figure O.4.  
**oxygenates** Alcohol-based fuels or fuel additives.



*Figure O.4* Diagrammatic representation of oversteer, showing the actual center of turn compared with the geometric center of turn that would prevail at low speed

## P

**packing** See *gasket*.

**pad** The friction lining of a *disc brake*.

**pallet truck** Industrial vehicle equipped with means of lifting and moving freight on pallets. See also *fork-lift truck*.

**palm coupling** Combined mechanical and pneumatic coupling for attaching a trailer and its *air brake* system to a towing vehicle.

**panel** Sheet metal component of a vehicle body, particularly when part of the outer shell.

**panel body** Fully enclosed truck or van body, constructed from sheet metal panels.

**Panhard rod** Transverse rod pivoted at one end to chassis or vehicle shell and at the other to a *beam axle*, which it constrains in lateral movement.

**pantechnicon (US: moving van)** Large capacity van, particularly one equipped for the transportation of bulky goods or household effects (mainly UK usage).

**parabolic spring** Leaf spring of parabolic taper profile, typically consisting of one to four leaves, and of lower *stack height* than an equivalent *semi-elliptical (multi-leaf) spring*. See also *semi-elliptical spring*.

**park** (1) Position of shift (selector) lever of an automatic transmission vehicle in which the transmission is disengaged from engine and the drive wheels locked. (2) To leave a vehicle in a designated place with engine stopped and parking brake (handbrake) securely applied.

**parking brake** Brake system that holds one or more brakes permanently on when vehicle is parked. Also *handbrake*.

**parking lamp** Lamp to show the presence of a parked vehicle, white to front and red to the rear. In some systems the offside lamps only may be activated. Also *sidelight* (informal).

**parking torque** Turning effort required in steering a vehicle at very low speed.

**part-time case** The gearbox or transmission of a *part time drive*. See also *transfer box*.

**part-time drive** Four wheel drive transmission that permits disengagement of the drive to one axle, giving the option of two wheel or four wheel drive (mainly US informal).

**partial skirt piston** See *slipper skirt piston*.

**particulate trap** Canister containing a filter medium and located within the exhaust tract or an engine, and particularly a diesel engine, to extract particulate products of the exhaust.

**particulates** Solid particle content of the exhaust products, mainly in the form of carbon (soot) and partially burned hydrocarbons. See also *emission*.

**passenger car** Vehicle with its own motive power and designed for carrying usually less than ten persons, and generally for private or non-commercial usage. An *automobile*.

**passenger compartment** Part of a vehicle body that houses the passengers and driver, except where the driver occupies a separate cab.

**passive restraint** Occupant restraint which does not require action of the occupant to fasten, secure or operate, for example an *air bag*.

**patch** (1) Area of contact of tire with ground (informal). Also *contact patch*; *footprint*. (2) A small repair piece for repairing a puncture in an *inner tube*.

**payload** The cargo of a goods vehicle, or the weight of the cargo.

**peak brake power** Highest power developed within the normal operating speed range of an engine. Most commercial diesel engines are governed to operate below absolute peak *brake power* speeds.

**peak power engine speed** Engine speed at which peak power occurs. See also *brake power*.

**peak torque speed** Engine speed at which peak torque occurs. Not necessarily the same as peak power speed.

**peaky** Of an engine, developing useful power over a narrow speed range, thus requiring frequent gear shifting under varying driving loads (informal). See also the antonym *flexible*.

**pedal** Foot operated control.

**pedal effort** Load applied by the driver's foot to depress a pedal.

**pendulum damper** Device employed particularly in diesel engines to attenuate crankshaft vibration by vibrating oscillating weights in antiphase.

**pentroof** Shallow angled wedge or cone, particularly of a *piston crown* or *cylinder head*.

**Perbury drive** A design of toric *infinitely variable transmission*.

**petroil** Gasoline mixed with lubricating oil for use in a *two stroke* engine (UK informal).

**petrol** (US: *gasoline*) Volatile hydrocarbon liquid fuel for spark ignition engines. Also *petroleum spirit*; *motor spirit*. See also *octane number*.

**petrol engine** (US: *gasoline engine*) Spark ignition engine using *gasoline* (petroleum spirit) as a fuel.

**petrol tanker** (US: *gas truck*) Heavy vehicle equipped for conveying and delivering petrol (gasoline).

**pickup truck** A small, open truck.

**pickup coil** Electrical speed sensor for *electronic ignition*.

**pickup lag** Delay of response of an engine to *accelerator* pedal depression.

**pickup truck** Light capacity open truck, usually with a lowering tail gate.

**piling** See *pitting and piling*.

**pilot jet** Carburetor jet that admits fuel downstream of the throttle for starting.

**pin boss** See *piston pin boss*.

**pin slide caliper** A sliding or floating caliper *disc brake*.

**ping** (UK: *pinking*) Detonation or partial detonation in engine cylinder, or the noise thereof (US informal). See also *knock*.

**pinion** A small gear wheel, or the smaller of a meshing pair of gear wheels.

**pinking** (US: *ping*) Detonation or partial detonation in engine cylinder, or the noise thereof (UK informal). See also *knock*.

**pintaux nozzle** Diesel fuel injector of *pintle* type with auxiliary hole through which a fraction of the fuel is directed to the combustion chamber center.

Mainly used in *Comet* type indirect injection systems.

**pintle** (1) Vertical pin or spigot to which a tow bar is attached. Also *pintle hook*. (2) Gas flow control valve. See also *pintle nozzle*.

**pintle nozzle** Diesel fuel injector nozzle in which a spring-loaded needle valve (or pintle) controls a hollow cone shaped fuel spray (Figure P.1).

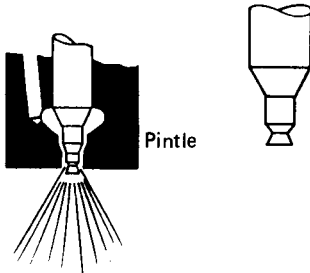


Figure P.1 Pintle nozzle of a diesel injector

**piston** Reciprocating component, usually in the form of a cylinder closed at one end, that operates under fluid pressure within a smooth walled cylinder. In a reciprocating engine gas pressure on the *piston crown* provides the prime force that is converted into rotating mechanical power by the *crankshaft*. See Figure P.2.

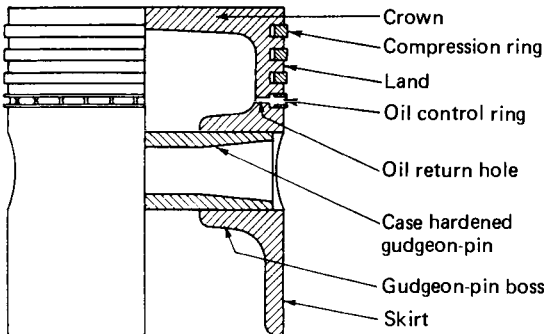


Figure P.2 Half-section of a piston

**piston cap** Additional crown, often of a specially durable or heat-resistant material, fitted to a piston, usually to improve durability. See also *piston crown*.

**piston crown** Closing end of a piston, of various shapes depending on engine type and valve configuration.

**piston pin (UK: gudgeon pin)** Pin that connects the piston to the connecting rod. Also *wrist pin (US)*.

**piston pin boss** Strengthened part of piston which holds the piston pin or gudgeon pin. Also *pin boss (US)*.

**piston ring** Ring, generally of hard, springy material, set in a groove beneath the piston crown or in the piston skirt. Internal combustion engines normally have three to five rings, each fulfilling a particular function. See also *compression ring*; *oil control ring*. See Figure P.2.

**piston skirt** Nominally parallel-sided cylindrical walls of a piston, extending beneath the crown (Figure P.2).

**piston slap** Noise made by contact between an excessively loose or worn piston and the *cylinder wall* of an engine.

**piston speed** Linear velocity of a piston in its reciprocating motion within a cylinder. The term should be qualified as *instantaneous piston speed* or *mean (average) piston speed*.

**pitching moment** See *primary couple*.

**Pitman arm (UK: drop arm)** Lever that converts rotary output from *steering box* to linear movement of a drag link. Also *sector shaft*.

**pitting** Chemical or mechanical surface damage to a metal involving the formation of pits or holes. See also *scuffing*.

**pitting and piling** Erosion of one ignition *contact breaker* point and deposition of metal on the other resulting from high temperature vaporization of the metal, or incorrect condenser capacity.

**pivot pin** (1) Vertical or inclined shaft about which a steered wheel assembly pivots. Also *kingpin*; *knuckle pin* (US informal); *swivel pin*; *wrist pin* (US informal). (2) Any shaft that is used as a pivot or hinge.

**pivot ring** Ring or raised annulus in a clutch casing that acts as a fulcrum for a diaphragm spring. Also *diaphragm spring ring*.

**planet carrier** Disc or *spider* that carries the planet wheels in an *epicyclic gearbox (planetary transmission)*.

**planet wheel** Spur gear wheel of an epicyclic (planetary) gear train that meshes with the central sun wheel and outer internally toothed annulus.

**planetary transmission (UK: epicyclic gearbox)** An epicyclic gear system, consisting in basic form of an internally toothed *annulus* or *ring gear* and a central externally toothed sun wheel, with usually three or four planet wheels or pinions meshing with the sun wheel and annulus. The planet wheels are often carried as a unit on a *planet carrier* or spider. Arresting the rotation of the planet carrier, annulus or sun wheel will provide a transmission ratio between the two remaining elements. Planetary gear sets can be coupled to increase the available number of ratios. See also *automatic transmission*; *pre-selector*; *Wilson gearbox*. See Figure P.3.

**plate** (1) Permanent official notice attached to a commercial vehicle to indicate authorized conditions of use and loading. (2) A positive or negative plate of a battery. (3) A clutch plate.

**plate load** Force applied by *clutch springs* in engaging a clutch.

**platform** (1) Horizontal load bearing surface or floor, particularly of a truck or lorry. See also *loadfloor*. (2) Entry staging of a bus or coach.

**platform lorry (US: flatbed truck)** Truck or lorry carrying a flat platform to which bulk goods or equipment may be lashed with cordage or belts.

**platform trailer** Trailer or semi-trailer with a load carrying platform. See *platform lorry*.

**platinum catalyst** Metallic platinum coating within an exhaust gas *catalytic converter* that accelerates the oxidizing reaction of carbon and hydrocarbon

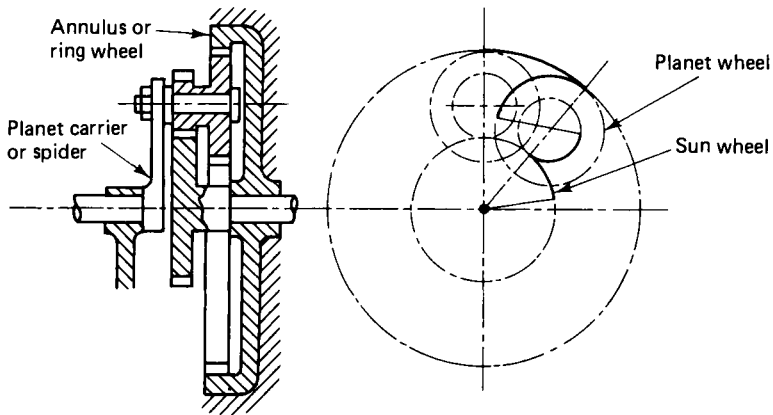


Figure P.3 Planetary or epicyclic transmission

based emissions and breaks down *oxides of nitrogen* without itself undergoing any change. The effectiveness of the platinum is nullified by lead based *antiknock additives*.

**play (US: lash)** Free movement or looseness within a mechanism, as for example any free movement of a steering wheel before the steered wheels respond by turning.

**plenum chamber** Any chamber in which air or gas is held at higher than ambient pressure.

**plug** (1) A (usually removable) stopper or closing element to prevent pressure loss or leakage. (2) Removable electrical connector, normally inserted into a fixed socket. (3) A *spark plug* (informal).

**plug lead** Lead which conducts timed high voltage to spark plug. Also *spark plug lead*.

**plunger** A pumping piston, often in the form of a free piston actuated by a cam, as in a fuel injection pump.

**plunger pump** Reciprocating pump, with valve chest, usually for delivering liquids under pressure. Also called *force pump*.

**plunging joint** A shaft joint or coupling with provision for axial or plunging movement. See also *pot joint*.

**ply** Layer of rubberized fabric from which a tire *carcass* is made.

**ply rating** Index of strength of a tire, originally, but no longer, the number of plies.

**pneumatic suspension** Suspension using air or other gas in compression as a suspension medium. See also *air suspension*; *Hydragas suspension*.

**pneumatic tire** Flexible, hollow rubber toroid forming the outer part of a vehicle wheel (which it covers or 'attires'), and inflated by air pressure. *Tyre* (UK). See also *contact patch*; *cover*; *footprint*.

**pneumatic trail** (1) Distance by which the point of effort of the total lateral force or *cornering force* on a tire lies behind the center of area of the tire *contact patch*. Numerically equal to self-aligning torque divided by lateral

force. (2) Horizontal distance between point of action of the side force due to the *slip angle*, or the *camber thrust*, and the tire contact point.

**point** The switching contact of an ignition contact breaker.

**poisoning** Of an exhaust catalyst, degrading or rendering ineffective by action of lead or other compounds in exhaust gas.

**pole trailer** (1) Full-trailer drawn by a pole or long circular section *towbar* or reach, which is connected to a steering axle. (2) Semi-trailer or full-trailer in which a central tube serves as a chassis, used for transporting lumber or other long and relatively rigid items. See also *spine back*.

**poppet valve** Disc shaped valve, the disc being attached to a stem, the reciprocating movement of which causes the valve to open and close. The valve disc edge is chamfered to facilitate sealing, location and heat transfer. Also called *mushroom valve* because of its shape. The normal type of valve in an internal combustion engine. See also *valve seat*. See Figure E.1.

**popping back** Premature ignition of a fuel/air mixture in an *inlet manifold*.

**port** Hole or aperture shaped to facilitate the flow of gas or liquid into or from a chamber. Usually denoted by its function, as inlet port or exhaust port.

**port closing** Of a *fuel injection* pump, the point of closing of the port by the metering member, corresponding to the nominal start of pump delivery. See also *open period*.

**port opening** Of a *fuel injection* pump, the point of opening of the port by the metering member, corresponding to the nominal end of pump delivery. See also *open period*.

**positive camber** Wheel camber in which wheel slopes outward at the top (Figure C.2).

**positive caster** Arrangement of *steering geometry* in which the center of tire contact lies behind the point at which the *steering axis* intersects the road surface, thus giving a positive or stable self-centering effect. Also *trailing caster*.

**positive crankcase ventilation** Emission control system that prevents crankcase gases from entering the atmosphere, usually by drawing the gases from the crankcase and feeding them into the engine's induction system. Also *PCV*.

**positive displacement pump** Pump that delivers a fixed or metered amount of gas or liquid per stroke or cycle.

**positive ignition** Ignition initiated by a particular event, such as the discharge of an electrical spark, as for example in a *spark ignition engine*.

**positive offset steering** Steering/suspension geometry in which the point of intersection of *kingpin axis* (*steering axis*) with the ground lies inboard of the center of the tire *contact patch* or plane of the wheel. See also *center point steering*.

**post** (1) Nominally upright structural member, particularly for supporting the roof and doors of a vehicle. (2) A battery terminal (US informal).

**post-ignition** Ignition emanating from *hot spots* within an engine cylinder and occurring after the main spark-initiated ignition.

**pot flywheel** Engine flywheel with extending flange or outer rim, usually to accommodate clutch assembly.

**pot joint** Universal joint in which the crosspin rollers are allowed axial movement in an internally slotted cylinder. A **plunging joint**. Also *de Dion joint* or *sliding-block joint*. See also *bi-pot joint*; *tri-pot joint*. See Figure P.4.

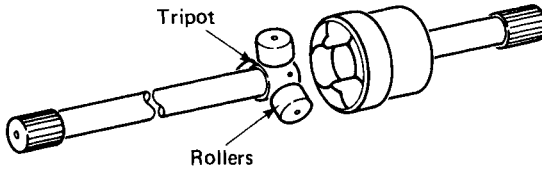


Figure P.4 A tri-pot type of pot or plunging joint

**pour point** Of a fuel oil, nominally the temperature three degrees C above which the fuel will just flow under its own weight. A measure of the low temperature flow characteristics of a fuel.

**power assisted steering** Steering in which driver effort is aided by mechanical, hydraulic or other power, while retaining some degree of road interaction feedback.

**power booster** Device for aiding or amplifying manual effort in operation of a control, such as a brake *servo* (mainly US usage).

**power brakes** Brakes operated by mechanical, hydraulic or pneumatic power rather than by driver effort.

**power divider** Geared unit that splits the power from one input shaft between two or more axles of a tandem axle arrangement. See also *transfer box*; *transfer case*.

**power hydraulic system** In context of braking, a system in which hydraulic fluid is stored under pressure and is metered out to the brakes by driver operation of a valve actuated by the *brake pedal*.

**power jack-knifing** Jack-knifing of an *articulated vehicle* resulting from spin or slip of the wheels under high driving torque (Figure J.1).

**power output** Power developed by an engine, the term normally being qualified by the means of measurement or test specification, and other parameters affecting operation. See *brake power*; *indicated power*; *peak brake power*.

**power shift PTO** Power take-off remotely controlled by mechanical, hydraulic or other form of power control.

**power steering** (1) Steering in which angular movement of the steering wheel actuates a powered steering system, there being no mechanical feedback between road and driver. (2) A power assisted steering system. Informal (and inaccurate). See also *in-line power steering*; *linkage power steering*; *offset power steering*. See Figure R.1.

**power stroke** Stroke of a reciprocating engine during which the piston moves under the effect of combustion pressure, normally taken from top dead center to bottom dead center. Preferred term, but also called *combustion*, *working* or *expansion stroke*. See Figure O.1.

**power take-off** (1) Driven shaft with external coupling on engine or transmission system to which ancillary equipment may be attached, as for example agricultural machinery to a tractor. (2) Separate transmission unit

for attachment to an engine, gearbox or part of a vehicle's transmission system, with external controls, for the driving of ancillary equipment, particularly when the vehicle is stationary.

**powered axle** See *live axle*.

**powertrain (UK: drive line)** Totality of components making up the power transmission system of a motor vehicle, from clutch to final drive. In some instances the term includes the engine. See Figure P.5.

**pre-engaged starter** Positive action solenoid operated *starter motor* in which a pinion engages with a ring gear before the full electric current flows. The pinion is free to freewheel before disengagement when engine has started. See also *overrunning clutch starter motor*.

**pre-ignition** Ignition of the fuel-air mixture in a spark ignition engine before the timed spark, as caused by a hot or glowing surface or other agency. (Obsolete and technically misleading term). See also *spark knock*.

**pre-selector** Semi-automatic change-speed gearbox in which the gear is selected before change is initiated, change being made by depressing a pedal. See also *Wilson gearbox*.

**prechamber** Small chamber in which combustion is initiated prior to delivery by way of a narrow port into the main combustion chamber of an engine. Prechambers are of widely varying design and are generally formed in the cylinder head. It is normally understood that fuel is injected within a prechamber, whereas it is not necessarily injected within an *air cell*. The term *indirect injection engine* is used in the UK and *precombustion engine* in the USA to describe engines employing prechambers. Also called *antechamber*. See also *Comet head*; *Lanova air-cell*.

**precombustion engine (UK: indirect injection engine)** Engine, particularly a diesel engine, employing a *prechamber*.

**precompression** Compression of a gas prior to the main compression cycle.

**pressure cap** The filler cap of a *pressurized cooling system* (mainly US usage). See also *radiator*.

**pressure charge induction** See *harmonic induction engine*; *ram air induction*.

**pressure drag** Aerodynamic drag resulting from difference between pressures acting on forward and rearward facing surfaces. See also *friction drag*; *induced drag*.

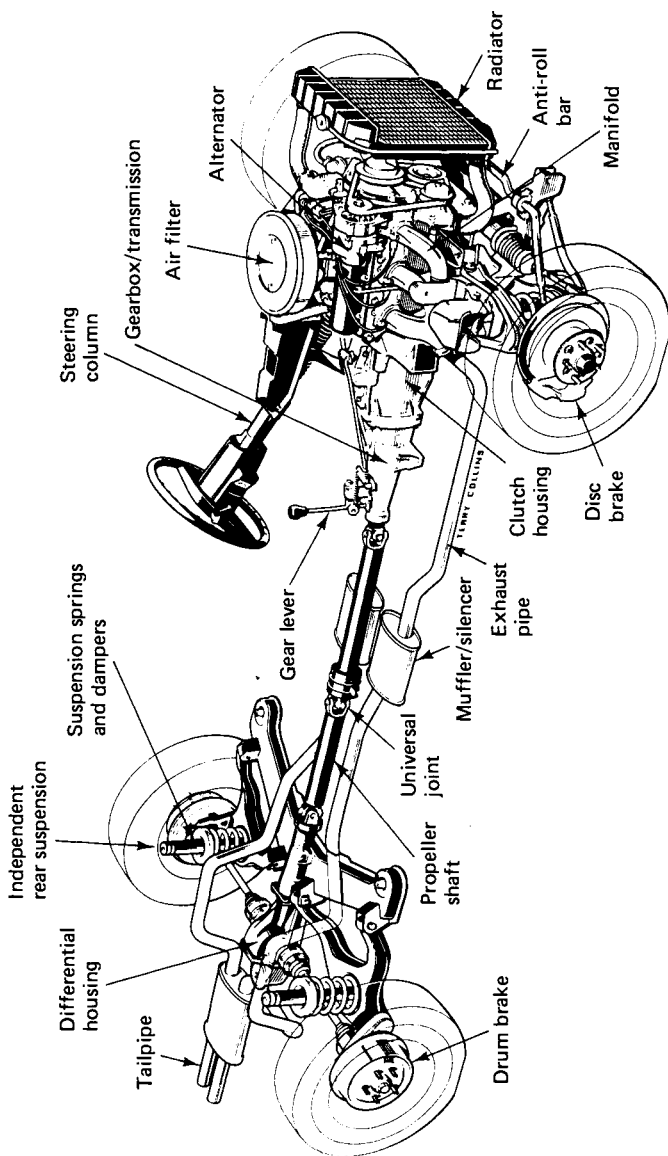
**pressure plate** Rigid disc shaped clutch element that acts under spring load against the friction lining of a clutch *driven plate (clutch disc)* to effect engagement (Figure C.4).

**pressure plate spring** Spring, either a diaphragm spring or one of a group of coil springs, that holds the *clutch pressure plate* in contact with the clutch *driven plate (clutch disc)* (Figure C.4).

**pressure protection valve** Pneumatic valve that prevents inadvertent loss of air from a pressurized system, as for example the *air brake* system of an *articulated vehicle* when the trailer and tractor are uncoupled.

**pressure wave supercharging** Increasing engine intake pressure by tuning the intake duct to resonate at a particular operating speed. See also *ram air induction*.

**pressurized cooling system** Engine sealed cooling system which uses the vapor pressure of the hot coolant to create an above ambient pressure in the system and thus raise the boiling point of the coolant.



*Figure P.5* The powertrain and running gear of a Ford passenger car

**primary** In context of engine balancing, related directly to engine speed (rather than to twice engine speed). See also *primary couple*; *primary force*; *secondary*.

**primary couple** Out-of-balance mechanical disturbance in an engine that causes rocking about a horizontal or transverse axis (in a vertical or V configuration engine) at right angles to the *crankshaft*, and at engine speed. Also called *pitching moment* if about transverse axis and *yawing moment* if about vertical axis.

**primary force** Out-of-balance force (in the plane of the cylinder axis in an in-line engine, or its bisection in a V configuration engine) resulting from disparity of static mass balance of rotating and reciprocating parts. Also called *free inertia force*.

**primary shoe** A leading brake shoe in a drum brake. Also *forward shoe* (US).

**priming** Introducing fuel into the *induction system* of an engine prior to starting.

**producer gas** Predominantly hydrogen gas produced by passing air and steam over burning coke or coal. Formerly used as an engine fuel in times of acute shortage of conventional fuels.

**progressive spring** Spring in which the spring rate (or force per unit deflection) increases with deflection.

**propane** Hydrocarbon gas fuel stored in liquid state under pressure. A constituent of *liquefied petroleum gas*.

**propeller shaft** (US: *driveshaft*) Rotating shaft, usually tubular, that transmits the drive from the main change speed gearbox to the differential or final drive. Also *drive shaft*. See also *Hotchkiss drive*. See Figure P.5.

**proportional control** Closed-loop engine control system in which the feedback signal is proportional to output of the measured parameter. See also *limit cycle controller*.

**proportioner** Valve in a hydraulic or pneumatic system that apportions effort between two or more circuits, as in a *split braking system*. See also *compensator*.

**PTO** See *power take off*.

**public service vehicle** Vehicle intended to carry passengers (usually twelve or more, not including the driver) for hire or reward. This definition is subject to local variation, particularly regarding the minimum number of passengers. Also *PSV*. See also *omnibus*.

**pull-type clutch** Clutch with a clutch release or throwout mechanism operated by a pull action, as used on heavy vehicles where depression of the *clutch pedal* also operates a *gearbox brake* to quicken the operation of synchronization. See also *push-type clutch*.

**pullrod** Any rod that transmits linear displacement to an actuating mechanism when in tension.

**pulsation damper** Any device, such as a hydraulic accumulator, for damping pulsations in a fluid system, as for example the pressure pulses from a *fuel pump*.

**pulse air injection** System that uses exhaust pressure pulsations to force air into an exhaust system to oxidize exhaust products. See also *air check valve*.

**pulse wheel** Indexed or castellated wheel whereby timed electrical pulses are sent to the spark plugs of an engine ignition system, usually replacing the conventional *distributor*.

**pump** (1) Mechanical device which causes liquids, gases or vapors to flow by means of pressure differential or positive displacement. (2) The impeller of a *torque converter* (mainly American informal). See also *oil pump*; *water pump*.

**pump control rack** Rack engaging with pinion that sets the position of the *fuel delivery plunger* in a *fuel injection pump*.

**pumping loop** The sequence of events comprising the exhaust and induction strokes of an engine, usually up to closure of the *intake valve*.

**pumping losses** Part of the total or indicated power of an engine that is expended on the induction of the fuel and air charge into an engine, and expelling the gases on completion of combustion. See also *brake power*.

**puncture** A hole in a tire through which pressurized air escapes. See also *blow-out*.

**punt chassis** Chassis consisting of a continuous box-structure, with side flanges and central well, to which a nominally non-structural body is attached.

**purge** In *exhaust emissions* testing, to remove residual gases from test equipment.

**purge cock** (UK: *drainplug*, *drain tap*) Outlet to facilitate draining or emptying a working fluid or lubricant from an engine, gearbox, etc.

**pusher axle** Rear powered axle of a *tandem axle* arrangement, when the forward axle or axles are non-powered or 'dead'.

**pusher tandem** Tandem axle arrangement in which only the rear axle is powered.

**pushrod** Rod that transmits linear displacement to an actuating mechanism when in compression, as for example *cam lift* of a four-stroke reciprocating engine to the valve gear. See *pushrod engine* and Figure V.1.

**pushrod engine** Reciprocating engine in which the valve mechanism is actuated by intermediate pushrods rather than directly by the cam (as in an overhead camshaft engine). Usually describes an *overhead valve* engine in which the pushrod transmits the linear displacement or lift of the cam to a rocker lever, the camshaft normally being at a lower level than the cylinder head (informal). See Figure O.3.

**push-type clutch** Clutch with a *clutch release mechanism* operated by a push action (Figure C.4). See also *pull-type clutch*.

**pyrene** A complex hydrocarbon product of combustion, of high toxicity and carcinogenicity. A constituent part of the *unburned hydrocarbon* content of exhaust gases. See *hydrocarbon*.

## Q

**quadrant** (1) The toothed sector used in a *worm and sector steering gear* (also called worm and quadrant steering gear). (2) Position indicator of an automatic transmission selector (shift) lever. (3) Any mechanical item of quadrant form.

**qualifying tire** Racing tire of high frictional coefficient but short life for achieving fast times on practice laps to qualify for favorable starting grid position.

**quarter elliptic** Cantilevered half of a semi-elliptic leaf spring.

**quarter light** (1) Rear side window of a passenger car or truck cab, particularly when set aft of the door. (2) Side window set aft of the opening window of a rear door. The quarter light is sometimes within the door area and may be vertically hinged for opening.

**quartz halogen lamp** High intensity lamp or bulb of quartz glass containing an incandescent halogen gas such as iodine.

**quartz iodine lamp** Also *tungsten halogen lamp*. See *quartz halogen lamp*.

**quench** The conductive cooling of a portion of the cylinder head gases during combustion in an internal combustion engine, usually by minimizing the clearance between *piston crown* and *cylinder head*. The high local *surface:volume ratio* effects rapid heat loss and suppresses detonation, though at the expense of higher hydrocarbon emission. See also *squish*.

**quench motor** Engine exhibiting quench features in combustion chamber design.

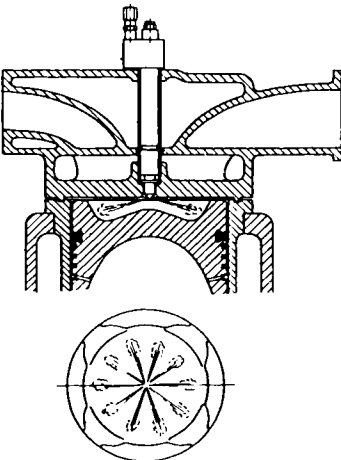


Figure Q.1 The quiescent combustion chamber of a larger diesel engine

**quick-detachable coupling** Quick release air pressure hose connector for use with single line braking systems of trailers and semi-trailers. See also *contact coupling; dummy coupling; stand pipe*.

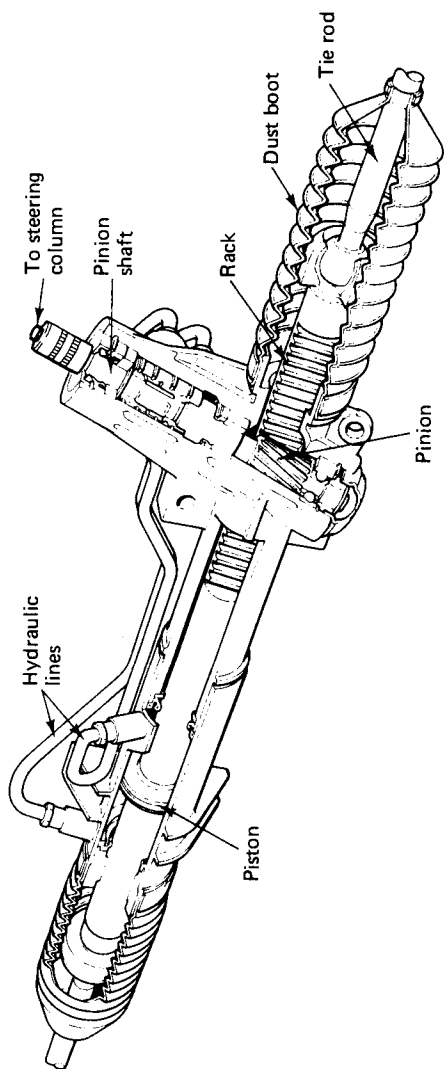
**quick release valve** (1) Valve that enables *brake chambers* of an *air brake* system to be rapidly emptied to effect the quick release of brakes. (2) Control unit which accelerates the release of air pressure from various portions of the brake system.

**quiescent chamber** Type of combustion chamber of a direct injection diesel engine, in which the mixing of the charge is predominantly non-turbulent or quiescent. See also *quiescent combustion*. See Figure Q.1.

**quiescent combustion** Non-turbulent combustion, particularly in a lower speed diesel engine, and normally employing a *multi-nozzle injector*.

**quietening ramp** Sector of engine valve train cam profile in which the acceleration characteristics imparted to the follower (for example an engine valve train) are such as to minimize the generation of mechanical noise.

**quill drive** Mechanical drive system using concentric shafts mounted on separated bearings. The inner shaft is usually of sufficiently small diameter to provide torsional flexibility.



*Figure R.1* The powered rack and pinion steering unit of a Volvo passenger car

## R

**RAC horsepower** Obsolete method of rating engines for taxation purposes using a formula based on cylinder bore and number of cylinders, instigated in England by the Royal Automobile Club. The rating was misleadingly expressed as a horsepower, which it approximated when the formula was introduced. In the USA the same method of rating was unjustly attributed to the SAE.

**RAC rating** See *RAC horsepower*.

**rack and pinion** Steering gear in which a pinion on the end of the steering shaft engages with a horizontal rack, the ends of which are coupled to the *steering arms* by tie rods (Figure R.1).

**radial** (1) Disposed at right angles to an axis. (2) A radial ply tire (informal).

**radial engine** Multi-cylinder engine in which the cylinders radiate from one single-throw crankshaft. For reasons of balance the number of cylinders is normally odd, three usually being the minimum to qualify for the definition. Widely used in aviation, rarely in automotive applications.

**radial ply tire** Tire in which the *plies* run radially, nominally at right angles to the *bead*. Also radial tire; a radial (informal). See Figure R.2.

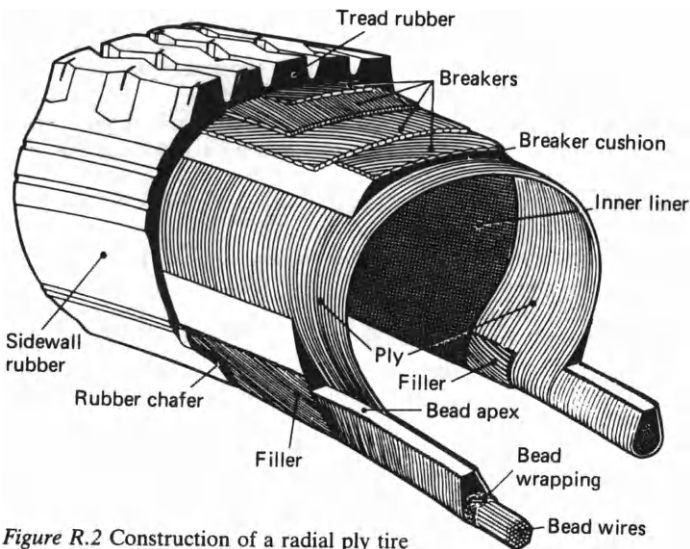


Figure R.2 Construction of a radial ply tire

**radial runout** Condition of wheel and tire assembly when radius of tire tread from wheel axis varies. An out-of-round condition.

**radiator** (1) Part of an engine *cooling system* through which excess combustion heat is lost to atmosphere by means of forced convection (not primarily by radiation as the name suggests) using a circulating liquid such as water or water/glycol to effect heat transfer (Figure P.5). (2) Device for heating a vehicle interior as part of a vehicle heating system. See also *oil cooler*; *water pump*.

**radiator blind** (US: *radiator shutter*) Device that limits the flow of air through a radiator, as for example when an engine is used in conditions of extreme cold.

**radiator cap** Cap that closes header tank of radiator. Also *pressure cap*.

**radiator grille** Protective and decorative guard to conceal radiator and protect it from impact by road debris while allowing free passage of cooling air. Occasionally *grill*.

**radius arm** See *radius rod*.

**radius rod** Suspension linkage providing fore and aft location of an axle. Also *radius arm*; *radius stay*; *torque arm*; *torque rod*. See also *leading arm*; *trailing arm*.

**radius stay** See *radius rod*.

**rag top** (UK: *soft top*) Open car with stowable fabric roof usually incorporating a transparent rear light (or screen) (informal). Also *convertible*.

**rail** A *dragster* (slang).

**rake angle** See *caster angle*.

**ram air** Air in rapid motion relative to the vehicle and therefore possessing kinetic energy, particularly in context of air required to charge an air-breathing device such as a cooling system or engine induction system. Note that on the road the air is stationary (if there is no wind) and that it is the vehicle that moves. Aerodynamic convention sometimes assumes that the vehicle is stationary and that the air is moving.

**ram air induction** Pressure charging using the momentum of the induction air in an intake pipe of tuned length. See also *harmonic induction engine*; *tuned intake pressure charging*.

**ram air supercharging** See *ram air induction*.

**ram pipe supercharging** See *ram air induction*.

**range change** Change-speed transmission for heavy vehicles in which the number of available speeds is doubled by the addition of an auxiliary gearbox (transmission) in series with the main gearbox, engagement of which provides a second range of gear ratios. Sometimes combined with a *splitter* to give a further set of ratios.

**Rankine cycle** Thermodynamic cycle of the steam engine and turbine involving evaporation of steam from water at boiler pressure, adiabatic expansion in cylinder or turbine, and condensation to the original temperature and pressure conditions. The practical steam engine deviates considerably from the ideal cycle in operation.

**rapid transit** Any vehicle intended for rapid transportation of passengers, particularly in urban and suburban areas.

**rated horsepower** See *rated power*.

**rated power** Power of an engine as stated in accordance with an acknowledged standard. See *brake power*.

**rated speed** Engine speed at which rated power is obtained. Sometimes maximum engine speed or *governed speed*.

**rave hook** Looped webbing hook, often of a folded wire rod eye form, for fastening the curtains of a *curtainslider* vehicle.

**RE valve** See *relay emergency valve*.

**reach** A type of towbar.

**reaction member** Any suspension member that reacts a load or force, and provides positive location for another member.

**reactive suspension** Tandem or multi axle suspension in which linkage between the axles or their suspension systems results in interactive response to transmission and braking inputs or bump displacement. See also *balance beam*; *compensating axle suspension*; *non-reactive suspension*; *walking beam*.

**reactor** The static reaction member of a torque converter.

**rear axle** The back axle.

**rear end roll steer** Steering effect imparted to a cornering vehicle by the roll deflection of the rear suspension. See also *roll oversteer*.

**rear engine** Engine mounted behind the rear wheels of a vehicle.

**rear fender** (UK: **rear wing**, **tonneau panel**) Body panel of passenger car between rear door and end of vehicle, and enclosing rear wheel (Figure B.4).

**rear lamp** Red lamp at extreme sides of back of vehicle to indicate presence and width. See also *tail lamp*.

**rear spoiler** Transverse aerofoil or projecting surface mounted at the rear of a vehicle to reduce lift and drag.

**rear view mirror** Internal mirror to provide driver with rearward view through the backlight.

**rear vision area** Portion of the backlight used by the inside rear-view mirror for vision to the rear.

**rear wheel drive** Transmission system in which the engine power is delivered to the rear wheels of a vehicle. See also *Hotchkiss drive*.

**rebore** Regrinding of worn or damaged cylinder bore of an engine (or pump) prior to the fitting of oversize piston, usually as part of a reconditioning process.

**rebound clip** Metal clip to prevent separation of leaves of a multi-leaf spring on rebound.

**rebound** Extension of suspension travel beyond static condition.

**rebound stop** Device for increasing the spring rate towards the end of rebound travel.

**recapped tire** A retreaded tire (informal).

**reciprocating engine** An engine in which a piston is constrained to move to-and-fro in a cylinder by a *crankshaft* and *connecting rod*, or other mechanical arrangement.

**recirculating ball steering** Type of *worm and nut* steering in which recirculating steel balls occupy the space between the nut and worm wheel, thus reducing friction.

**recoil starter** Engine hand starter in which the energy for starting is stored in a coiled spring, or which uses a spring to re-wind a hand pulley-cord.

**reconditioned engine** Used engine renovated for continued use by rebore,

regrinding of crankshaft journals and replacement of items subject to wear or or other forms of degradation. **Recon** (slang). See also **short engine**.

**recovery vehicle** (US: **wrecker**) Salvage vehicle equipped to retrieve a damaged or stranded vehicle. Also **breakdown truck**.

**recreational vehicle** Vehicle intended primarily for off-highway leisure use. Also **RV**.

**rectifier** Electrical device for changing alternating to direct current.

**reed valve** One-way valve in which sprung plates or fingers deflect under pressure to admit a working fluid. Sometimes used in two-stroke motorcycle engines and in air compressors.

**reflector** See **reflex reflector**.

**reflector panel** An external panel that reflects incident light.

**reflex reflector** Molded optical mirror to indicate presence of a vehicle by reflecting incident light close to the direction of source.

**refuse vehicle** (US: **garbage truck**) Vehicle for collecting and compacting waste. **Dust cart** (UK informal). **Garbage truck** (US informal).

**regenerative braking** Braking in which the loss of kinetic energy from braking is stored and subsequently fed back to provide tractive effort. Currently practical only in electric vehicles where braking can be aided by switching the motor to generator mode, the recovered energy being stored in the battery.

**regenerator** A form of heat exchanger.

**regrooved tire** Used tire on which a new tread has been cut, either into the original tread or on a **retread**, but to a greater depth than that of the original molded groove.

**regulator** Electrical, electronic or semi-conductor assisted device for stabilizing or controlling the current and voltage in a vehicle electrical system. See also **current regulator**; **cut-out**; **electronic regulator**; **voltage regulator**.

**reinforcing plies** Plies laid circumferentially beneath the tread of a tire. Also **undertread**.

**relay** (1) Electrical switch magnetically operated by flow of current through a coil, used prior to electronic systems for **voltage regulators** and **current controllers**. (2) Any unit, mechanical, electrical or otherwise, that remotely actuates or switches in response to a signal or stimulus.

**relay emergency valve** Valve that applies trailer brakes in the event of a break-away. Also **RE valve**.

**relay lamp** (UK: **additional direction indicator lamp**) Additional flashing traffic indicator, particularly at side of long vehicle.

**relay rod** A **track rod** or part of the track rod directly coupled to the **drop arm** (**pitman arm**). Also **intermediate rod**.

**relay valve** Valve situated near local reservoir and brake chamber of an **air-brake** system to decrease the response time of the brake, particularly on long vehicles.

**release bearing** See **clutch release bearing**; **throwout bearing**; **throwout sleeve**.

**release lever** See **clutch release lever**.

**release lever plate** Clutch element that communicates the axial motion of the **clutch release bearing** to the **clutch release levers**.

**reluctor** Electronic spark triggering device in an electronic ignition system.

**remold (UK: remould)** Used tire onto which a new *tread* has been molded.  
**removal van (US: moving van)** Large capacity van for removal of household effects. See also *pantechnicon*.

**Research Octane Number** One of the standard methods for determining the octane value of a fuel. The quoted octane value of a fuel in the UK. See also *Motor Octane Number*.

**retaining ring** (1) Any annular fitting for holding a movable item securely in place. (2) Clamping device for holding a *headlamp* in position.

**retard stop** Mechanical contact to restrict degree of ignition retard of a centrifugal advance *distributor*. See also *advance stop*.

**retarded ignition** Timing of the ignition spark to occur later than the optimum timing for fuel of specified octane rating. Ignition may be intentionally retarded to enable an engine to operate on fuel of lower than specified quality, or may be out of adjustment. See also *advanced ignition*.

**retarder** Any braking device that supplements a vehicle's *service brake* by dissipating energy of motion, as by electrical or hydraulic means. See also *electric retarder*; *engine brake*; *exhaust brake*.

**retread** See *retreaded tire*.

**retreaded tire** Used tire to which a new *tread* has been affixed by vulcanization to extend its useful life. Retread, informal. Also *remould* (UK), *remold* (US). See also *regrooved tire*.

**rev counter** A tachometer (informal)

**reverse flow** See *cross scavenging*.

**reverse gear** Gear that changes the sense of rotation of the output shaft with respect to the engine, thus permitting rearward motion of the vehicle.

**reverse rod** Rod that connects control lever to the reverse gear *selector mechanism* in an *automatic transmission*.

**reversed clutch** Clutch assembly with input and output shafts on the same side, as for a *transverse engine* car.

**reversed Elliot** Arrangement of steered stub axle whereby the axle beam terminates in an eye end which holds the *kingpin*. The *stub-axle* kingpin axis divides as a yoke or fork-end which straddles the axle beam end. See also *Elliot axle*; *Lemoine*. See Figure R.3.

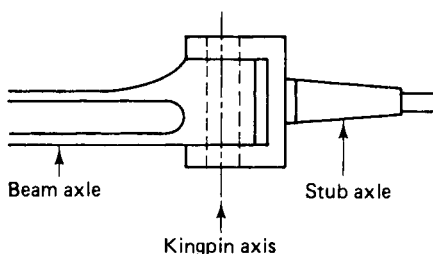


Figure R.3 Reversed Elliot steering arrangement of a beam axle

**reversing bleeper (US: back-up alarm)** Acoustic warning that automatically sounds when a vehicle, particularly a commercial vehicle, engages reverse gear.

**reversing lamp (US:back-up lamp)** Lamp to illuminate to the rear of a vehicle.

**revolution counter** See *tachometer*. Also *rev counter* (informal).

**rhombic drive** Mechanism that converts reciprocating to rotary motion when two pistons are required to operate out of phase on a common axis. A feature of some *Stirling engines*. See Figure R.4.

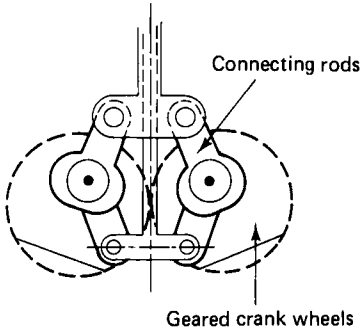


Figure R.4 Rhombic drive crank and connecting rod arrangement of a Stirling engine

**rib** Raised circumferential feature of a tire tread pattern.

**Ricardo engine** A standard variable compression engine used for test or research purposes.

**Ricardo head** Type of high squish, high turbulence combustion chamber for *side valve (L head) engines*.

**rich mixture** Fuel/air mixture in which the proportion of fuel exceeds that necessary for theoretically complete or *stoichiometric* combustion.

**ride** Qualitative and quantitative nature of the response of a vehicle to road perturbations, particularly in relation to the performance of the *suspension* system and its influence on the degree of comfort experienced by the occupants.

**ride clearance** Maximum displacement in compression of a suspension unit from the normal load position. Also *ride height*.

**ridging (US: nibbling)** Effect of lateral force on a tire resulting from glancing contact with a rut or shallow ridge.

**right hand drive** Controlled from the right hand side of the vehicle.

**rigid** See *rigid vehicle* (UK informal).

**rigid axle** A *beam axle*.

**rigid vehicle** A non-articulated vehicle, particularly a commercial vehicle carrying the payload on its own axles (Figure R.5).

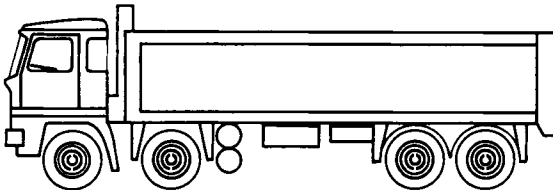


Figure R.5 A rigid eight-wheeler tipper truck

**rim** Part of a wheel assembly on which the tire is mounted.

**rim flange** The retaining flange of a wheel rim, which supports and retains the tire *bead*.

**rim pull** Tractive effort of a vehicle as measured at the wheel/road interface, or as calculated from torque and *transmission ratio* data.

**rim width** The width across a wheel, measured between the rims.

**ring expander** Annular spring within *piston ring* to enhance sealing action of lower rings and in worn cylinder bores.

**ring gap** Gap in the annular shape of a piston ring, enabling the ring to be opened out for installing.

**ring gear** (1) Spur gear teeth set on periphery of flywheel with which the starter motor pinion engages (Figure B.2). (2) Any large diameter annular gear wheel, whether internally or externally toothed. See also *annulus*.

**ring groove** Annular slot or recess in piston into which a piston ring fits.

**rising rate suspension** Suspension in which the spring rate increases with compression.

**road feel** Feedback of front suspension and steering input to steering wheel, and to driver.

**road tanker** Commercial vehicle equipped to convey liquids or bulk powder.

**road train** Heavy goods vehicle towing one or more trailer. See also *locomotive*.

**roadholding** Qualitative, and non-technical, term for handling and particularly freedom from *oversteer*.

**roadster** Passenger car of sporting appearance. A *convertible* (US informal).

**roadway flusher** Vehicle equipped for washing roadways. A watering cart.

**rocker arm** Centrally pivoted beam which transmits a linear displacement at one end to a required linear displacement at the other. In particular the member of the *valve train* of an engine that transmits the lift of a cam to operate a *poppet valve*. See also *Roesch rocker*. See Figure E.1.

**rocker** See *rocker arm*.

**rocker arm cover** (UK: **rocker box**) Cover for the rockers and associated valve gear of an engine, attached to the cylinder head (Figure E.1).

**rocker arm shaft** See *rocker shaft*.

**rocker shaft** (1) Shaft about which rocker arms pivot in a valve train. Also rocker arm shaft. (2) A steering sector shaft.

**rod** (1) A *connecting rod* (informal). (2) A car tuned for performance or otherwise personalized (slang). (3) To scour or clean pipework of a cooling or hydraulic system.

**rod bearing** See *connecting rod bearing*.

**Roesch rocker** Pressed rocker arm of concave section, pivoting on a semi-spherical washer with nut to facilitate adjustment rather than on a *rocker arm shaft*. Also *ball-type rocker*.

**roll** Angular displacement of the sprung mass of a vehicle about its longitudinal axis.

**roll axis** Imaginary axis about which a vehicle rolls. An imaginary line joining the (instantaneous) roll centers.

**roll bar** (1) Single element transverse frame to protect occupants of an open

car in event of a roll-over. Also **roll-over bar**. (2) An **anti-roll bar** in a suspension system (informal).

**roll cage** Safety structure built onto an open or convertible car, agricultural tractor or off-highway vehicle to protect occupants in event of a roll-over.

**roll camber** Change of wheel camber resulting from suspension roll.

**roll center** Instantaneous geometric center about which a vehicle body rolls, as determined by the suspension geometry. Normally, both axles will have their own roll centers, the line joining these determining the **roll axis**.

**roll oversteer** Roll steer which increases oversteer or reduces understeer, often as a consequence of an unsatisfactory rear suspension geometry.

**roll rate** (1) Suspension roll stiffness. (2) Vehicle roll velocity.

**roll steer** Change of **steer angle** due to suspension roll.

**roll stiffness** Resistance of a vehicle to rolling, expressed mathematically as a moment per unit angular displacement in roll.

**roll understeer** Roll steer which increases understeer or reduces oversteer.

**roll velocity** Angular velocity about the roll axis.

**roller clutch** Freewheel or one way clutch using hardened balls in tapered detents.

**roller lifter** (1) Overhead cam valve lifting mechanism in which each cam is individually carried on a rolling element bearing, usually a needle bearing. (2) Cam follower, lifter or tappet incorporating a small wheel which is in rolling contact with the cam. Rare, except in some larger diesel engines.

**rolling radius** Radius of loaded tire from axis to center of tire footprint.

**rolling resistance** Resistance to motion on a flat road surface, attributable mainly to rolling and mechanical friction, but excluding air resistance.

**rolling road** Test apparatus consisting of horizontal powered cylinders on which the road wheels of a vehicle ride to facilitate laboratory observation of the performance of a vehicle, its engine and transmission, under simulated road conditions. A **dynamometer**.

**rollover** Overturning of a vehicle by rolling.

**roof bow** See **roofstick**.

**roof lining (UK: headlining)** Fabric or soft material roof ceiling of a vehicle passenger compartment or cab.

**roof rack** Framework, usually detachable, for carrying items on a vehicle roof.

**roof spoiler** An **air deflector** mounted on the roof of a commercial vehicle cab, or on a vehicle towing a tall trailer (mainly UK usage).

**roofstick (US: roof bow)** Transverse frame or stiffener supporting a vehicle roof, but particularly the curved roof of a box body van or bus.

**Roots supercharger** Mechanical supercharger in which air pressure is provided by the contiguous rotation of two or three lobed rotors. **Roots blower** (informal). Not Rootes.

**rose joint** Proprietary eye-end or ball and socket joint incorporating a spherical bearing.

**rotary engine** (1) Engine that converts the energy of gas expansion to mechanical power by direct rotary as opposed to indirect reciprocating action. See also **Wankel engine**. (2) Obsolete form of **radial engine**, used mainly for the propulsion of early aircraft, in which the crankshaft remained stationary while cylinders and airscrew rotated about the

crankshaft axis. See Figure W.1.

**rotary valve** Valve system of an engine or pump in which the valve ports form part of a rotating assembly, usually of tubular or disc configuration.

**rotating beacon** Any light system that displays a rotating beam of light in a nominally horizontal plane. Also *rotating warning lamp*; *warning light system*.

**rotating warning lamp** See *rotating beacon*.

**Rotoflex joint** Proprietary *universal joint* in the form of a hexagonal rubber ring.

**rotor** (1) Component or assembly of components that turns about its own axis, as of a turbine or electric motor. (2) The rotating part of a *rotary engine*, such as a *Wankel engine*, that converts gas expansion into rotary motion. (3) The rotating part of an axial compressor or *gas turbine* that carries (and includes) the blades. (4) The contact arm of the distributor in a spark ignition engine. Also *rotor arm*.

**rotor arm** Rotating ignition distributor component that establishes high tension electrical contact between source and the individual spark plug HT leads.

**rubbing strip** Longitudinal rubber or plastics molding attached at waistline of vehicle to prevent damage through contact or minor impact.

**Rudge nuts** Quick release nuts for releasing wheels, particularly on racing cars.

**rumble** (1) Low pitch thudding, differing from knock and accompanied by engine roughness, usually caused by high pressure rise rate associated with very early ignition or *runaway surface ignition*. (2) Low frequency tire generated noise, characteristic of certain surfaces.

**rumble seat (UK: dickie seat)** An occasional open tail seat.

**runaway knock** Engine knock that becomes progressively worse under steady speed and load conditions.

**run-flat tire** Pneumatic tire capable of limited operation without air inflation.

**run-on** Continued firing of a spark ignition engine after the ignition system has been switched off. Also *running on*. See also *dieseling*.

**run-on tire** Pneumatic tire designed for use with special rims to prevent bead unseating in the event of a puncture or blow-out, thus enabling a moving vehicle to be brought safely to rest.

**runaway surface ignition** Improper ignition within engine cylinder emanating from hot engine components (not from carbon deposits) and becoming more pronounced as engine temperature increases. See also *deposit-induced runaway surface ignition*.

**running board** Lengthwise horizontal step at sill level to facilitate access to a vehicle.

**running gear** (1) The driving, steering and suspension mechanism of a vehicle. This term often implies the unsuspended undercarriage components such as wheels and axles, final drives and steering linkages. (2) The undercarriage of a vehicle.

**running-in.(US: breaking-in, wearing-in)** Initial operation of new or rebuilt machinery under light load and reduced speed to ensure even bedding of bearings and reciprocating items, and avoidance or *scuffing* or *seizure*.

**running on** See *run-on*.

**runout** Eccentricity, and in some cases allowable eccentricity, of a shaft, bearing or other rotating component.

**Rzeppa joint** Constant velocity joint in which driving and driven members bear spherically upon caged balls.

## S

**S-cam brake** Brake with S shaped cam to compensate for lining wear.

**sac** Cavity immediately before the discharge orifice of a diesel fuel injector (Figure I.3).

**sac volume** Volume of the sac of a diesel fuel injector.

**saddle** (1) The molded seat for the rider of a bicycle or motorcycle. (2) The flat or concave support and attachment point of an axle on which a *leaf spring* is mounted, often with an intermediate *cushion*. (3) Any concave or flat component or surface that provides positive location for the attachment of an item. See also *seat*.

**SAE rating** Standard of engine horsepower measurement using a bare engine, thus excluding losses to generator, pumps and other ancillaries. See also *DIN rating*.

**safety belt** See seat belt.

**safety bumper** Bumper designed to protect vehicle on impact or reduce injury on impact with other road users. See also *Federal bumper*.

**safety glass** Glass that is resistant to impact and that shatters in such a way as to minimize injury to impacting occupant. See also *laminated glass*; *toughened glass*.

**saloon** (1) Passenger compartment of a bus or coach. (2) Saloon or sedan car.

**sandshoe** Trailer *landing leg* foot for use on soft or uneven terrain.

**scatter shield** Protective safety cover over any item liable to explosive failure, such as the clutch assembly of a racing car.

**scavenge pump** (1) Oil pump that returns oil to the main oil reservoir in a dry sump lubrication system. (2) Any pump that serves to remove unwanted fluids or suspensions from a system.

**scavenging efficiency** The ratio of the mass of working gas retained in an engine cylinder at completion of the exhaust cycle to the total charge mass supplied. See also *pumping loop*.

**scavenging** Removal of exhaust gases from an engine cylinder, particularly by an induced flow of gas.

**Schnuerrle system** System of scavenging in two stroke engines, also called *loop scavenging* or reversed loop scavenging, in which the scavenging flow enters and leaves the cylinder from the same side, describing a loop from piston crown to cylinder dome.

**Schrader valve** Type of pneumatic non-return valve used especially for tire inflation. Depression of a central spigot opens the valve to facilitate inflation and the measurement of tire pressure.

**scoop** A cowed aperture to gather and direct ambient air, generally for cooling. See also *naca duct*.

**scouring** Form of tire wear caused by inaccurate tracking.

**scout car** A small military vehicle, mainly for reconnaissance.

**scraper ring** Piston ring that removes excess oil from a cylinder bore and

returns it to the lubricating circuit. Also *oil control ring* (Figure P.2).

**screen** Transparent panel for dividing compartments of a vehicle or deflecting airflow. Also *light*, as in *backlight*. A windscreen or windshield.

**screen wiper** (US: *windshield wiper*) Windscreen or windshield wiper (UK informal).

**screw and nut steering** See *worm and nut steering*.

**scuffing** Abrasive or adhesive damage to surfaces in relative motion resulting in scraping or scratching, for example of cylinder bore journal bearings, piston rings, cams and tappets. See *pitting*.

**scuttle** The lower, forward part of a driver's cab or passenger compartment that accommodates the legs of front-seated occupants and forms a *bulkhead* with the engine compartment (UK informal).

**sealed beam** Lamp, such as a headlamp or fog lamp, of which all components such as lens, reflector and light source are an inseparable unit.

**seat** (1) Support and attachment point, particularly where load carrying, as for example a spring seat. (2) The seat of a driver or passenger. See also *bucket seat*; *squab*.

**seat belt** Occupant restraint system consisting of webbing and latching hardware, and firmly anchored to the vehicle structure.

**seat pan** Transverse horizontal structural panel on which seats, usually only the rear seats in a passenger car, are placed.

**secondary** In engine balancing, an event occurring at twice engine speed. See also *secondary couple*; *secondary force*.

**secondary brake** Heavy vehicle spring brake system which, when air pressure is released, allows the spring brake to exert force, and particularly to provide a positive brake force for parking. Air pressure failure will also bring this brake into operation.

**secondary couple** The out-of-balance disturbance in an engine that causes rocking about a horizontal or vertical axis (in a vertical or V configuration engine) at right angles to the crankshaft, and at twice engine speed.

**secondary force** The out-of-balance force (in any plane of the crankshaft axis) resulting from disparity of static mass balance of rotating and reciprocating parts, and acting at twice engine speed.

**secondary shoe** The *trailing shoe* of a drum brake (Figure C.1).

**secondary venturi** Small venturi mounted coaxially within the main venturi of a carburetor to provide higher air velocity. Also *auxiliary venturi*; *booster venturi*.

**sector shaft** Output shaft from a *steering box*, to which the drop arm or pitman arm is attached. Also *rocker shaft*.

**sedan delivery body** (UK: *car-derived van*) Van or delivery vehicle based on a passenger car body and running gear.

**sedimenter** Device for isolating and/or removing sediment from a fuel or other liquid. See also *filter*; *separator*.

**seize** (US: *freeze*) Sudden adhesive or frictional locking of parts normally in lubricated sliding contact, due to surface welding or clamping, as of a piston in its bore. Also *seizure*; *seize-up*.

**select** To choose, and by implication to engage, as of a gear in a change-speed gearbox. See also *pre-selector*.

**selector fork** (US: *shift fork*) Forked member for moving a sliding pinion

into and out of engagement in a change-speed gearbox (Figures G.1 and S.1).

**selector lever** See selector fork.

**selector mechanism** Mechanism for selecting a gear in a change-speed transmission, comprising *gearshift lever*, *selector fork* and associated shafts and bearings (Figure S.1).

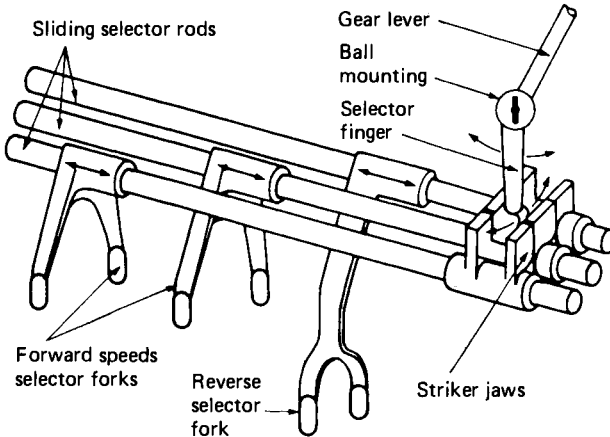


Figure S.1 Multi-rail gear selector mechanism

**selector rail** See *selector rod*.

**selector rod (US: shift rail)** Shaft on which a selector fork travels in a change-speed gearbox. Also *selector rail*. See Figure S.1.

**self-adjusting tappet** Tappet devised to automatically compensate for variations in valve operating clearance, for example a hydraulic tappet.

**self-aligning torque** Torque acting on the tire of a steered wheel that tends to reduce the *slip angle* and contributes to the feel experienced by the driver at the steering wheel. See also *caster action*.

**self-ignition** See *auto-ignition*.

**self-indexing starter** Four pole four brush starter or cranking motor with plate clutch mechanism.

**self-levelling suspension** Suspension system that maintains constant ground clearance or that compensates for unequal loading of the axles. Particularly applied to passenger cars to prevent excessive tail-down trim when the boot or trunk is heavily loaded.

**self-parking wiper** Screen wiper that automatically aligns itself in its parked position when switched off.

**semaphore indicator** Vehicle direction indicator consisting of an arm on the side of the vehicle that can be manually or automatically raised and lowered. See *trafficator*.

**semi-automatic headlamp beam switch** Device which provides automatic or manual control of headlamp beam switching at the option of the driver. See *headlamp beam switch*.

**semi-automatic transmission** Transmission system that requires some manual control, such as gear selection, but that engages the selected gear automatically. A *pre-selector* or *Wilson gearbox*.

**semi-diesel** Compression ignition engine working on other than the ideal diesel cycle, as for example with *hot-plug* ignition.

**semi-elliptical spring** Leaf spring operating as a pin-ended beam reacting loads acting at its mid-length in bending, and so called originally because of its unloaded shape, though modern types approximate a shallow arc or catenary. May be of single or multi-leaf configuration. The traditional means of suspending a beam axle. Also *half-elliptic*; *semi-elliptic leaf spring*. See also *multi-leaf spring*; *parabolic spring*; *single leaf spring*. See Figure L.2.

**semi-floating axle** Live axle assembly in which the weight of the vehicle is transferred from the axle casing or housing to the *axle shaft*, usually by a bearing within the housing. In a live semi-floating axle the axle shaft will carry rotational (torsional) as well as bending loads. Also *half-floating axle*. See also *fully-floating axle*; *non-floating axle*.

**semi-tracked vehicle** Vehicle, particularly a military vehicle, with traction provided by track-laying apparatus, but steered by conventional wheels. A *half-track*.

**semi-trailer** Trailer of which the forward end is normally supported by and coupled to a tractor unit, normally by means of a *fifth-wheel*, the combination of tractor and semi-trailer making an *articulated vehicle* (Figure A.3).

**semi-trailing arm** Trailing suspension linkage, usually employed in independent rear suspensions, in which the pivot axis is inclined backwards in the horizontal plane to impart an increase in negative camber with increase of load. Also *semi-trailing link*. See Figure S.2.

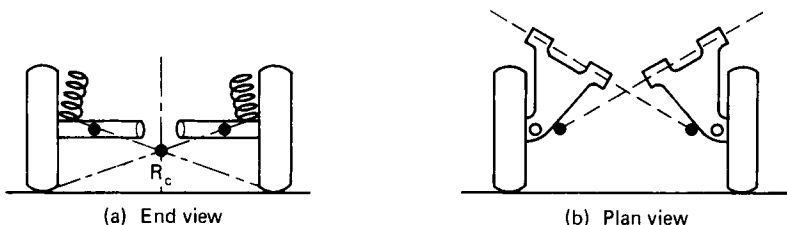


Figure S.2 Semi-trailing arm rear suspension showing position of roll center

**sensitivity** (1) Of a control system, the degree of response to an input, as for example sensitive steering or a sensitive throttle. (2) Of a gasoline fuel, the difference between the Research and Motor Octane Numbers. **nsor** Device in a control system that provides information from an input, as for example of rotational speed or line pressure.

**separator** Device for removing suspended particles from a fluid, or water from a fuel or oil. See also *filter*; *centrifuge*; *cyclone*.

**service brake** Primary brake used for retarding and stopping a vehicle.

**servo** A *servomechanism* (informal).

**servo-assisted** Assistance, particularly of human effort, by mechanical power, as in servo-assisted brake, direct manual operation in some instances being possible without the aid of the servomechanism.

**servomechanism** System or device that supplements physical effort in operating a control (as for example a brake or clutch), either by direct mechanical amplification of feedback or by external power assistance (Figure S.3).

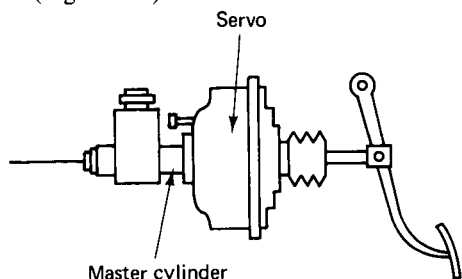


Figure S.3 A direct pedal-operated brake pneumatic servo

**set-back axle** Vehicle *running gear* configuration in which the front axle is set substantially back from the front of the vehicle.

**shackle** Pivoting link between a leaf spring and its mounting, comprising two coupled parallel rods.

**shell** A bare enclosed structure, but especially one made mainly of panels. A *monocoque* structure. A *body shell*.

**shell bearing** Plain bearing formed from two interlocking and abutting thin walled semi-circular cusps (Figure C.9).

**shell structure** Vehicle structure consisting predominantly of stress carrying panels. See also *monocoque*; *unitary construction*.

**shift fork (UK: selector fork)** Forked member for moving a sliding pinion into and out of engagement in a change-speed transmission (Figure S.1).

**shift lever** See *gearshift lever*.

**shift range** The engaged ratio set of a range change or two-speed transfer gearbox or transmission. Mainly US usage.

**shift valve** Valve that actuates the automatic gearchange in an automatic transmission following the signal from the throttle and governor.

**shimmy** Low amplitude mechanical vibration, particularly as an imbalance fault of steered wheels. Wheel wobble (informal). See also *lateral runout*; *tramp*.

**shock** A suspension *shock absorber* (informal).

**shock absorber** Mechanism for damping vibration in a sprung system, such as a vehicle suspension. Also *shock damper*. A telescopic hydraulic damper (Figure S.4).

**shocker** A shock absorber (slang).

**shoe** The arcuate internally expanding element of a drum brake, to which the friction lining is attached (Figure D.8).

**shooting brake** See *estate car*; *station wagon* (UK archaic).

**short block** See *short engine*.

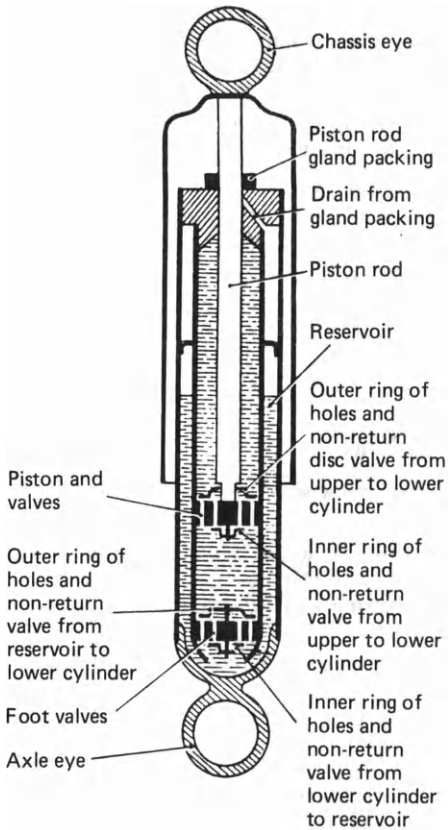


Figure S.4 A telescopic shock absorber

**short engine (US: short block)** (1) Incomplete engine, usually lacking cylinder head and ancillaries. (2) A reconditioned engine as in (1).

**shoulder harness** Belt occupant restraint system in which an anchored length of webbing passes over one shoulder of an occupant and is fastened at waist height. May be used in conjunction with a seat belt.

**shut line** Visual line of styling significance, as of the outline of closed doors, hatches and other hinged features.

**shutter** (1) Mechanical device consisting of movable vanes for restricting the flow of air, as for example air flow to cool an engine. See also *radiator blind*.

**siamesed** Abnormally joined or paired: (1) Of cylinder bores, joined metal-to-metal to the full depth of the cylinder, thus precluding the flow of cooling water between them. (2) Of exhaust pipes, parallel pipes joined along part or all of their length. (3) Of valve ports, arranged so that two adjacent valves are served by one port.

**sideboard** See *side panel*.

**side draft carburetor** Carburetor with horizontal barrel.

**side intrusion bar** Reinforcing beams, usually set within the door structure of a vehicle, to reduce intrusion in side impact.

**side lamp** Low intensity lamp mounted on each forward corner of a vehicle to indicate presence from front. See also *parking lamp*.

**side light** The light emitted by a side lamp (and not the item itself).

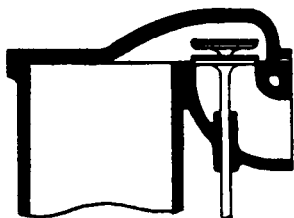
**side marker lamp** Lamp mounted on the side of a long vehicle or vehicle combination particularly to indicate its presence to other vehicles.

**side panel** Raised panel at either side of an open truck's platform, to retain the load. See also *dropside flat*. Also *sideboard*.

**side screen** Usually flexible and detachable side windows of an open car, such as a sports car.

**side stand** Retracting leg to support a motorcycle in an upright position when parked.

**side valve (US: L head, T head)** Of an engine, having the valves and valve gear to the side of the cylinder rather than above it, and normally mounted in the cylinder block. See also *overhead valve*. See Figure S.5.



*Figure S.5* Diagrammatic representation of a side valve engine cylinder and head. The arrangement illustrated, in which intake and exhaust valves are on the same side of the cylinder, is often called L head

**sidewall** (1) The side of a tire, between the tread and bead. (2) Side panel, particularly of a truck or box-van.

**silencer (US: muffler)** Box or chamber within an engine exhaust system for reducing exhaust noise. See also *exhaust pipe*. See Figure E.2.

**Silenbloc bearing** Proprietary rubber/metal anti-vibration mounting.

**single acting engine** Engine in which the working pressure of combustion gases is applied to one side of the piston only, as is normal practice in automotive engines.

**single anchor brake** Drum brake in which the leading and trailing shoes both pivot about one fixed stud or anchor.

**single axle weight** Total weight transmitted to the road by wheels whose axes are 40 inches or less apart for purposes of US legislation.

**single beam headlamp** Headlamp with a single filament and therefore able to provide main (upper) or dipped (lower) beam but not both. See *dual beam headlamp*.

**single leaf spring** Single element suspension spring that operates as a flexible beam, supporting the vehicle axle at mid-section. See also *semi-elliptical spring*.

**single overhead camshaft** Valve train camshaft operating both intake and exhaust valves. Also *sohc*. See also *twin camshaft*.

**single pivot steering** Steering in which a beam axle is pivoted at its mid-point. Rare except on small agricultural and horse-drawn vehicles. See also *Ackermann steering*; *double-pivot steering*.

**single plane crankshaft** Crankshaft in which cranks are in line or disposed at 180 degrees to one another.

**single plate clutch** Clutch with one driven plate (Figure C.4).

**single-reduction axle** Live axle in which the reduction in rotational speed between the propeller shaft (drive shaft) and the final drive is in one stage, normally within the differential casing.

**sipe** Usually shallow groove or channel in a tire tread pattern that may serve to reduce tire noise, dissipate heat or increase flexibility of the tread pattern. Also *kerf*.

**skeletal** Commercial vehicle, semi-trailer or full-trailer chassis on which sturdy cross members or *bolsters* are mounted to support a container or other boxed load.

**skid** (1) Motion of a vehicle when the wheels are locked or partially locked, or when the vehicle moves sideways as in a side slip. A wheel skid. (2) Flat wooden base to facilitate lifting or loading of heavy items. A pallet (US informal).

**skid plate** Any deflector plate under a vehicle that provides protection, as to the oil pan (sump) of an engine (US informal).

**skip** Demountable hopper, usually for refuse or builder's waste (UK).

**skipshift** Gear shifting (gearchanging) between two non-contiguous gears, as from second to fourth.

**skirt** (1) The wall of a piston below the piston crown that spreads side-thrust loads (Figure P.2). (2) Any downward planar extension of a vehicle body for the control of air flow or the reduction of road soiling.

**skylight** Transparent screen in the roof panel of a vehicle.

**slack adjuster** (1) Device that keeps the push rod and cam lever of an air brake at approximately right angles to provide maximum effort despite wear of linings. (2) An adjustable member which transmits brake application force and permits compensations for lining wear.

**slant engine (UK: inclined engine)** An in-line engine designed for installation with its cylinders inclined to the vertical. A *sloper* (informal, and also used of a single cylinder engine).

**slap** (1) Smacking noise produced when a tire traverses road seams or other surface irregularities. (2) Piston slap.

**slave cylinder** Cylinder and piston which, under hydraulic or pneumatic pressure from a master cylinder, actuates mechanical components as for example a brake or clutch *slave cylinder*.

**sleeping cab** Commercial vehicle cab providing sleeping accommodation for a driver.

**sleeve** (1) (UK: cylinder liner) Hard metal tubular lining to an engine cylinder. (2) Any tubular component, usually finished to close tolerances, that fits within an aperture or onto a shaft, but particularly one that is long in relation to its diameter, whereas a bush is usually short. (3) A *sleeve valve*.

**sleeve control** Method of diesel engine injection metering and pumping in which a coaxial sleeve around the plunger controls the opening and closing of the spill port. Particularly used with distributor type pumps.

**sleeve valve** Mechanically operated tubular sleeve or liner, with apertures, located between piston and cylinder wall of an engine, and serving as an intake and exhaust valve through its rotary and/or oscillatory motion which brings the apertures in the sleeve in conjunction with the appropriate ports.

**sleeve valve engine** Engine employing a sleeve valve controlled induction and exhaust system. Currently rare in automotive practice.

**sliding block joint** See *sliding joint*.

**sliding dog** (1) Internally splined collar that slides along the mainshaft of a change speed transmission under the action of a selector fork and so ensures positive engagement of mainshaft gear to mainshaft. Sometimes called synchronizer or synchromesh sliding sleeve. (2) Any form of axially mobile dog clutch.

**sliding gear** A movable pinion in a change-speed *sliding mesh* gearbox. Also *sliding pinion*.

**sliding gear transmission** (UK: *sliding mesh gearbox*, *sliding pinion gearbox*) Manual shift transmission in which the change of gear ratios is accomplished by sliding a spur gear along a main shaft to engage with fixed wheels on a *countershaft*.

**sliding joint** A shaft joint or coupling that allows axial movement between the joined shafts. A *plunging joint*. See also *pot joint*.

**sliding mesh gearbox** (US: *sliding gear transmission*) Gearbox in which the change of gear ratios is accomplished by sliding pinions along a main shaft to engage with fixed wheels on a layshaft. Also sliding pinion gearbox. See also *constant mesh gearbox*; *crash gearbox*, *selector fork*.

**sliding pinion** See *sliding gear*.

**sliding tandem** Two axle commercial vehicle undercarriage with facility for longitudinal relocation of one axle or both axles to obtain a favorable load distribution.

**slinger** (1) Disc used for imparting radial momentum to a liquid, and particularly a lubricating oil, to prevent impingement on a shaft seal. (2) Device used to throw oil from a sump or oil pan onto surfaces requiring lubrication. See also *oil flinger*.

**slip** See *clutch slip*; *wheel slip*.

**slip angle** Angle between plane of wheel and direction of travel of center of tire contact. Also *distortion angle*.

**slipper block** Robust seating that supports one end of a leaf spring and allows sliding fore and aft movement as spring deflects.

**slipper skirt piston** Piston with skirt cut away beneath *piston pin* axis to provide crankshaft clearance. Also *partial skirt piston*.

**slipstreaming** Using the wake of a preceding vehicle to reduce air resistance of the following vehicle.

**sloper** (US: *slant engine*) Engine of which the cylinder axes are inclined to the vertical (informal).

**slotted piston** (US: *split skirt piston*) Piston in which the *skirt* is slotted to counteract effects of thermal distortion.

**slow running jet** Carburetor jet that compensates for the natural reduction in mixture strength at low engine speed by supplying excess fuel. Also *idling jet*. See also *idle system*.

**sludge** Thick deposit formed from lubricant stiffened with products of combustion and partial combustion such as unburned hydrocarbons, carbon particles, oxides and aldehydes.

**smoke** Visible emission consisting primarily of suspended particulates or vapor.

**small end** The piston pin end of a connecting rod (UK informal). Also *little end*.

**smoke opacimeter** Optical instrument for measuring the opacity of exhaust gases.

**smoke tunnel** Wind tunnel in which streams of smoke enable the air flow over a vehicle or component to be visualized.

**smokemeter** Meter for measuring smoke content of exhaust emissions.

**snow chain** Link chain attached to tire to improve traction in snow.

**snowmobile** Vehicle designed primarily for off-highway mobility on snow.

**snub** Act of retarding a motor vehicle between two speed values by use of the brakes.

**snubber (UK: bump stop)** Compressible rubber or spring to prevent excessive suspension travel.

**soak time** Time required for an engine to reach a stable low temperature throughout all components.

**sodium cooled valve** Engine exhaust valve cooled by the agency of sodium within a hollow valve stem. Movement of the sodium, which liquefies at engine running temperature conveys heat from the valve head to the stem, where it is conducted to the valve guide.

**solenoid switch** Electro-magnetically activated electrical switch.

**solid-axle suspension** Suspension in which wheels are mounted at either side of a rigid *beam axle*, so that any vertical movement of one wheel is transmitted to the opposite wheel. A non-independent suspension.

**solid drive clutch** Simple disc clutch with no cushioning.

**solid injection** Fuel injection in which the fuel charge is injected under hydraulic pressure and not as part of an airborne spray. Also *airless injection*.

**solid-state ignition** Ignition system employing non-moving electronic means of ignition timing. See also *electronic ignition*; *transistorized ignition*.

**sonic throttling** Increasing the flow velocity of a gas or vapor in a pipe, tube or orifice to sonic speeds by throttling, as applied to carburetion or engine induction air flow.

**space frame** Three dimensional structural framework that serves as a chassis and anchorage for body panels as an alternative to a *monocoque* or conventional chassis structure, particularly in racing cars (Figure S.6).

**spark advance** See *advanced ignition*.

**spark gap** Gap between the electrodes of a *spark plug* (Figure S.7).

**spark ignition** System that uses an electric spark to ignite a fuel/air mixture.

**spark ignition engine** (1) Engine running on the Otto cycle. (2) Any form of reciprocating engine in which combustion is initiated by a spark. Often contracted to *SI engine*, a CI engine being a compression ignition or diesel engine.

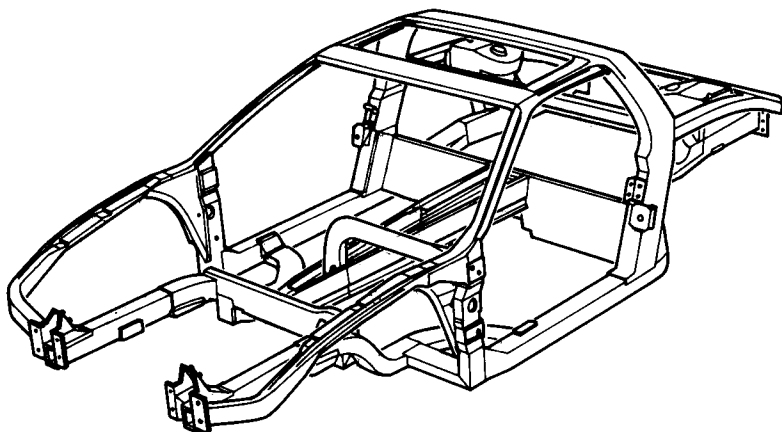


Figure S.6 A pressed-steel space frame for a sports car (TI Automotive)

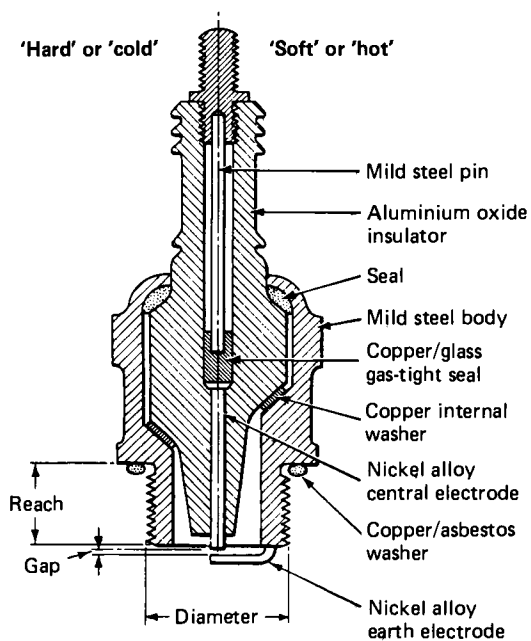


Figure S.7 Sectional views of a 'cold' spark plug (left) and a 'hot' plug (right)

**spark knock** Detonation within an engine cylinder caused by excessively advanced ignition timing rather than to *surface ignition*. See also *deposit induced runaway surface ignition; detonation; knock; pre-ignition*.

**spark plug** Insulated plug that supports the electrodes between which the high voltage spark passes to initiate ignition in a *spark ignition engine*. Also *sparking plug* (Figure S.7).

**sparkling plug** See *spark plug*.

**specific fuel consumption** Fuel consumed per unit of power output, usually expressed as mass or volume per unit power per unit time, for example litres per kilowatt hour, or pounds per brake horsepower hour. Also *SFC*.

**spider** (1) Any component with any number of legs or shafts radiating from a central hub. In nature the spider has eight legs whereas in engineering it often has fewer. (2) Cruciform wheel-wrench having different sized box-heads on each leg. (3) In certain types of pressed wheel, the component that secures the wheel to the hub. (4) High-performance sports car (German).

**spill port** Hole through which excess fuel is returned to the fuel system in a diesel engine injector pump at the end of injection.

**spin** To crank a motor for starting (US informal).

**spin axis** Axis about which a wheel spins.

**spin velocity** Angular velocity of a wheel about its spin axis.

**spindle** See *kingpin*.

**spindle arm** (UK: *steering arm*) Lever attached to the stub axle assembly of a steered wheel whereby the movement of the *drag link* is converted to the steering movement of the steered wheel about its *steering axis*. Occasionally the arm that links the *track rod (tie rod)* to the *steering knuckle (stub axle assembly)*. See Figure S.8.

**spine-back** Narrow central chassis to which running gear and bodywork is attached, mainly on heavy-duty commercial vehicles and semi-trailers. Also *spine chassis*.

**spine chassis** See *spine-back*.

**spinner** Clutch *driven plate* (UK informal).

**spiral bevel** Crown wheel in which the teeth radiate as part of a geometric spiral, commonly used in differentials.

**splash guard** (UK: *mud flap*) Flexible deflecting shield mounted behind roadwheels of a vehicle to control spray.

**split crankcase** Crankcase comprising two or more parts, usually divided in the plane of the crankshaft to facilitate assembly. See also *monobloc construction; unitary construction*.

**split crankshaft** Crankshaft assembled from individual components rather than forged or cast as a unit.

**split cycle engine** Engine in which the normal cycle of operations is apportioned between two separate cylinders, or in which there are more than four separate cycle activities.

**split single** Two stroke engine in which two pistons share the same combustion chamber. Also called *U-cylinder*.

**split skirt piston** (UK: *slotted piston*) Piston in which the skirt is slotted to reduce thermal distortion. See also *T-slot piston*.

**split system** See *divided system*.

**splitter transmission** Manual change-speed transmission with additional gearing that, by interposing an extra output ratio, increases the number of available speeds by providing for example, a lower and three intermediate speeds for a nominally four speed transmission. The splitter is usually engaged by an automatic pre-selector. Also *splitter box*. See also *auxiliary gearbox*; *range change*.

**spoiler** Any transverse aerodynamic device attached to or built onto a vehicle to modify air flow. Originally an extensible vertical flap to reduce or 'spoil' the lift of the wing or an aircraft on landing. See also *air dam*; *apron*.

**spoke** Wire bracing between hub and wheel rim.

**spot lamp** Front mounted narrow beam lamp to be aimed at the will of the driver, normally restricted to use when vehicle is stationary. Illegal in UK where lamp, usually fitted to bumper as an accessory, must not have provision for aiming from within vehicle.

**spot type disc brake** A conventional caliper disc brake.

**sprag clutch** Type of one-way clutch or freewheel using spring loaded locking cams between two races.

**spray holes** Small holes in a fuel injector through which the fuel is sprayed under pressure. See also *sac*.

**spread tandem axle** Widely spaced tandem axle arrangement of a heavy vehicle, usually employed to circumvent axle weight restrictions applying to conventional close-coupled tandem arrangements.

**spring base** Transverse distance between the points of action of the springs of a vehicle suspension.

**spring brake** Pneumatic parking or secondary brake in which a helical spring is compressed by action of air pressure on a piston when the brake is not required, the pressure then being reduced to apply the brake. Pressure within a second chamber causes the spring brake to assist the service brake as a secondary brake.

**spring flange** Removable spring steel flange for retaining tire on two piece wheel rim. See also *bead flange*.

**spring hanger** Bracket on a vehicle chassis to which a leaf spring end is attached.

**spring liner** Soft material set between the leaves of a leaf spring.

**spring pocket** Recess in a mounting bracket or other chassis member to locate a suspension coil spring. Also *spring seat*. See also *spring tower*.

**spring seat** See *spring pocket*.

**spring tower** Raised disc to locate a suspension coil spring.

**spring wind-up.** Deflection of a suspension spring, particularly a leaf spring, resulting from torsional loads of braking or acceleration. See also *axle wind-up*.

**sprung mass** (1) The mass of the body and chassis of a vehicle that rides on the suspension springs. (2) The mass of suspended body and chassis, sometimes including half of the suspension mass.

**sprung weight** See *sprung mass*.

**spur differential** Differential employing spur gear wheels rather than bevel wheels, as in the more common bevel differential.

**squab** The upholstered backrest of a seat (UK).

**squab panel** Nominally vertical transverse panel which supports the rear seat squabs and separates the passenger compartment from the luggage space in a passenger car.

**square engine** Engine in which the cylinder bore diameter is equal to the piston stroke. See also *oversquare engine*; *undersquare*.

**square four** Four cylinder engine in which each cylinder axis forms one corner of a square, the engine being equivalent to two parallel vertical twin engines geared to one crankshaft.

**squeal** (1) Noise of high frequency vibration from a brake assembly. (2) Tire noise resulting from slip or skidding.

**squish** Area of an engine combustion chamber with minimal clearance between piston crown and cylinder head at top dead center.

**squish lip** Bowl-in-piston combustion chamber featuring squish with a re-entrant bowl and hard-edged entrance from bowl to crown, originally developed by Perkins.

**squish motor** Engine in which squish is a prominent feature of the combustion chamber configuration.

**stability** Tendency of a vehicle to remain in a steady state under the influence of perturbing forces, or to return to that state when momentarily disturbed from it.

**stabilizer bar (UK: anti-roll bar)** Torsion bar coupling nearside and offside wheel suspensions of an independent suspension system, to minimize body roll (Figure A.2).

**stack height** Of a leaf spring assembly, the total depth over the individual leaves at the spring's mid-section (Figure L.2).

**staggered V engine** Engine with cylinders set in two banks with their planes of axes at an acute or narrow V angle, the axes of the individual cylinders in each bank staggered to obviate interference of the bores.

**stall** (1) Inadvertent stopping of an engine, usually due to sudden increase in load without a commensurate increase in fuel flow. (2) Engine rotational speed when driving through an automatic transmission with the vehicle stationary.

**stand pipe** Vertical air-pipe with fitting at upper end for attachment of trailer air pressure hose to air brake system of tractor unit. See also *quick-detachable coupling*.

**star wheel** An adjusting nut with indexing arms for positive and accurate rotation, as on a brake or clutch.

**starter motor** High torque electric motor for starting an engine, normally by a high ratio geared drive to the flywheel *ring gear*. Also *cranking motor*. (US informal). See also *Bendix drive*.

**starting handle** Cranked handle for manually starting an engine.

**static tire deflection** Effective decrease in wheel radius from *center of tire contact* to *spin axis*.

**static toe** Difference in distance at extreme points of tire tread between front and rear of a pair of wheels with the vehicle stationary. See also *toe-in*; *toe-out*.

**station wagon (UK: estate car)** Passenger car with extended constant height body fitted with tailgate or rear doors to facilitate access and provide stowage for bulky items. A *shooting-brake* (UK archaic).

**stator** The non-moving parts of a rotating system, as for example the static blades of a torque converter or the static winding of a dynamo or alternator. Note that in some torque converters the stator may rotate in free-wheeling mode.

**steering** Mechanism or means whereby the direction of a vehicle is controlled.

**steering angle** (UK: **angle of lock**) Angle between the projection of the longitudinal axis of a vehicle and plane of steered wheel. Also **steer angle** (US).

**steering arm** (1) Lever that imparts the steering action to the steering knuckle or stub axle assembly, as from a tie rod or track rod. Also **spindle arm** (US), though this term is often used for the lever that imparts steering action from **drag link** to steering knuckle. (2) An intermediate arm in a steering system. See Figure S.8.

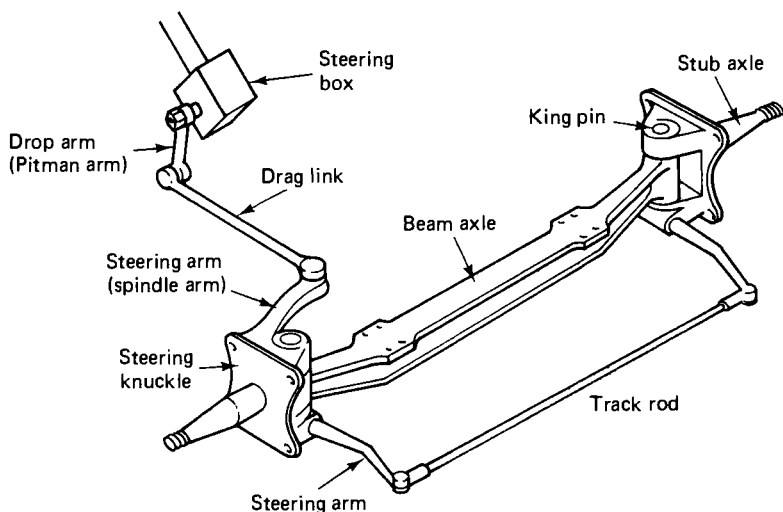


Figure S.8 Steering nomenclature of a simple beam axle arrangement. Many of the items have alternative names

**steering axis** See **kingpin axis**.

**steering box** (US: **steering gear**) Gearbox in which the rotary movement of the steering column is converted to the angular motion of the drop arm or Pitman arm. See also *Gemmer*; *Marles*; *recirculating ball steering*; *worm and nut steering*; *worm and peg steering*; *worm and sector steering*.

**steering column** Shaft that transmits the rotation of the steering wheel to a **steering box** or **rack and pinion**. Also **steering post** (US archaic). See Figure P.5.

**steering column gear change** (US **steering column gear shift**) Gear shift mechanism in which the shift lever is remotely mounted on the steering column, operating the **selector forks** by means of a system of rods and levers. Also **column change**.

**steering damper** Device for damping vibrations or shock loads in the steering system.

**steering feel** Subjective quality of the steering response of a vehicle. See also *road feel*.

**steering gear** (1) The components by which a vehicle is steered (UK). (2) (UK: steering box) Gearcase in which the rotary movement of the steering column is converted to the angular motion of the *drop arm* or *Pitman arm*.

**steering geometry** The geometric arrangement of the components and linkages of a steering system, and the numerical value of the lengths and angles thereof. See also *suspension geometry*.

**steering head** Tube or socket at the forward end of a motorcycle or bicycle frame which provides the pivot bearing for the front forks.

**steering knuckle** Assembly or component comprising *stub axle* and *steering arm*.

**steering lock** (1) Angular travel of steered wheel from straight ahead to *full lock*, the extreme angle in either direction. (2) Security locking device that locks or disables a vehicle's steering.

**steering post** Shaft that transmits the rotation of the steering wheel to a steering box or rack and pinion (US archaic).

**steering ratio** Ratio of angular movement of steering wheel to change of steering angle of the steered wheels.

**steering side tube** See *drag link*.

**steering spindle** A steered *stub axle*.

**steering tie-rod (UK: track rod)** Rod that connects the steering arms (knuckle arms) of one steered wheel to another (Figure S.8).

**steering wheel** The wheel by which the driver controls the direction of a vehicle.

**stellite** Proprietary hard metal alloy noted for hardness and wear resistance at high temperature and used for coating exhaust valve seats.

**step-frame trailer** Trailer, and particularly a semi-trailer, of which the forward part of the platform is raised by a step to clear the tractor chassis, the after part being lower to facilitate loading.

**stepped piston engine** Engine with pistons stepped to give two diameters, smaller and larger diameter parts normally fulfilling different functions, such as pumping and power (Figure S.9).

**stepless transmission** Transmission with continuously variable ratio of output to input speeds, usually, though not necessarily, automatic. See *continuously variable transmission*; *infinitely variable transmission*.

**Stirling engine** An external combustion engine working on a closed regenerative thermodynamic cycle, with cyclic compression and expansion of a gas in which flow is controlled by volume changes, usually between two co-axial pistons. The practical Stirling engine does not work on the idealized Stirling cycle.

**stoichiometric ratio** Ratio, usually of mass, between air and flammable gas or vapor, at which complete combustion or chemical combination takes place. Previously called 'chemically correct mixture strength'.

**stop lamp (UK: brake lamp)** Rear signal lamp which illuminates when brake is applied.

**storage battery** See *battery*.

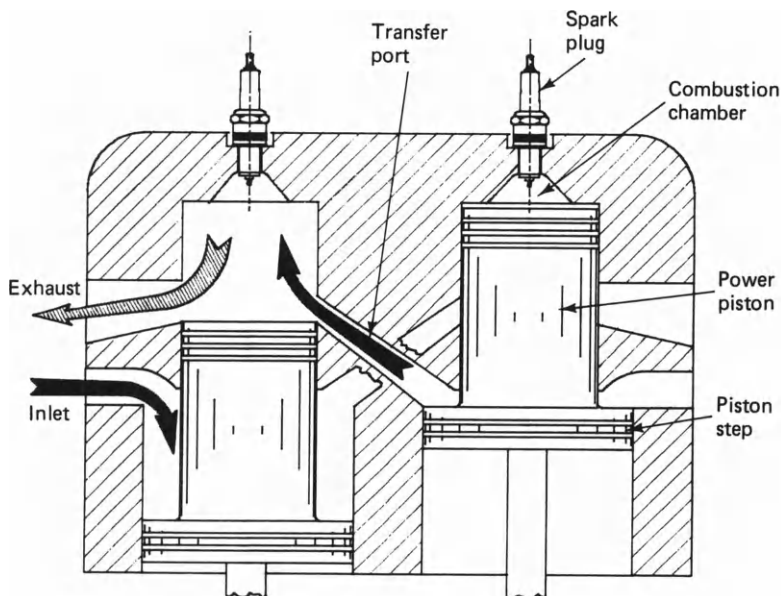


Figure S.9 Cylinder and head of the Hooper stepped piston engine

**straight engine** An in-line engine. The term is often used in conjunction with the number of cylinders, a 'straight eight' being an informal term describing an in-line eight cylinder engine.

**straight truck (UK: rigid)** Truck with body, cab and engine mounted on the same chassis. A non-articulated commercial vehicle.

**strainer** A filter, particularly a coarse full-flow filter.

**strangler** Flap that restricts the flow of air into an engine induction system. A *choke*. See Figure C.3.

**strap drive** Tangential steel springs by which a clutch pressure plate is attached to the rotating clutch cover, thereby providing a degree of axial and rotational flexibility.

**stratified charge** Reciprocating engine combustion system in which combustion is initiated in a layer of relatively fuel-rich mixture, and then spreads to a much weaker mixture elsewhere in the combustion chamber to increase fuel economy.

**striker jaws** See *striking fork*.

**striking fork** Attachment that moves a selector rod in a change-speed gearbox (Figure S.1).

**strobe** A stroboscope, as for timing an engine ignition system (informal).

**stroke** Total axial movement of a piston in its cylinder bore, equivalent to the diameter of the circle described by the *crankpin* axis.

**stroke-bore ratio** Ratio of stroke to cylinder diameter in an engine. See also *oversquare engine*; *square engine*; *undersquare engine*.

**stroking** Increasing the swept volume of an engine by increasing the stroke. Informal.

**stub axle** Short cantilevered axle on which a wheel is mounted.

**sub-frame** Usually removable chassis sub-structure on which may be mounted, for example, a suspension and steering system. Also *subframe*.

**suction manifold** See *intake manifold*.

**suction stroke** The induction stroke or intake stroke.

**sulphur oxides** Generic term for the various oxides of sulfur (sulphur), particularly as present in the exhaust of an engine.

**sump** (US: **oil pan**) Oil reservoir, as fitted beneath the crankcase of an engine (Figure E.1).

**sump guard** Shield fitted under engine to prevent impact damage to a sump or oil pan.

**sun visor** Hinged screen or panel to shield a driver's or passenger's eyes from direct sunlight. Also *sun shade*.

**sun wheel** Central spur gear wheel of an epicyclic gear train. Also *sun gear*. See also *annulus*; *planet wheel*; *ring gear*. See Figure P.3.

**super single** Large heavy duty tire for commercial vehicle road use, intended to offer the performance of double tires.

**supercharge** Artificial increase in pressure of induction air or gases, achieved by pressure charging (or supercharging).

**supercharger** Mechanical pump or compressor for increasing the pressure of induction air or gases. See also *blower*; *turbocharger*.

**supplementary driving lamp** Lamp to supplement the main or upper beam of a headlamp in absence of oncoming traffic.

**supply dump valve** Valve fitted in two-line air brake systems of tractor-trailer combinations to monitor pressure in respective brake systems and to equalize pressures and ensure parity of braking effort between tractor and trailer.

**suppressor** Electrical device for preventing radio interference by the radiation of electromagnetic waves from an ignition or other vehicle electrical system.

**surface ignition** Ignition emanating from hot spots within an engine cylinder rather than from a timed spark. See also *knock*; *spark knock*.

**surface:volume ratio** Numerical ratio of surface area to volume, specifically in the combustion chamber of an engine.

**suspension air control system** Pneumatic system for setting the ride height, as of a commercial vehicle trailer *air suspension*.

**suspension geometry** The geometric arrangement of the components and linkages of a suspension system and the numerical value of the lengths and angles thereof. See also *steering geometry*.

**suspension** Means whereby vehicle body is supported on its undercarriage, comprising springs, dampers and locating linkages.

**suspension rate** Change of wheel load at center of tire contact per unit displacement of the vehicle sprung mass.

**suspension roll** Roll of the sprung mass of a vehicle excluding tire deflection.

**suzie** Coiled, usually coloured, plastic tubing that connects the air brake system of a tractor unit with that of its trailer (informal).

**swap body** A demountable freight body of a commercial vehicle or its trailer. Also *demountable*; *swop body*. See Figure D.2.

**swash plate** Rotating disc or plate mounted obliquely as an alternative to the crank in translating reciprocating to rotary motion.

**swash plate engine** Engine employing a swash plate rather than a crank to convert piston motion into shaft rotation.

**swept volume** In a reciprocating engine, the volume of the cylinder formed by the bore diameter and the stroke of the piston. See also *capacity*; *displacement*.

**swing axle** A driven half-axle, pivoted at a central differential case, the change of wheel camber being identical to the angular suspension deflection (Figure S.10).

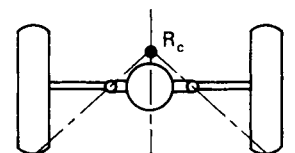


Figure S.10 A rear swing axle showing position of roll center

**swinging caliper** Disc brake caliper assembly in which the complete assembly can pivot to accommodate wear or distortion, one pad only being actuated by hydraulic pressure (Figure S.11).

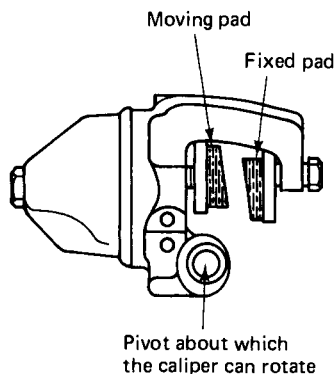


Figure S.11 A disc brake swinging caliper

**swinging shackle** Spring shackle pivoted to chassis to support the rear end of a leaf spring and provide for longitudinal movement of the spring eye.

**swirl** Orderly rotation of combustion gases in an engine cylinder, to improve mixing and heat transfer.

**swirl chamber** Small chamber or cavity formed in cylinder head of an engine to promote swirl. See also *Comet head*.

**swivel pin** A *kingpin*.

**symmetrical beam** Light beam in which both sides of the beam are symmetrical with respect to the median vertical plane of the beam.

**synchromesh** Change speed gear system in which the speed of rotation of a selected gear is automatically synchronized with that of the mainshaft immediately prior to engagement.

**synchromesh sliding sleeve** Internally splined sleeve that performs the function of a *dog clutch* by mechanically locking the mainshaft gear pinion to the *balk ring* and mainshaft when gear is engaged in a *synchromesh gearbox*.

**synchronizer** Sliding clutch mechanism by which gear engagement is synchronized in a synchromesh gearbox (transmission).

**system protection valve** Air brake safety device that permits other reservoirs to be partly charged in the event of failure of one reservoir.

## T

**T head engine** Side-valve engine with inlet and exhaust valves on opposite sides of the cylinder block, giving a combustion chamber resembling the shape of the letter T.

**T slot piston** Piston with vertical slots in the skirt terminating in horizontal slots to reduce heat transfer and counteract thermal distortion. A type of split piston. See also *heat dam*; *split skirt piston*; *slotted piston*.

**tachograph** Electrical device that records vehicle usage data against a time base, usually by stylus on a paper disc.

**tachometer** Instrument for measuring speed of rotation, as of an engine.

**tag axle** A trailer *dead axle*.

**tail fin** See *fin*.

**tail lamp** Red lamp to show the presence of a vehicle from the rear.

**tail pipe** The rearmost pipe of an exhaust system, downstream of the rear muffler (silencer). Occasionally used to describe intermediate pipes. Also *kick-up pipe* (US informal). See Figure E.2.

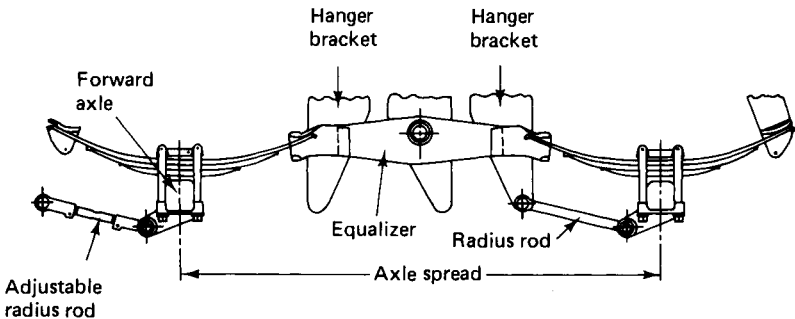
**tailgate** Hinged transverse rear door of a van or passenger car. See also *hatchback*.

**tailshaft** An output or drive shaft from engine, gearbox or other item of rotating machinery.

**tailshaft governor** Speed-sensitive device that monitors torque convertor tailshaft speed and governs engine speed accordingly.

**take-off** See *power take-off*.

**tandem axle** Undercarriage arrangement where two or more axles are close coupled, for example the paired steered axles or rear axles of a heavy commercial vehicle. See also *dual-drive tandem*; *interactive suspension*; *pusher tandem*; *tri-axle*. See Figure T.1.



**Figure T.1** An equalizing tandem-axle leaf spring suspension with equalizer or equalizing beam (Crane Fruehauf)

**tandem master cylinder** Two master cylinders in one housing for operating divided system brakes (Figure T.2).

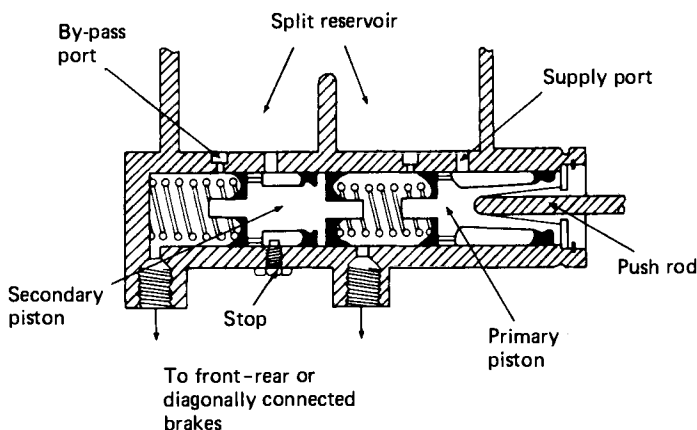


Figure T.2 A brake tandem master cylinder

**tandem plunger pump** Distributor type diesel fuel injection pump in which a second pair of pumping plungers provides excess fuel for starting.

**tank** (1) A closed container or reservoir from which a liquid may be drawn, as *gas tank* (US) or *petrol tank* (UK). (2) Tracked armored fighting vehicle.

**tank body** See *tanker*.

**tanker** Commercial vehicle designed for the transport of bulk liquids or powders.

**taper leaf spring** Single leaf spring of tapering section, and usually of high capacity for weight. Also *tapered leaf spring*.

**taper roller bearing** Rolling element bearing employing conical rollers and able to carry thrust (axial) loads as well as journal loads.

**tappet** (1) (US: valve lifter) Cylindrical reciprocating cam-follower, as for example in an engine gear train. The tappet converts cam lift into linear reciprocating movement which it transmits directly or indirectly to the valve. *Valve plunger* (obsolesc). (2) The sliding component that forces apart the brake shoes in a *wedge brake*. (3) Adjusting screw for valve clearance (US). (4) A valve *rocker arm*.

**tare weight** Weight of a vehicle without fuel and cargo (but subject to local definition).

**targa top** Removable rigid roof-panel, particularly of a sports car.

**tarp hook** Hook or cleat for fastening a tarpaulin or fabric cover over an open truck body, or for fastening the sides of a *curtain sider*.

**taxi** Passenger car licensed to carry passengers for hire. Also *cab*; *hackney* (UK); *taxicab*.

**TCP** Tri-cresyl phosphate. A fuel additive.

**TEL** Tetra-ethyl lead. An anti-knock fuel additive.

**telescopic fork** Steering/suspension arrangement mainly applied to motor-cycles, in which the steered wheel is straddled by two telescopic struts linked below the steering head.

**telescopic shock absorber** Coaxial tubular hydraulic damper (Figure S.4).

**telescopic steering column** Steering column which undergoes progressive collapse on impact. The steering column thereby absorbs some of the energy of impact as the driver's thorax comes into contact with the steering wheel.

**temperature map** Diagrammatic representation of the temperature values of a component or assembly (for example, a piston) when operating, as by isotherms or lines of equal temperature.

**Templug** Steel plug of known hardness inserted into a component of which the operating temperature is to be found. After the test the plug is removed and its new hardness measured, from which the maximum operating temperature can be deduced. Trade name.

**tension rod** Steering *track rod* or *tie rod*.

**terminal post** Tapered barrel or lug shaped terminal on battery to which battery lead is attached by clamp or screwed cap.

**test cycle** Laboratory or highway test procedure that follows a strictly controlled sequence of operating parameters, usually to simulate driving under real conditions and to assess performance in respect of emissions, fuel consumption or other measurable quantities.

**THC** Total hydrocarbon (content of exhaust)

**thermal efficiency** Ratio of useful work performed by an engine to the total energy content of the fuel consumed. A measure of the efficiency of the combustion process.

**thermal loading** Total effect of heat and temperature on mechanical and structural components, particularly of an engine. Not a load in the quantitative mechanical sense.

**thermal reactor** Emission control device relying principally on high temperature to effect oxidation of pollutants.

**Thermoflow piston** Piston with broadly arched undercrown, providing a full and unobstructed path for heat flow to the skirt and thence to the cylinder walls. Trade name, though term tends to be used generically.

**thermostatic interrupter** Electrical device to prevent overheating in lighting circuits in event of a fault or short-circuit.

**thermostatically controlled air cleaner** Device that controls the temperature of air entering an engine air cleaner (filter), mainly as a means of reducing emissions resulting from too hot or cool a charge. Also *TAC*.

**thermosyphon** Radiator cooling system that relies on the density differential between hot and cooled water to produce circulation of coolant.

**thin wall bearing** A journal shell bearing, of thin section relative to width and diameter.

**third brush generator (UK: three brush dynamo)** Obsolete type of DC generator in which a moveable third brush controls output current.

**third-motion shaft** The output shaft of a change-speed gearbox.

**thrash** Severe transverse oscillation or whip of a chain or belt drive system.

See also *damping slipper*.

**three bearing crankshaft** Engine crankshaft having one additional central

journal bearing. Common feature of lightly loaded four cylinder engines.

**three brush dynamo (US: third brush generator)** Obsolete type of DC generator in which a moveable third brush controls output current.

**three piece construction** Construction of an item in three usually separable pieces, but particularly a heavy vehicle wheel in which a removable ring flange and *locking ring* locate and restrain the tire *bead*.

**three-quarter floating axle** Axle arrangement in which the axle or half-shaft reacts cornering loads but carries only a small proportion of the vehicle's weight. See also *semi-floating axle*

**three-way converter** Catalytic converter containing one stage coated with platinum and palladium and another with platinum and rhodium. Also called *dual-bed converter*. See also *two-way converter*.

**three wheeler (US: tricar)** Three wheeled car-type motor vehicle (other than a motorcycle combination).

**throat** Narrow end of a tapered aperture or venturi, as of a carburetor inlet.

**throttle** (1) Valve, particularly a butterfly valve, for controlling the flow of fuel through a carburetor (Figure C.3). (2) A venturi or stepped pipe for throttling a supply of gas or vapor. (3) The *accelerator* pedal, being the control that operates the throttle (informal).

**throttle body injection** Fuel injection into a venturi device similar to a carburetor barrel. See also *downstream injection; multi-point injection*.

**throttle body injection system** Electronically controlled closed-loop single point gasoline fuel injection system.

**throttle lever** Lever for operating a carburetor throttle.

**throttle return dashpot** Hydraulic damping device that slows the closing of the throttle valve of a carburetor when the accelerator pedal is lifted, thus preventing stalling through fuel starvation.

**throttle valve** (1) Flap valve by which the driver controls the flow of air or air/fuel mixture into a carburetor, and thus the output of the engine (Figure C.3). Also *butterfly valve*. (2) Fluid flow control valve in an automatic transmission.

**throttling** Reducing the power output of an engine by closing the throttle.

**throw** (1) Connecting rod or big-end bearing of a crankshaft (archaic, except US). (2) Radial distance between the crankshaft and connecting rod bearing axes, equivalent to half the stroke. Occasionally the diameter of the circle described by the connecting rod bearing axes (equal to the stroke). Care is therefore required when using or interpreting this term.

**throwout bearing (UK: clutch release bearing)** Shaft-mounted thrust bearing that transmits the motion of the clutch pedal to disengage the clutch. See also *throwout fork*.

**throwout fork (UK: clutch release lever)** Lever, mechanically or hydraulically actuated by clutch pedal, that acts on the throwout (clutch release) bearing to disengage clutch. Also *thrust bearing actuating lever*. See also *pull type clutch; push type clutch*. See Figure C.5.

**throwout sleeve** Sliding sleeve on which a *clutch release bearing (throwout bearing)* is mounted.

**thrust bearing** Bearing intended principally to react axial or thrust loads. *Thrust race* (informal).

**thrust bearing actuating lever** Lever, often fork-ended, by which the clutch

is disengaged. A **clutch release lever** or **throwout fork** (US). See Figure C.5.

**tick over** Running of an engine at lowest practical speed with drive disengaged. Idling.

**tie bar** Any bar that serves to tie parts or components together. See also *strut*.

**tie rod** (1) Any structural member or mechanical linkage that is normally in tension. (2) Steering track rod or cross rod, or any nominally transverse linkage that directly or indirectly actuates steered wheels.

**tilt-bed trailer** Trailer with facilities for tilting of the platform to allow loading and unloading from a ramp. See also *beaver tail*.

**tilt cab** Commercial vehicle *forward control* cab hinged so that it can tilt forward to facilitate access to engine and running gear.

**tilt deck** Commercial vehicle, semi-trailer or full trailer of which the whole or part of the cargo floor or platform may be tilted relative to the chassis for loading and unloading.

**timed fuel injection** Fuel injection system in which the fuel for each cylinder is injected as a timed, discontinuous event, rather than continuously into the inlet tract.

**timing** Scheduling of events related to an operating cycle, as of an engine, such as the opening and closing of valves (valve timing), or the firing of the mixture by spark (ignition timing).

**timing belt** Flat toothed belt of reinforced rubber for driving the camshaft of an engine.

**timing chain** Continuous roller chain for driving the camshaft of an engine.

**timing gear** (1) Gear wheel (or wheels) for driving the camshaft of an engine from the crankshaft. Obsolesc. (2) Any mechanism associated with the driving of a timing mechanism.

**timing mark** Any mark on flywheel, crankshaft, camshaft or other rotating component to serve as reference when the valves, ignition or injection system of an engine are being timed. Also *reference mark*.

**timing shaft (UK: distributor shaft)** Shaft for driving an ignition distributor. See also *quill drive*.

**tipper (US: dump truck)** Commercial vehicle with tilting body or hopper and opening taildoor through which bulk materials may be discharged.

**tippling gear** The tipping body of a tipper truck, and the operating machinery thereof.

**tire** (1) Air-filled or solid covering for a wheel, normally of rubber (US spelling). (2) Device made of rubber, fabric and other materials which, when filled with fluid under pressure and mounted on a wheel, cushions and sustains the load. *Tyre* (UK). See also *bias ply*; *cross-ply*; *inner tube*; *radial ply*.

**tire carcass** See *carcass*.

**tire casing** (1) The tread and shoulder of a tire. (2) The rubber-bonded cord structure of a tire.

**tire scrub** Sliding movement of tire at right angles to the plane of the wheel, effectively the active component of slip angle.

**toe-in** (1) Setting of paired wheels on an axle so that the leading edge of each wheel is inclined slightly inwards. Also *gather*. (2) The numerical value of such inclination, usually expressed as the difference in effective

track from leading to trailing edge of wheel at specified diameter, usually at the rim flange.

**toe-out** Setting of paired wheels on an axle so that the leading edge of each wheel is inclined slightly outwards. See also *toe-in*.

**Toluene Number** An early anti-knock index of fuel rating, superseded by *Octane Number*.

**tonneau** Passenger compartment of an early car, particularly when separated from the driver's compartment.

**tonneau cover** Detachable fabric cover to protect the passenger compartment of an open car when not in use. Also *tonneau* (informal).

**tonneau panel** External rear side panel, particularly of a four door saloon or sedan car (mainly UK usage). See Figure B.4.

**toothed belt** Positive action reinforced rubber belt in which parallel striations engage with grooves in a driving and driven wheel. Cogged belt (informal). Commonly used for valve timing gear as an alternative to a roller chain, when it is often called a *timing belt*.

**top dead center** Uppermost point of movement of piston in a cylinder, or the point furthest from the crankshaft axis. Also *TDC*; *upper dead center*; *outer dead center*.

**top speed** Maximum steady speed of a vehicle, usually measured on a flat surface and with no wind.

**toric transmission** Generic term for constantly variable transmission that operates by changing the input and output radii of discs or wheels rolling within a split torus. See also *Hayes transmission*; *Perbury drive*.

**torque arm** (1) Any arm or lever primarily intended to resist or transmit torque. (2) Suspension linkage that reacts drive and braking wind-up of an axle.

**torque converter** (1) Device that transmits torque from one shaft to another usually by hydraulic means and permitting asynchronism between the shafts. (2) Hydraulic torque converter, consisting of rotating and static vane assemblies, by which torque can be transmitted, multiplied and controlled. A feature of many automatic transmissions. See also *fluid flywheel*; *lock-up*. See Figure T.3.

**torque converter pump** Vaned driven rotating element of a torque converter, normally set opposite to the turbine. Also *pump* (informal). See also *stator*.

**torque ratio** Ratio of output torque to input torque, as of a torque converter. Often expressed as a percentage.

**torque rod** A suspension *radius rod*.

**torque tube transmission** Vehicle final drive system in which the propeller shaft (drive shaft) is housed within a structural tube which is rigidly attached to the differential housing. The back axle housing, differential case and torque tube therefore form one rigid assembly, thus eliminating one of the Hotchkiss drive's universal joints and divesting the rear suspension of the need to react drive and braking torques (Figure T4).

**torque tube** Tube enclosing propeller shaft and forming torsionally rigid connection between gearbox and final drive (Figure T.4).

**torsion bar** Bar or rod that fulfils a mechanical or structural function by reacting loads in torsion (Figure T.8).

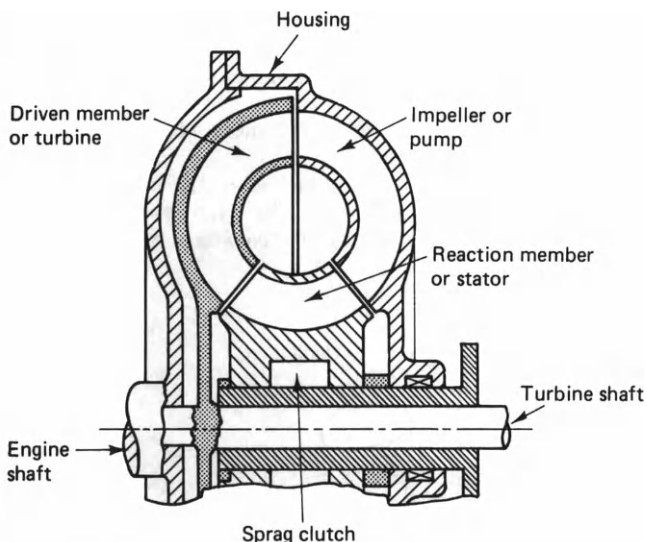


Figure T.3 Components of a torque converter

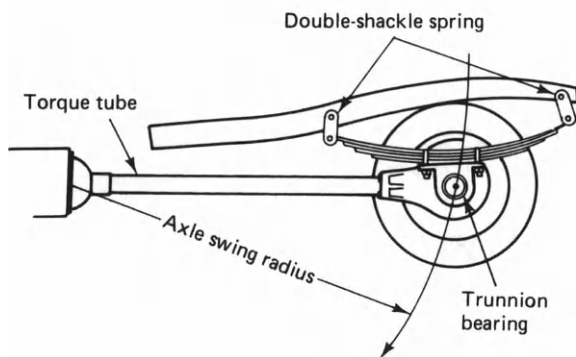


Figure T.4 A torque tube transmission with semi-elliptic leaf springing

**torsion bar suspension** Suspension that uses a rod, bar or tube in torsion as a spring.

**torsional vibration damper** (1) Any mechanical or hydraulic device that reduces torsional vibrations, as of an engine crankshaft or transmission shaft. (2) Lever-type suspension damper or shock absorber.

**torso line** See *waistline*. Line on a two-dimensional drafting template connecting the shoulder reference point with the H-point.

**torus** (1) A ring, usually of thick, circular section. (2) A flexible coupling of toroidal shape.

**toughened glass** Safety glass that fractures into small, nominally blunt particles rather than sharp splinters.

**tow bar** Rigid bar by which a trailer or towable vehicle is towed. A drawbar.

**towing fork (US: trailer hitch)** Mechanical attachment whereby a trailer is coupled to a tractor. Also *towing jaw*.

**towing hook** Vertically orientated hook, attached to the chassis or rigid structural member of a towing vehicle, with which the towing eye of the towed vehicle engages. Also *towing hitch*; *trailer coupling*. See Figure T.5.

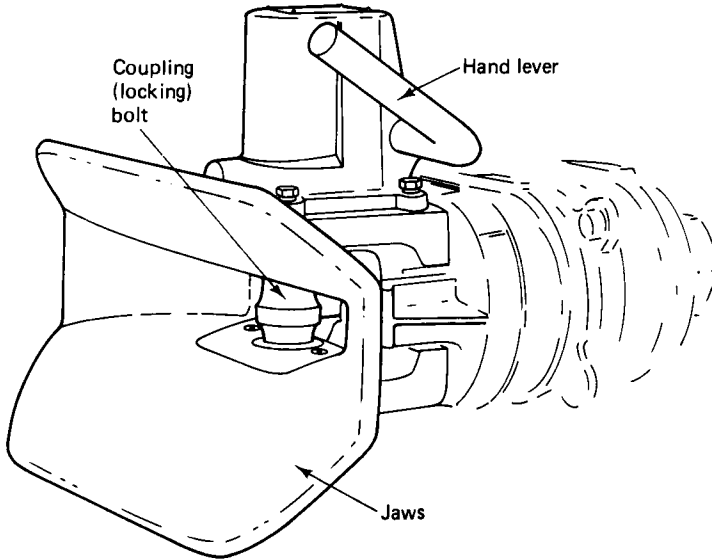


Figure T.5 A trailer coupling jaw or towing hook, showing the coupling or locking bolt with which the drawbar eye engages

**track (US: tread)** Transverse distance between left and right side wheels on the same axle, measured between specified points, such as the centers of tire contact (Figure T.6).

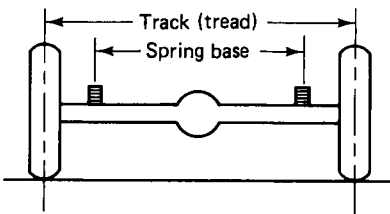


Figure T.6 Wheel track (tread) and spring base

**track arm** Pivoted transverse member constraining the wheel against transverse motion, particularly in a MacPherson strut or Chapman strut independent suspension system. Also *track control arm*. See also *tie rod*. Sometimes, though misleadingly, used as an alternative to track rod.

**track chain** Continuous linked track of a tracked or track laying vehicle, such as a tank or crawler tractor.

**track control arm** Any transverse member that maintains the track or reacts lateral loads in a vehicle suspension. A *tie rod*.

**track laying vehicle** Vehicle of which the wheels run within a continuous chain or track, as for example a fighting tank. A *crawler* (US informal). See also *half-track*.

**track pin** Metal pin that forms the pivot and coupling between two track elements of a track chain.

**track pitch** Distance between track pin centers of a track chain.

**track rod** Transverse rod that connects the *steering arms* of steered wheels and so maintains the geometric relationship between them when steering. A *rack and pinion* steering system will have two track rods or side rods. In an independent front suspension steered from a steering box there will often be a single *intermediate rod* or *relay rod* (US) communicating the steering to the steering arms by two side rods or tie rods. See also *relay rod*; *tie rod*. See Figure S.8.

**track rod end** Ball joint forming pivot between track rod, or tie rod, and steering arm.

**track rod lever** A steering arm or Pitman arm, or other lever actuating a track rod (Figure S.8).

**track thrash** Periodic whipping motion of the track of a track laying vehicle.

**tracked vehicle** See *track laying vehicle*.

**tracking** (1) Conducting of high voltage electricity along the surface of an insulator such as a cable or inside of distributor cap, due particularly to accumulated dirt and dampness. (2) The geometric settings and alignments of a vehicle steering and suspension system, or the adjustment thereof. (3) Relative directional orientation of the wheels of a vehicle.

**tracking error** Misalignment of road wheels particularly where adversely affecting steering or tire wear.

**Tracta joint** See *Bendix-Tracta joint*.

**traction** Driving force or effort of a motor vehicle.

**traction avant** Front wheel drive (French).

**traction bar** Rod or strut attached to a live axle to react torque loads and prevent or minimize axle wind-up and hop.

**traction differential** See *limited slip differential*.

**traction engine** Heavy road locomotive usually steam powered, formerly used for heavy haulage, and the hauling and operation of farm machinery. A road *locomotive*.

**tractive effort** Quantitative measure of the ability of a vehicle to pull or haul.

**tractive unit** The towing vehicle of an articulated commercial vehicle. Also *tractor* or *tractor unit*.

**tractor** A steerable vehicle for towing, but particularly an agricultural vehicle, or a commercial vehicle equipped with *fifth-wheel* for towing a semi-trailer.

**traffic indicator (US: turn signal lamp)** Lamp to show the intention of a driver to turn. Also *direction indicator lamp; flasher* (informal).

**trafficator** Mechanically or electrically raised arm, sometimes illuminated, and mounted at the side of a vehicle to indicate the driver's intention to turn. Also *semaphore indicator*. (Obsolete term).

**trail** Horizontal distance between a vertical line through the front wheel centerline and the projection of the steering head or kingpin axis measured at ground level.

**trailer** A non-powered vehicle designed to be towed by a tractor. See also *drawbar trailer; full trailer; semi-trailer*.

**trailer hitch (UK: towing fork or towing jaws)** Mechanical link by which a trailer is towed by a towing vehicle.

**trailer sway (UK: trailer swing)** Excessive directional deviation of a trailer, particularly a semi-trailer, from the intended direction of tow resulting from slip of the trailer rear wheels, either as movement in one direction or as an oscillation (Figure T.7).

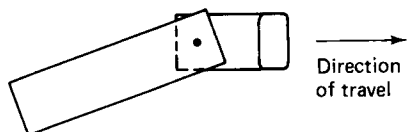


Figure T.7 Trailer sway (trailer swing) of an articulated vehicle

**trailing arm** Suspension linkage supporting wheel assembly aft of a transverse pivot axis (Figure T.8).

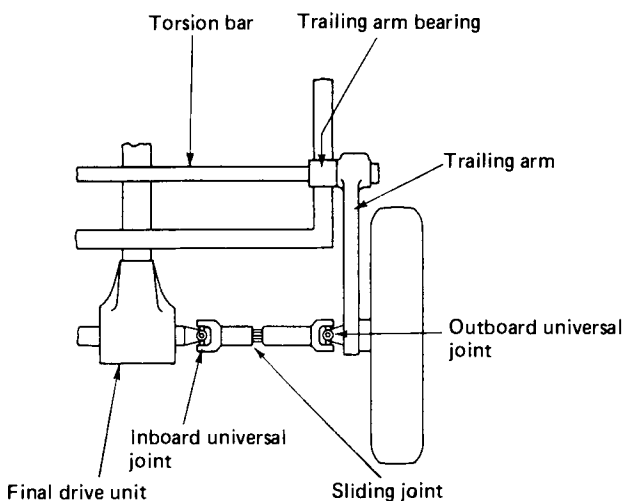


Figure T.8 Torsion bar trailing arm independent rear suspension

**trailing axle** The after axle of a tandem axle.

**trailing link** A *trailing arm*.

**trailing shoe (US: secondary shoe)** Shoe of a drum brake system in which the actuated end trails, facing the normal direction of rotation (Figure C.1).

**tram** See *tramcar*.

**tramcar (US: streetcar)** Passenger carrying rail vehicle, usually electrically propelled, that runs on tracks laid within a street system. *Tram* (UK informal).

**tramp** Wheel hop in which a pair of wheels hop in opposite phase. Sometimes called *shimmy* in US.

**tramway** Track on which a tram runs.

**transaxle** (1) Rear axle assembly that incorporates the main change-speed gearbox. (Mainly US usage) (2) Combined gearbox and differential unit attached to the engine in some front-wheel drive vehicles. Contraction of transmission-axle. (3) Transmission which provides differential output.

**transfer box (US: transfer case)** Gear system that apportions the drive between front and rear axles of a four wheel drive system. See also *full-time drive*; *part time drive*. See Figure T.9.

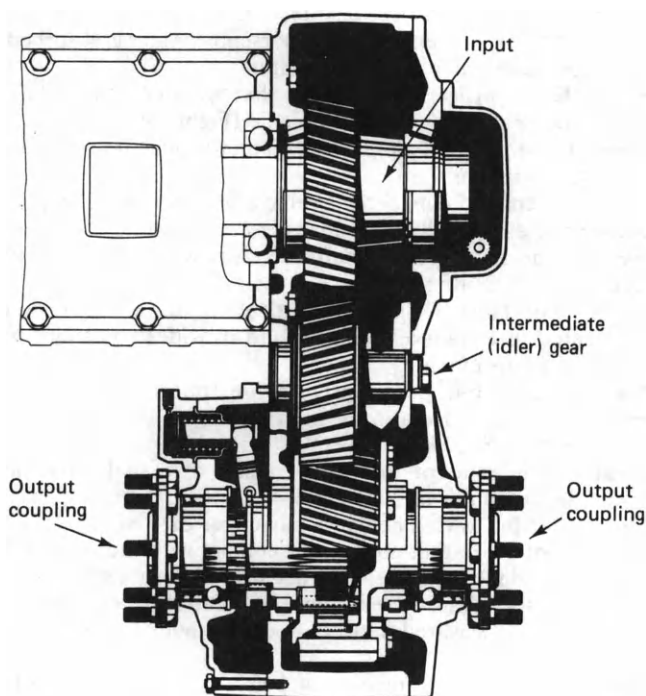


Figure T.9 A transfer case or drop box (ZF)

**transfer case** See *transfer box*.

**transfer drive** Bevel gearbox, the output axis of which is at an acute angle to the input axis, mainly used as a drive from the gearbox to the propeller shaft in transverse rear engine buses.

**transfer gear** (1) Transmission that apportions an input drive between two shafts, as for example between front and back axle in four wheel drive. (2) A *drop gear* (mainly US usage).

**transfer port** Aperture in cylinder of two stroke engine through which compressed combustible mixture passes from crankcase (Figure T.10).

**transistorized ignition** Conventional mechanical contact breaker ignition system with transistor voltage regulation permitting higher speeds. See also *electronic ignition*; *solid-state ignition*.

**transition system** Metering or flow system in a carburetor that provides smooth engine operation under transient conditions and throttle openings, as for example acceleration or overrun.

**transmission** (1) (UK: gearbox) Mechanical unit containing a manual or automatic change speed gear system and associated actuating machinery. (2) Collective term for the components, such as clutch, gearbox, drive shaft, whereby power is transmitted from engine to driven wheels (mainly UK usage). See also *driveline*; *powertrain*.

**transmission brake** Brake operating on the transmission system of a vehicle rather than directly on the wheels. See also *inboard brake*.

**transmission loss** That part of the engine brake horsepower that is absorbed by the clutch, gearbox and other transmission items.

**transmission shaft** (UK: *propeller shaft*) Shaft that transmits the rotary power from an engine or gearbox to a driven axle (Figure P.5).

**transmission tunnel** Raised section along centerline of vehicle floor-pan to accommodate the transmission shaft.

**transporter** Usually articulated commercial vehicle built for the transport of other vehicles, or of abnormally large loads.

**transverse engine** Engine having crankshaft axis athwart the vehicle, at right angles to the axis of motion.

**transverse link** Any mechanical linkage, particularly in a suspension system, that is located in a transverse plane, and provides constraint in transverse or trackwise movement.

**transverse springs** Springs, but particularly semi-elliptical leaf springs, located in a transverse plane. See also *swing axle*.

**trapped-line pressure valve** See *check valve*.

**trapped-volume ratio** The ratio of the total volume of a fuel injection system to the fuel delivered per injection.

**travel trailer** Box-trailer for towing behind a passenger car.

**tread** (1) The portion of a tire that comes into contact with the road. (2) The grooved or patterned face of a tire, intended for road contact. See also *tread depth*. (3) (UK: track) Transverse distance between left and right side wheels on the same axle, measured between specified points, such as the centers of tire contact.

**tread contact length** Length of a tire contact patch or footprint, usually measured in the wheel plane. See also *tread contact width*.

**tread contact width** Distance between the extreme edges of tire-road

contact at a specified load and pressure measured parallel to the wheel axis at zero slip angle.

**tread contour** Cross sectional shape of the tread surface of an inflated unloaded tire neglecting tread pattern depressions.

**tread depth** Distance between the base of a tire tread groove and a line tangential to (or in simple measurements joining) the surface of two adjacent tread ribs or rows.

**tread noise** Noise produced by the interaction of tire tread pattern and the road surface, though excepting squeal and slap.

**trembler coil** Electrical coil for generating high tension electricity from a low voltage source. Obsolete.

**tri-axle** Axle arrangement in which three axles are located in close succession as a means of distributing weight. See also *tandem axle*.

**tricar (UK: three wheeler)** A three-wheeled passenger car or van.

**trigger rod** Hand-lever operated rod that disengages the locking pawl on a handbrake.

**trip computer** Dedicated microcomputer circuit that monitors various performance parameters to give readings of, for example, average speed, fuel consumption, fuel cost per mile.

**trip recorder** Secondary mileometer that may be manually set to zero to record journey length. Also *trip odometer*.

**triple-reduction axle** Heavy vehicle axle with three stages of reduction gearing between propeller shaft and final drive.

**Triplex** A high-strength safety glass (trade name).

**tri-pot joint** A radially self-supporting plunging universal joint having three rollers on radial pins. See also *bipot joint*; *pot joint*. See Figure P.4.

**trochoidal rotor** Working rotor of the *Wankel engine*, of triangular form with convex sides.

**trolley bus** Electrically powered bus equipped to draw current from overhead wires while in motion.

**truck (UK: lorry)** A commercial goods vehicle, other than a light delivery vehicle.

**truck cab** The enclosed driver's compartment of a commercial vehicle.

**truck-tractor** Heavy vehicle equipped for towing a semi-trailer by supporting its forward end on a fifth-wheel. See also *articulated vehicle*; *locomotive*.

**truck-trailer** A commercial vehicle trailer. See *full-trailer*; *semi-trailer*.

**true joint angle** Acute angle described by the intersection of the rotational axes of the input and output shafts of a universal joint and measured in the plane of these axes.

**trunk (UK: boot)** Rear luggage compartment of a passenger car, internally isolated from the passenger compartment, and with a lifting lid to facilitate access.

**trunnion axle** Beam axle suspended at its mid-point to facilitate movement in the roll plane, as for example on uneven terrain.

**tubeless tire** Tire in which the air pressure is contained by the carcass of the tire and the rim of the wheel, there being no inner tube.

**tumblehome** Of a vehicle body, inward sloping towards the top in section, from maritime terminology.

**tune** (1) To adjust the operating variables of an engine (ignition timing, fuel mixture metering, etc) to give optimum performance. (2) The running condition of an engine with regard to such variables.

**tuned intake pressure charging** Increasing the mass of inducted fuel mixture by matching the acoustic resonance of the induction system to engine speed. Also *tuned intake tube charging*. See also *harmonic induction engine*; *ram air induction*.

**tungsten halogen lamp** Lamp bulb or sealed beam unit filled with the halogen iodine, which combines with the evaporated tungsten of the filament to form tungsten iodide, which does not deposit an opaque film within the bulb envelope but ionizes redepositing the tungsten on the filament. The glass envelope is normally made of quartz, hence quartz halogen. Also *called quartz iodine lamp*.

**turbine** (1) A wheel with blades or vanes, driven by a flow of gas, as in a *turbocharger*. (2) A gas turbine engine (informal). (3) The output wheel of a torque converter or fluid flywheel, which derives its energy of rotation from the circulatory flow of a fluid (Figure T.3).

**turbine matching** Selection of the characteristics of a turbocharger to provide optimum performance of an engine.

**turbo-compound engine** Exhaust turbocharged compression ignition engine deriving a substantial part of its power from exhaust gas energy.

**turbo-supercharger** See *turbocharger*.

**turbocharger** Induction pressure charger normally comprising an exhaust gas driven air turbine driving an air compressor. See also *blown*; *supercharger*.

**turbulence** Disorderly and agitated motion of a gas, fluid or vapor. In automotive context the term relates either to the turbulent flow of air that has ceased smooth or laminar flow over a vehicle body, or to the intentionally disorderly flow of air that promotes good mixing with the fuel charge in an engine cylinder. See also *quiescent combustion*.

**turn signal lamp (UK: direction indicator)** Signalling element of a turn signal system to indicate intention of driver to turn. *Flasher* (informal).

**turning center** Centre of the radius of the turn of a vehicle, at which the axes of all wheels ideally coincide.

**turning circle** (1) Radius of the circle about which a vehicle turns when steered. (2) The minimum diameter of the circle within which a vehicle turns when steered at full lock.

**turning radius** The radius of the turning circle, measured either to the nearest point on the plane of symmetry, or to the center of tire contact of the wheel describing the largest circle.

**turning track** Radial width between centers of road contact (centers of contact patches) of innermost and outermost tires of a vehicle when negotiating a turn. In the case of dual tires, center of road contact is taken to be midway between those of individual tires.

**turnpike double** Commercial vehicle truck or tractor unit hauling two trailers. Also *double-trailer*. Mainly US usage.

**turntable** (1) The flat bearing surfaces of a *fifth wheel*. (2) The rotating extension ladder of a fire-fighting vehicle.

**twin cam** Informal, and confusing, contraction of twin camshaft.

**twin camshaft** Arrangement of two parallel camshafts per bank of cylinders in an engine, normally with one operating the intake and the other the exhaust valves.

**twin carburetor** Having two (usually balanced) carburetors. Also *TC*.

**twin choke** Carburetor having two (usually parallel) venturis. Also *dual venturi carburetor*. See *choke*.

**twin screw** Vehicle with two driven tandem axles (US slang).

**twist grip** Hand control, as for the throttle of a motorcycle, in which the rotation of a handgrip at one or other extreme end of the handle bars controls the length of a shrouded cable, and thereby a control such as the throttle.

**twistlock** Manually operated lock for attaching a *demountable* to the bolster of the carrying vehicle.

**two cycle** See *two stroke*.

**two-piece construction** Construction of an item in two usually separable pieces, but particularly the construction of a heavy vehicle road wheel in which a detachable flange, such as a spring flange, facilitates the changing of tires. See also *three-piece construction*.

**two speed double reduction axle** Drive axle with two reduction stages, one of which is a change-speed geartrain with a choice of high or low ratios.

**two stroke** Thermodynamic cycle of spark or compression ignition engine in which the principal operations of induction, compression, power and exhaust stroke take place within one revolution of the engine (Figure T.10).

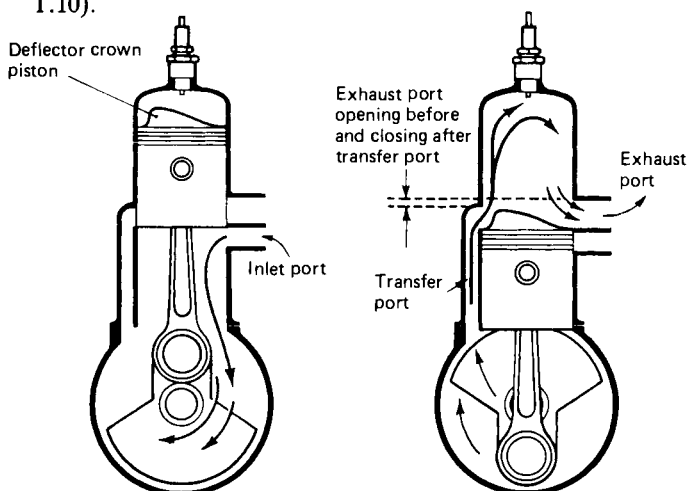


Figure T.10 A crankcase-compression two stroke engine

**two-way converter** Catalytic converter containing pellets or honeycomb coated with platinum and palladium. See also *three-way converter*.

**type approval** Official ratification of the compliance of a vehicle type with national or international regulations.

**tyre** Widely accepted UK spelling of tire.

## U

**U-engine** Two-stroke engine in which two parallel pistons are driven by one crank, and therefore move in the same direction for most of the cycle. Sometimes called split-single. A variant of this type, the Puch engine, has a Y shaped connecting rod rather than two separately pivoted rods.

**unburned hydrocarbons** Unburned or incompletely burned products of engine combustion, particularly as released to the atmosphere as an exhaust emission. Also *HC*; *THC*.

**underbody** (1) The body structure of the underside of a vehicle including floor, wheel wells and stiffening members. (2) The underneath of a vehicle or its effective profile, particularly in an aerodynamic context.

**underbumper apron** See *apron*.

**undercarriage** The wheels, axles and suspension system of a vehicle, but particularly of a commercial vehicle.

**undercoating (UK: underseal)** Heavy protective coating applied to the underside of a vehicle to resist corrosion and damage from roadstone impact, and to reduce noise transmitted from under the vehicle.

**undercrown** The underside of a piston crown (Figure P.2).

**underrun protection** Transverse structure attached to the rear of a commercial vehicle chassis to prevent a smaller impacting vehicle running under the chassis.

**underscreen** See *undershield*.

**underseal** See *undercoating*.

**undershield** Paneling under an engine compartment. Also *underscreen*.

**underslung worm transmission** Worm and worm wheel final drive in which the worm is set below the worm wheel, giving a low propeller shaft. See also *overslung worm transmission*.

**undersquare engine** Engine having a larger stroke than cylinder bore diameter.

**understeer** (1) Response of a vehicle if the ratio of steering wheel angle gradient to overall steering ratio is more than the Ackermann steer angle gradient. (2) Under-response to steering input, as by generation of excessive slip angle on front wheels. (3) Response of vehicle to steering input characterized by an incremental increase in yaw rate which necessitates an increase in *steer angle* to maintain the intended radius of turn. See Figure U.1.

**undertread** Reinforcing plies laid beneath the tread of a tire.

**unequal wishbones** Type of independent suspension (in most examples a front suspension) in which vertical travel of the wheel assembly is controlled by two nominally parallel wishbones, hinged to the chassis or vehicle structure at the inner ends and to the steering knuckle of the individual wheel assemblies at the outer ends.

**uniflow scavenging** System of scavenging in two-stroke engines in which the fresh mixture enters the cylinder at one end while the exhaust gases leave through valves or ports at the other.

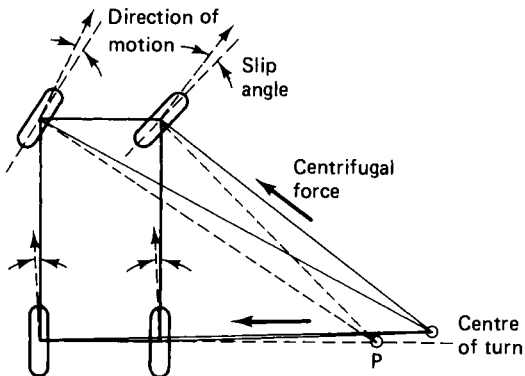


Figure U.1 Diagrammatic representation of understeer, showing the actual center of turn compared with the geometric center of turn that would prevail at low speed

**unit fuel injector** Assembly which receives fuel at supply pressure and is then actuated by an engine mechanism to meter and inject the fuel charge into the engine combustion chamber.

**unit pump** Injection pump containing a single pumping element operated by an engine cam. Mainly used on marine engines.

**unitary construction (US: unitized construction)** (1) Of a vehicle drive system, the construction of engine, clutch and gearbox to form one rigid unit, though enabling each individual item to be detached. (2) *Monocoque* or chassis-less structure of a vehicle body.

**universal joint** Rotating shaft coupling that permits angular axial displacement. Some types will also operate with linear misalignment of axes. See also *Bendix-Tracta joint*; *Bendix-Weiss joint*; *Cardan shaft*; *constant-velocity joint*; *Hooke's joint*; *Layrub joint*; *Rzeppa joint*.

**unleaded gasoline (UK: unleaded petrol)** Gasoline free from lead compounds such as tetra-ethyl lead. Also *lead-free gasoline*.

**unleaded petrol** See *unleaded gasoline*.

**unloader valve** Valve that controls or limits air pressure in a pneumatic control system such as a commercial vehicle *air brake* system, usually by exhausting excess air to atmosphere. Also *governor valve*. See also *check valve*; *pressure protection valve*.

**unsprung mass** (1) Mass of a vehicle undercarriage below the springs. (2) Mass of vehicle components not carried by the suspension system. In some definitions half the spring and damper mass is included.

**unsprung weight** Unsprung mass expressed in gravitational units. Loosely used as a synonym for unsprung mass.

**updraft carburetor (UK: updraught carburettor)** Carburetor in which the inducted air flows upwards past a jet, usually centrally located in a venturi.

**upper beam** The main or driving beam of a headlamp.

**upper dead center** See *top dead center*.

**urban cycle** Driving test cycle that simulates driving conditions in a typical urban area.

**ute** A commercial or utility vehicle (Australian slang).

## V

**V-belt** Continuous reinforced rubber belt with angled faces that bear on the inner faces of a taper-grooved pulley. Used for driving engine ancillaries such as fan or water pump and, in more robust form, for final drive transmissions. See also *infinitely variable transmission*; *Variomatic transmission*.

**V-engine** Engine of which the cylinders are set an angle to each other so that the axes form the letter V. The angle is commonly 60 or 90 degrees. See also *narrow V engine*.

**vacuum advance** Mechanical-pneumatic system for advancing ignition timing, using carburetor throat depression as a source of vacuum.

**vacuum assisted brake** Hydraulic brake actuated or assisted by atmospheric pressure, usually through mechanical linkages. Also *air-over-hydraulic brake*.

**vacuum fluorescent display** Electronic active (light emitting) display for vehicle instruments such as speedometers, particularly with digital readouts. Also *VFD*.

**vacuum over hydraulic brake** A vacuum assisted hydraulic brake system.

**vacuum pump** Pump for exhausting air from a cylinder or reservoir, as for operating vacuum assisted brakes.

**vacuum servo** Servo system using the differential between atmospheric pressure and a lower pressure source to assist the operation of a mechanical or hydraulic system, such as a brake.

**vacuum tank** Usually cylindrical container from which air has been partially exhausted, used to back-up vacuum brake system, particularly in event of failure of the engine operated system.

**valve** (1) Any device for controlling, restricting or interrupting the flow of a fluid. (2) A poppet valve or mushroom valve for controlling the flow of gases into or out of an engine cylinder. (3) Any form of engine valve. See also *disc valve*; *reed valve*; *rotary valve*; *sleeve valve*. See Figure V.1.

**valve bounce** Bouncing of a poppet valve on its seat when closing, usually as a result of spring resonance or overspeeding.

**valve crown** See *valve head*.

**valve face** The bevelled mating surface of a poppet valve.

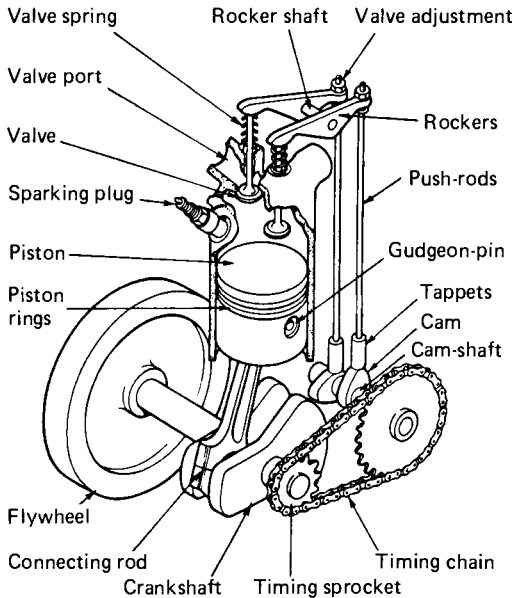
**valve gear** The mechanism that actuates a valve, and in particular the mechanical parts of the valve mechanism from cam to valve. See *valve train*.

**valve guide** Tubular insert in engine cylinder head, in which the valve stem slides.

**valve head** The disc end that performs the sealing operation in a poppet valve. Also *valve crown*.

**valve lifter** (1) Engine valve train component that bears directly on the cam. A *cam follower* or *tappet*. (2) Tool for removing valves.

**valve lock** Lock nut or other locking item that secures the tappet adjustment of a valve train once set. Also *keeper*.



*Figure V.1* Valve train of a single cylinder overhead valve engine

**valve overlap** Period, usually expressed in degrees of crankshaft rotation, between the opening of intake valve and the closing of the exhaust valve.

**valve rocker** See *rocker arm*.

**valve rotator** Mechanism for rotating a *poppet valve* while engine is running.

**valve seat** The annular bevelled surface with which a poppet valve is in contact at rest.

**valve seat insert** Ring shaped insert of harder or more durable material than that of the cylinder head of an engine.

**valve spring** Spring, usually a coil spring, that returns a poppet valve to its closed position (Figure V.1).

**valve spring shimmy** Resonant vibration of an engine valve spring.

**valve stem** Narrow cylindrical rod to which valve disc of poppet valve is attached.

**valve timing** Geometric positions in relation to crankshaft rotation or other reference at which valves open and close.

**valve train** The total mechanism from camshaft to valve of an engine that actuates the lifting and closing of a valve (Figure V.1).

**van** Vehicle with fully enclosed body primarily for transportation of freight or for trade use. See also *box van*; *demountable*; *luton*; *panel body*.

**vapor lock (UK: vapour lock)** Interruption of flow in a piped fluid system (such as a fuel line) resulting from vaporisation of the fluid or entrainment of air.

**variable choke carburetor** See *constant depression carburetor*.

**variable compression engine** Usually a standard engine for laboratory or research use in which the compression ratio can be varied, particularly whilst the engine is operating.

**variable depression carburetor** See *fixed choke carburetor*.

**Variomatic transmission** Infinitely variable light car transmission using rubber belts on expanding pulleys, originally produced by van Doorne in the Netherlands.

**varnish** (1) A clear lacquer. (2) A lacquer-like deposit composed of products of combustion and lubricant breakdown, often occurring on piston skirts. See also *gum*.

**vehicle clearance circle** Diameter of the smallest circle which will enclose the outermost points of projection of a vehicle when executing a turn at low speed and full lock.

**Vehicle Identification Number (VIN)** Number assigned to a vehicle by the manufacturer primarily for registration and identification purposes. It may consist of numerals and letters.

**ventilated disc** Disc of disc brake system consisting of two discs separated by ribs to bring about the flow of cooling air between the discs.

**ventilation** Provision of a free or forced draft of air to and from a vehicle passenger compartment.

**venturi** Convergent-divergent nozzle which accelerates and lowers static pressure in gases or vapors flowing through it. In a carburetor the venturi provides the depression in the air flow pressure that causes the fuel to be drawn from its bowl or chamber into the air stream. Also *choke*.

**vertical engine** Engine in which the cylinder axes are vertical.

**veteran car** A car of an early and specified period of construction maintained in original condition.

**VI improver** Compound added to lubricating oil to improve *Viscosity Index*.

**vibration damper** (1) Device utilizing fluid or mechanical friction to reduce vibration of a machine. (2) Rotating or oscillating mechanical device that counteracts vibrations in a machine, and particularly a reciprocating machine. See also *harmonic damper*.

**vintage car** Car of a later period than veteran, but particularly one preserved and maintained in original condition. The age of the car is variously specified.

**Viscosity Index** Empirical measure of the viscosity of a liquid. The higher the Viscosity Index, the smaller the change of viscosity with temperature.

**viscous coupling** Friction shaft drive using the property of fluid friction within an oil to transmit power.

**viscous damping** Vibration damping by fluid friction.

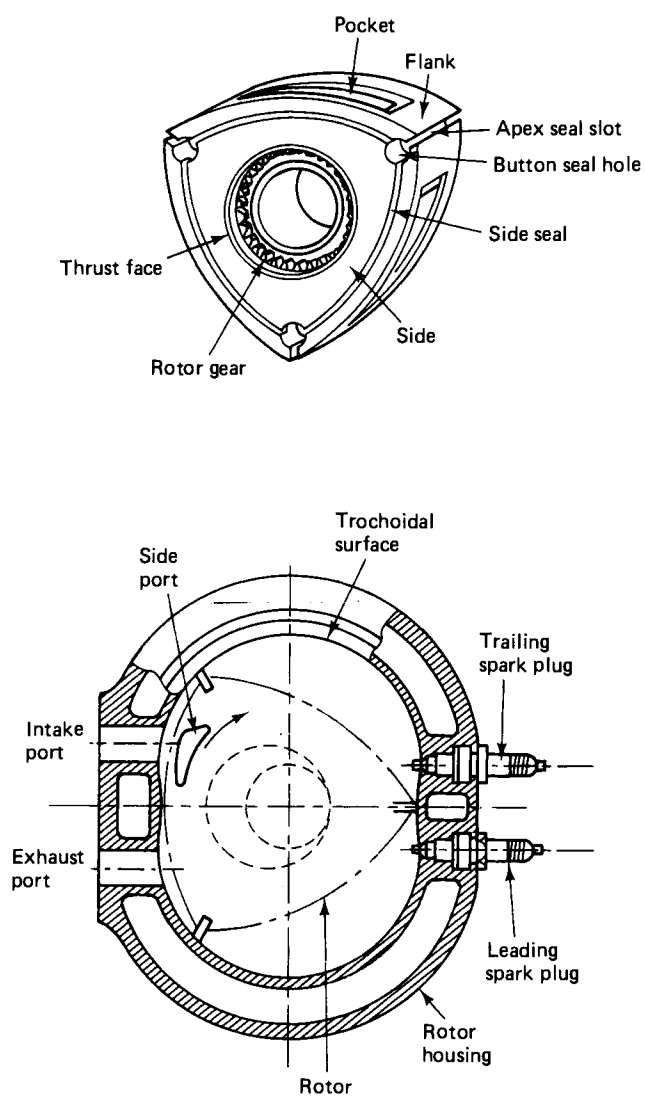
**voltage regulator** Electromechanical switch or relay, often with vibrating contacts, for limiting the voltage output from a generator. See also *control box*.

**volumetric efficiency** Extent to which the cylinder of an engine is completely filled by the incoming charge following an exhaust stroke. A measure of the ability of an engine to breathe freely. Note that the volumetric efficiency is a ratio of masses, not of volumes. Original definition was the ratio of volume of induced charge at inlet valve temperature and pressure to engine swept volume.

**vortex induced drag** See *induced drag*.

**vortex pair** Revolving wakes of air that follow a vehicle in motion.

**vortex stabilizer** (1) Vertical, forward projecting plate on the front of a semi-trailer, which obstructs lateral flow through the gap behind the cab in cross-wind conditions and is intended to stabilize the vortex between cab and trailer. (2) Any aerodynamic device intended to promote the orderly formation of trailing vortices, and thereby reducing drag.



*Figure W.1* Rotor and 'cylinder' of a Wankel engine

## W

**waddle** Side to side oscillation of a moving vehicle, often as a result of suspension or tire damage, or *lateral runout*.

**waffle clutch** Clutch of which the friction material is grooved with a criss-cross pattern to aid cooling, giving the appearance of a waffle.

**waist molding** Metal or non-metallic strip attached along the belt line of a vehicle. See *belt line*.

**waistline** See *belt line*.

**walk point** Beginning of onset of apparent loss of adhesion in cornering, when steered wheels in an understeering vehicle appear to walk sideways. (US informal).

**walking beam** Centrally pivoted beam that supports at each end a swinging shackle of a tandem rear axle leaf spring suspension. See also *balance beam*.

**wander** Directional oscillation of a vehicle or tendency to deviate from the steered direction, for example as a result of incorrect steering geometry or excessive wear in the steering mechanism.

**Wankel engine** Rotary engine using a three-cornered rotor in a trochoidal chamber, after inventor Felix Wankel (Figure W.1).

**water cooled** Using water as a heat transfer medium.

**water injection** Injection of water mist or vapor directly or indirectly into cylinder of an IC engine.

**water jacket** Part of the cylinder block and head of an engine that encloses the cavity through which cooling water flows (Figure E.1).

**water pump** (1) Pump that circulates the water of an engine's cooling system. Also *circulating pump*. (2) Any pump for delivering water under pressure, as for screen washing, etc.

**Watt's linkage** Three element linkage (four if the plane of attachment is included) providing straight line motion of the central element. The three elements usually lie within one plane, the two pivoted outer elements are linked at their inner ends to a short vertically mobile element that follows a perpendicular to a line joining the pivots of the outer linkages. Typically used for rear axle lateral location. See Figure W.2.

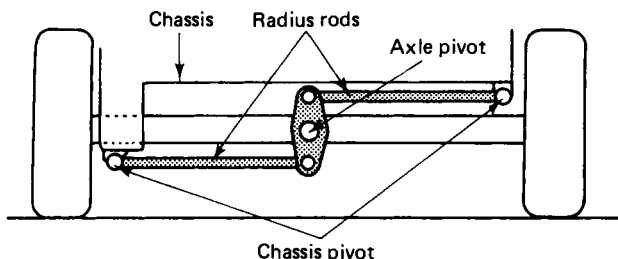


Figure W.2 Watt's linkage lateral location of rear dead axle

**wax element thermostat** (1) Temperature control device normally mounted on or near the radiator to restrict flow of cooling water when the engine is operating at less than optimum temperature. (2) Radiator thermostat in which a wax capsule melts at a predetermined temperature and so releases a valve to allow the escape of steam. Also *wax pellet thermostat*.

**wax injection** Injection of enclosed body components structural members with a corrosion-inhibiting wax.

**wax pellet thermostat** See *wax element thermostat*.

**wax plugging** Blocking of diesel fuel delivery lines by the formation of wax crystals at low temperature.

**weak mixture** Air : fuel mixture in which the proportion of air exceeds that for stoichiometric combustion. Also *lean mixture*.

**wear adjuster** Device to take up lining or pad wear in brakes. See also *automatic wear adjuster*.

**wearing-in (UK: running in)** Initial operation of new or rebuilt machinery under light load and at reduced speed to ensure even bedding of bearings and reciprocating items, and avoidance of scuffing or seizure.

**weatherstrip** Strip of flexible material attached to vehicle doors and intended to prevent the ingress of moisture.

**wedge combustion chamber** Tapering combustion chamber of overhead valve engine of a type intended to reduce the tendency to detonate. (Figure W.3).

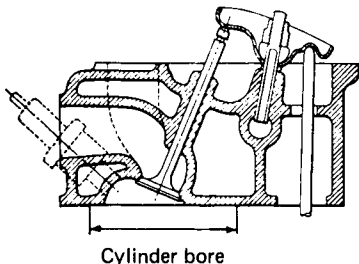


Figure W.3 Wedge combustion chamber with Roesch-type rocker

**wedge expander** Brake expander unit in a drum brake in which a taper wedge forces apart two pistons or tappets, which bear on the brake shoes.

**wedge lock** Sliding wedge of a fifth-wheel that prevents the semi-trailer kingpin disengaging from the hook.

**wedge-operated brakes** Drum brake in which shoes are forced apart by a *wedge expander*.

**weight transfer** The effective change of axle load when a vehicle accelerates or decelerates.

**Weiss coupling** See *Bendix Weiss joint*.

**welch plug** Disc shaped metal plug mainly used for closing apertures in engine cylinder block castings.

**wet clutch** Friction clutch that runs in an oil bath. Also *oil-immersed clutch*.

**wet grip** Ability of a tire to maintain adhesion on wet surfaces.

**wet liner (US: wet sleeve)** Not strictly a liner as it does not line a cylinder, but is the cylinder of a water-cooled reciprocating engine (UK informal). See also *cylinder sleeve; dry liner; liner; wet sleeve cylinder*. See Figure W.4.

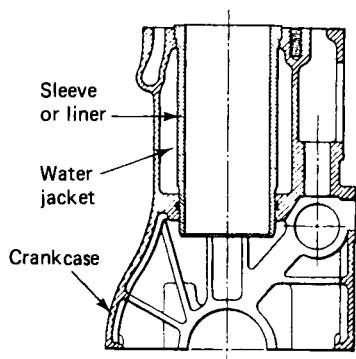


Figure W.4 A wet sleeve or wet liner cylinder

**wet sleeve (UK: wet liner)** Thin walled hard metal engine cylinder supported at head and crankshaft ends, but in contact with cooling water in between (Figure W.4).

**wet sleeve cylinder** Cylinder manufactured as a separate entity and inserted in a cylinder block, its outer walls being in contact with the cooling water. Also *wet liner*.

**wet sump** An oil reservoir normally attached to the bottom of the crankcase, from which lubricating oil is circulated (UK).

**wets** Racing tires for use in wet conditions (slang).

**Weymann construction** Type of vehicle construction in which fabric is stretched over a framework, after carriage-builders of that name (obsolete).

**wheel** (1) The disc assembly on which a vehicle runs, but in some definitions excluding the tire and hub. (2) Assembly of rim and center member or spider for attachment to an axle. (3) The steering wheel (informal).

**wheel arch** The usually semicircular housing above a roadwheel. See also *mudguard*.

**wheel base** See *wheelbase*.

**wheel brake** A brake operating directly at a road wheel, as opposed to an *inboard brake, transmission brake* or *retarder*.

**wheel cylinder** Hydraulic cylinder that forces shoes of a drum brake apart.

**wheel flutter** Oscillation of steered wheel about its steering axis, usually at a frequency greater than that of rotation. See also *wheel wobble*.

**wheel hop** Severe oscillation of a wheel in the vertical mode, in which the tire intermittently loses contact with the ground.

**wheel nut** Nut which fastens onto a stud and thereby attaches a wheel to its hub. See also *Rudge nut*.

**wheel plane** Central plane of the tire, normal to the spin axis.

**wheel rim** The periphery of a wheel on which the tire is mounted. See also

*three-piece construction; two piece construction.*

**wheel shimmy** Oscillations of the steered wheels about their steering swivel axis.

**wheel skid** Sliding between tire and road surface.

**wheel slip brake control** See *anti-lock braking system*.

**wheel spin** Rapid slipping rotation of a driven wheel resulting from the application of excessive torque for prevailing friction conditions. See also *limited slip differential*.

**wheel torque** Torque applied to the wheel from the vehicle about the spin axis.

**wheel well** (1) Cavity within a vehicle structure or coachwork to accommodate a wheel. (2) The recessed part of a wheel rim, between the flanges.

**wheel wobble** (1) Oscillation of a wheel at rotational frequency usually resulting from unbalance or misalignment. (2) Self-excited oscillation of steerable wheels about their steering axes, occurring without appreciable *tramp*. See also *wheel flutter*.

**wheelbase** Longitudinal distance between the front and rear wheel axes of a vehicle (Figure L.3).

**whelflight** Rotary disturbance at the steering wheel produced by forces acting on the steerable wheels.

**wheel slip (UK: wheelspin)** Slipping of driven wheels when friction between tire and road surface is insufficient to react driving torque.

**wheelspin** (1) Excessive slipping rotation of a driven wheel, where coefficient of friction is insufficient to react applied torque, as for example on ice. (2) Rotation of a driven wheel at a very low factor of motion transmissibility.

**wheelspin** See *wheel slip*.

**whiplash** Sudden forward and backward movement of the head of an occupant in a vehicle impact. See also *head restraint*.

**whip (UK: whirl)** Transverse oscillation of a shaft, and particularly a rotating shaft, due to eccentricity or resonance as a result of operating at the critical speed.

**whirl** See *whip*.

**whitemetal** Tin based bearing alloy.

**Wilson gearbox** A *pre-selector* change-speed epicyclic gearbox of specific design.

**wind tunnel** Aerodynamic test facility in which air is blown in orderly fashion over an object such as a vehicle or scale model, and instrumented so that quantitative readings of drag, lift and other parameters can be made.

**wind-up** See *axle wind-up*.

**window recess** Distance by which windows of a vehicle are set within the outer body profile, thus exposing structural pillars to the airflow. Also *window reveal*.

**window reveal**. See *window recess*.

**windscreen (US: windshield)** The forward-facing window of a motor vehicle, through which the driver sees.

**windshield** See *windscreen*.

**windscreen angle** See *windshield angle*.

**windshield angle** Angle at which the windshield or windscreen is set to the horizontal or vertical.

**windshield rake** Angle of the windshield or windscreen to the vertical. See also *windshield angle*.

**windshield wiper** (UK: **windscreen wiper**) Oscillating blade, with flexible rubber edge, for cleaning and removing water from a windshield or windscreen.

**windtone horn** Audible warning in which a vibrating diaphragm produces sound by vibrating a column of air in a horn.

**wing** (1) (US: fender) Side panel of a vehicle partially shrouding the wheels, but particularly the front wheels (Figure B.4). (2) See also *aerofoil; tonneau*.

**wing mirror** (US: **side mirror**) Rear-view mirror located near either exterior front corner of a vehicle. See also *driving mirror*.

**winglets** Small horizontal aerofoils attached to a high-speed vehicle such as a racing car.

**winker** Flashing indicator or hazard warning lamp (slang).

**winter front** Removable shield, often of fabric, that is attached in front of the grille to deflect cold winter air from a radiator.

**wiper blade** Rubber or composition blade of a windscreen or windshield wiper.

**wire wheel** Wheel of which the hub and rim are linked by wire spokes. Informal.

**wiring harness** The complete wiring assembly of a vehicle, particularly when installed as an integrated unit. Also *wiring loom*.

**wiring loom** See *wiring harness*.

**wishbone** Two-armed or V-shaped frame, mounted in horizontal plane for locating an independently suspended wheel.

**withdrawal** Disengagement, as of a clutch.

**withdrawal bearing** See *clutch release bearing* (UK); *throwout bearing* (US).

**withdrawal lever** A clutch release lever by which a clutch is disengaged.

**withdrawal plate** Circular dished clutch element used in certain designs of clutch to disengage the pressure plate from the driven plate. See also *clutch release lever; throwout sleeve*.

**wobble plate** See *swash plate*.

**worm and lever steering** Generic term for any steering box in which the drop arm movement is brought about by the action of a follower in a worm. See *Marles steering gear; worm and nut steering; worm and peg steering; worm and sector steering*.

**worm and nut steering** Steering gear in which *drop arm* action is brought about by movement in translation of a threaded follower on a worm gear, the follower being slotted to engage with a spigot on a crank arm (Figure W.5).

**worm and peg steering** Steering gear in which one or two pegs on a crank arm engage with a helical cam. Also called *peg and cam steering gear*.

**worm and roller** Mechanism consisting of a worm and a pinion roller in external contact, as used in some types of steering gear or rear axles (Figure W.6).

**worm and sector steering** Steering gear in which a worm, sometimes

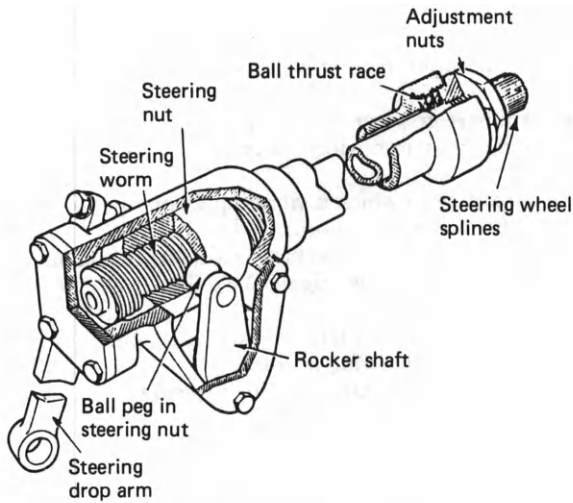


Figure W.5 Worm and nut steering box

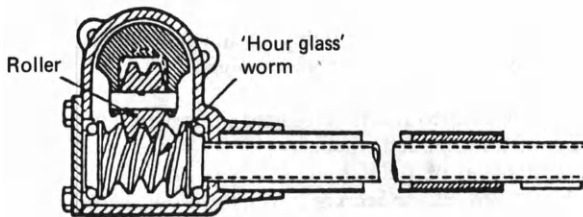


Figure W.6 Hourglass worm and roller steering box

waisted, acts upon the toothed radiused edge of a sector. A type of worm and lever steering gear.

**wrapround** Vehicle body element that curves from front or rear to the sides, as for example a wrapround windscreen (windshield).

**wrecker** (1) Someone engaged in the recovery of disabled vehicles. (2) A recovery vehicle, particularly one for the recovery of heavy commercial vehicles (US informal).

**wrist pin** (UK: **gudgeon pin**) Bearing pin that connects a connecting rod to a piston.

## Y

**Y pipe** Two branch exhaust manifold connecting the exhausts of a V engine to form a single exhaust. Also *breeches pipe*.

**yaw** To move or oscillate about a vertical axis, when in motion, as of a vehicle. The term was originally used to describe such motion in ships, and is similarly used in aeronautics.

**yaw angle** Angle of a vehicle's plane of symmetry or heading to its actual direction of travel or course. Also *heading angle*.

**yaw rate** See *yaw velocity*.

**yaw velocity** Angular velocity of a vehicle about its vertical axis. Also *yaw angular velocity*.

**yawing moment** The moment or applied torque tending to displace a vehicle in the yaw sense.

**yawing moment coefficient** Non-dimensional measure of the tendency of aerodynamic forces to displace a vehicle in the yaw sense.

**yawing rate** (1) Frequency of oscillation of a vehicle in yaw. (2) Yaw angular velocity.

**yoke** A fork-ended component, as of a tow bar or universal joint.

## Z

**Zimmermann valve** Type of crankcase induction *disc valve* for two-stroke motors.

## Y

**Y pipe** Two branch exhaust manifold connecting the exhausts of a V engine to form a single exhaust. Also *breeches pipe*.

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## Z

**Zimmermann valve** Type of crankcase induction *disc valve* for two-stroke motors.

# Appendix

## Abbreviations and acronyms

Readers should refer to main text for definitions of technical terms listed below.

<b>AA</b>	Automobile Association (UK)
<b>AAA</b>	American Automobile Association
<b>ABS</b>	anti-lock braking (also acrylonitrile-butadiene-styrene)
<b>ACL</b>	automatic chassis lubrication
<b>AEA</b>	Automotive Electrical Association (US)
<b>AERA</b>	Automotive Engine Rebuilders Association (US)
<b>AHP</b>	accelerator heel point
<b>AIR</b>	air injection reactor
<b>ALU</b>	arithmetic and logical unit (electronics)
<b>ANSI</b>	American National Standards Institute
<b>API</b>	American Petroleum Institute
<b>APRA</b>	Automotive Parts Rebuilders Association (US)
<b>ASME</b>	American Society of Mechanical Engineers
<b>ASR</b>	anti-spin regulation
<b>ASTM</b>	American Society for Testing and Materials
<b>AWD</b>	all wheel drive
<b>BDC</b>	bottom dead centre
<b>BHP</b>	brake horsepower
<b>BICERI</b>	British Internal Combustion Engine Research Institute (formerly BICERA)
<b>BNA</b>	Bureau des Normes de l'Automobile (France)
<b>BSAu</b>	British Standards Automotive (standards)
<b>BSFC</b>	brake specific fuel consumption
<b>BSI</b>	British Standards Institute
<b>BTC</b>	British Technical Council of the Motor and Petroleum Industries
<b>BTDC</b>	before top dead centre
<b>BUDC</b>	before upper dead centre (prefer BTDC)
<b>CAD</b>	computer aided design
<b>CAE</b>	computer aided engineering
<b>CAM</b>	computer aided manufacture
<b>CARB</b>	Californian Air Resources Board
<b>CBE</b>	cab behind engine
<b>CCMC</b>	Committee for Common Market Automobile Constructors
<b>CCS</b>	controlled combustion system

<b>CD</b>	capacity discharge (electronic ignition)
<b>CEC</b>	Coordinating European Council (standards)
<b>CFR</b>	Cooperative Fuel Research Committee
<b>CI</b>	compression ignition
<b>CMVSS</b>	Canadian Motor Vehicle Safety Standard
<b>CO</b>	carbon monoxide
<b>COE</b>	cab over engine
<b>CP</b>	centre of pressure (aerodynamic)
<b>CRC</b>	Coordinating Research Council
<b>CV</b>	constant velocity
<b>CVCC</b>	compound vortex controlled combustion
<b>CVS</b>	constant volume sampling (emissions)
<b>CVT</b>	continuously variable transmission
<b>DBP</b>	drawbar pull
<b>DIN</b>	Deutsches Institut für Normung (German standards authority)
<b>DIRSI</b>	deposit induced runaway surface ignition
<b>DLO</b>	daylight opening
<b>DOHC</b>	double overhead camshaft
<b>DOT</b>	Department of Transportation (US)
<b>DTp</b>	Department of Transport (UK)
<b>ECM</b>	electronic control module
<b>ECS</b>	evaporative control system (emissions)
<b>EEC</b>	electronic engine control (also evaporative emission control)
<b>EGO</b>	exhaust gas oxygen
<b>EGR</b>	exhaust gas recirculation
<b>EIN</b>	engine identification number
<b>EMC</b>	electromagnetic compatibility
<b>EP</b>	extreme pressure (lubricant)
<b>EPA</b>	Environmental Protection Agency (US)
<b>ESC</b>	electronic spark control
<b>ESV</b>	experimental safety vehicle
<b>EVC</b>	exhaust valve closed
<b>EVO</b>	exhaust valve open
<b>FAT</b>	Forschungsvereinigung Automobiltechnik (Germany)
<b>FISITA</b>	Fédération Internationale des Sociétés d'Ingénieurs des Techniques de l'Automobile
<b>FMVSS</b>	Federal Motor Vehicle Safety Standard
<b>FTP</b>	Federal Test Procedure (US)
<b>FWD</b>	front wheel drive. Also four wheel drive
<b>GAWR</b>	gross axle weight rating (US)
<b>GCW</b>	gross combination weight (US)
<b>GT</b>	Gran Turismo
<b>GTW</b>	gross train weight
<b>GVW</b>	gross vehicle weight
<b>HC</b>	hydrocarbons (collective term)
<b>HGV</b>	heavy goods vehicle
<b>HUCR</b>	highest useful compression ratio
<b>IAC</b>	Idle Air Control
<b>ICC</b>	Interstate Commerce Commission (US)

<b>ICEI</b>	Internal Combustion Engine Institute
<b>IFS</b>	independent front suspension
<b>IHP</b>	indicated horsepower
<b>IMechE</b>	Institution of Mechanical Engineers (UK)
<b>IMEP</b>	indicated mean effective pressure
<b>IMI</b>	Institute of the Motor Industry (UK)
<b>IP</b>	Institute of Petroleum
<b>IRS</b>	independent rear suspension
<b>IRT</b>	Institut de Recherche des Transports (France)
<b>ISO</b>	International Standardization Organization
<b>IVC</b>	inlet valve closed
<b>IVO</b>	inlet valve open
<b>LCD</b>	liquid crystal display
<b>LDC</b>	lower dead centre
<b>LED</b>	light emitting diode
<b>LNG</b>	liquefied natural gas
<b>LPG</b>	liquefied petroleum gas
<b>LVI</b>	Low Viscosity Index
<b>MAA</b>	Motor Agents Association (UK)
<b>MAF</b>	mass air flow
<b>MAP</b>	manifold absolute pressure
<b>MAS</b>	maximum axle spacing
<b>MAT</b>	manifold air temperature
<b>MIRA</b>	Motor Industry Research Association (UK)
<b>MoT</b>	Ministry of Transport (former UK ministry)
<b>MPV</b>	multi-purpose vehicle
<b>MVI</b>	Medium Viscosity Index
<b>NDIR</b>	non-dispersive infrared
<b>NHTSA</b>	National Highway Traffic Safety Administration (US)
<b>NVH</b>	noise, vibration and harshness
<b>OEM</b>	original equipment manufacturer
<b>OHC</b>	overhead camshaft
<b>OHV</b>	overhead valve
<b>PAH</b>	polyaromatic hydrocarbon
<b>PCV</b>	positive crankcase ventilation
<b>PIN</b>	Product Identification Number
<b>PR</b>	ply-rating (of tires)
<b>PRF</b>	primary reference fuel
<b>PSV</b>	public service vehicle
<b>PTO</b>	power take-off
<b>RAC</b>	Royal Automobile Club (UK)
<b>ROPS</b>	roll-over protective structure
<b>RV</b>	recreational vehicle
<b>RVI</b>	Recreational Vehicle Institute (US)
<b>SAE</b>	Society of Automotive Engineers (US)
<b>SFC</b>	specific fuel consumption
<b>SFI</b>	sequential fuel injection
<b>SG</b>	spheroidal graphite (iron)
<b>SHP</b>	shaft horsepower (rare in automobile context)

<b>SI</b>	spark ignition (also Système International d'Unités)
<b>SMMT</b>	Society of Motor Manufacturers and Traders (UK)
<b>TC</b>	twin carburetor (also twin camshaft)
<b>TCP</b>	tri-cresyl phosphate (fuel additive)
<b>TDC</b>	top dead centre
<b>TEL</b>	tetra ethyl lead (additive)
<b>THC</b>	total hydrocarbon (emissions)
<b>TIR</b>	Transport International Routier
<b>TML</b>	tetramethyl lead (additive)
<b>TPV</b>	thermoplastic vulcanizate
<b>TRA</b>	Tire and Rim Association (US)
<b>TVO</b>	tractor vaporizing oil (fuel)
<b>UJ</b>	universal joint
<b>VCM</b>	vehicle condition monitoring
<b>VDI</b>	Verein Deutsche Industrie (Germany)
<b>VFD</b>	vacuum fluorescent display
<b>VI</b>	Viscosity Index
<b>VIN</b>	vehicle identification number
<b>WMI</b>	world manufacturer identifier