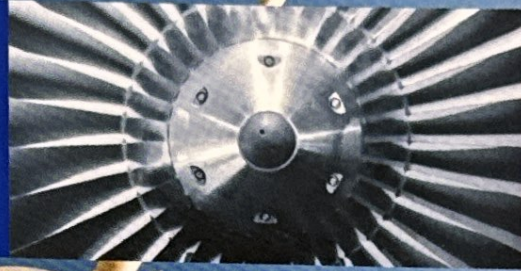


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TONY ATKINS & MARCEL ESCUDIER

A Dictionary of

Mechanical Engineering

TONY ATKINS
AND
MARCEL ESCUDIER

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solenoid A coil of electrically-conducting wire wrapped around a metal core, typically iron, to produce a magnetic field and hence a force on the core when an electric current passes through the coil. Solenoids are widely used to produce linear movement to actuate valves (**solenoid valves**) and other devices.

sol-gel technique deposition A micro-fabrication process in which a polymer compound dissolved in a solvent is spin-coated onto a substrate surface to form a gelatinous network (the gel) on the surface. Subsequent removal of the solvent solidifies the gel. The process can also be used to deposit various ceramics.

solid-body rotation Rotation of a body or mass of fluid about a fixed axis in which the tangential velocity varies in proportion to radial distance from the axis. *See also* FORCED VORTEX.

solid coupling A coupling forged in a solid piece with its shaft.

solid damping *See* STRUCTURAL DAMPING.

solid head A piston engine in which the cylinder head and cylinder block are cast in one piece and so cannot be separated.

solid-injection system A fuel-injection system for diesel engines in which liquid fuel at very high pressure is pumped through a fuel line, and then atomizing nozzles, into the combustion chamber.

solidity (σ) 1. For a screen, the ratio of the blockage area of the screen wires to the total area of the screen. 2. For a wind turbine, propeller, turbine, or compressor rotor, the ratio of the projected area of the blades to the total disc area.

solidity ratio For a cascade of turbine or compressor blades, the solidity ratio is equal to the blade chord divided by the pitch.

solid mechanics The elastic, plastic, or time-dependent behaviour of solid materials subjected to stress, temperature change, displacements, etc.

solidus The locus of temperatures on a phase diagram below which a given substance is completely solid (crystallized) and above which melting of the substance begins. Above the **liquidus temperature**, the material is homogeneous and liquid at equilibrium. Between the solidus and liquidus temperatures, mixed liquid-solid microstructures exist in alloys. When solid-state transformations occur, the corresponding names are solidoid and liquidoid.

soliton A self-reinforcing wave packet or pulse that maintains its shape while propagating, for example on a water surface, at constant speed. The permanency of form is a consequence of the non-linear effects that prevent dispersion.

solid-solution strengthening The process by which metal alloys have increased strength compared with the elements of which they are composed, owing to the presence of interstitial or substitutional atoms.

solution A homogeneous mixture of two or more substances. The **solute** is dissolved in the **solvent**, both of which may be gaseous, solid, or liquid, but it is usual for the solvent to be a liquid. *See also* GAS MIXTURES.

Sommerfeld number *See* BEARING.

sonar The acronym for **sound**, **navigation**, and **radar**. It is an underwater system which uses reflected sound waves at sonic or ultrasonic frequencies to detect and locate submerged objects.

sonic A term for anything pertaining to the speed of sound.

sonic anemometer An instrument for measuring a component of airspeed V based on the time of flight t of sound between a transmitter and a receiver a known distance s apart. V is found from $V = s(1/t_1 - 1/t_2)/2$ where t_1 is the time in one direction and t_2 the time in the opposite direction. The soundspeed c can be found from $c = s(1/t_1 + 1/t_2)/2$. The total airspeed and its direction can be determined if three sets of measurements are made with the receiver-transmitter pair successively positioned at the corners of a triangle.

sonic area (A^*) (Unit m^2) The cross-sectional area for isentropic flow of a perfect gas through a duct at which the gas velocity equals the speed of sound at that location. For a choked convergent-divergent nozzle, the sonic area occurs at the throat (**sonic throat**). In other situations, it may not be a physically realized area but simply a reference area.

sonicator A high-frequency ($c.20$ kHz) sound generator used to agitate liquids. Applications include ultrasonic cleaning, agitation of suspended particles, dispersion of nanoparticles, and degassing.

sonic boom The sudden noise associated with the shock waves caused by an object flying through the lower atmosphere at supersonic speed. The shock waves create an N-shaped

fuels and nuclear energy. *See also* RENEWABLE ENERGY.

alternative-fuel engine An internal-combustion engine that can operate either as a diesel engine using diesel fuel or as a gas engine using gaseous fuel. *See also* DUAL-FUEL ENGINE.

alternator A relatively small electrical generator, usually driven by an internal-combustion engine to operate its ignition and charge the battery.

altitude Vertical height measured relative to a specified datum such as sea level.

altitude chamber (hypobaric chamber) A chamber in which conditions at different altitudes are simulated by a combination of appropriate pressures, temperatures and relative humidity. *See also* HYPERBARIC CHAMBER.

AM *See* ADDITIVE-LAYER MANUFACTURING.

Amagat's law (Amagat's law of additive volumes, Leduc's law) The volume of a mixture of ideal gases is equal to the sum of the volumes (partial volumes) each gas would occupy if it existed alone at the same temperature and pressure. *See also* DALTON'S LAW.

ambient conditions The thermodynamic properties, including pressure, temperature, and humidity, of the environment surrounding a body or system.

American valve *See* SCHRADER VALVE.

ammonia absorption refrigerator *See* VAPOUR-ABSORPTION REFRIGERATION CYCLE.

Amontons friction (Coulomb friction) Friction between surfaces where the ratio of the frictional force F to the normal force N is constant and independent of the area in contact. *See also* ANGLE OF FRICTION; COEFFICIENT OF FRICTION.

amplifier A device by which the output of a hydraulic, pneumatic, or electrical source is increased. *See also* ATTENUATION; GAIN.

amplitude For a sinusoidal signal, the amplitude is the peak value. More generally, the peak-to-peak amplitude may be defined as the difference between the highest and lowest values of a periodically-varying quantity. An alternative is the root-mean square (RMS) amplitude, which is the square root of the time average of the squared signal.

amplitude-decay coefficient *See* DAMPING CONSTANT.

anaerobic digestion A process whereby organic waste is broken down by naturally-occurring bacteria in a controlled, oxygen-free environment to produce biogas. *See also* AEROBIC DIGESTION.

analogue readout A display on a meter or other measuring device where the reading is taken from a pointer on a scale, rather than being shown in digital form.

analogue-to-digital converter (ADC) A device which converts a continuous quantity to a sampled digital representation of that quantity.

anechoic chamber A room having all surfaces covered with sound-absorbing material, often in the form of wedges pointing into the room. The aim is to simulate free-field acoustic conditions.

anelasticity Literally 'not elastic', but in practice used for materials that display time-dependent recovery on unloading. *See also* INELASTIC.

anemometer (velocimeter) Any instrument that measures speed, and in some cases also direction, usually of a fluid flow but also applicable to surface movement. *See also* LASER-DOPPLER ANEMOMETER; LASER 2-FOCUS ANEMOMETER; PARTICLE-IMAGE VELOCIMETER.

aneroid Liquid free.

aneroid barometer An instrument that measures and records changes in atmospheric pressure using the expansion and contraction of a sealed bellows vacuum unit that is kept open by an internal spring.

aneroid calorimeter A calorimeter that uses a metal of high thermal conductivity such as silver, rather than stirred water, to absorb the heat released by a chemical reaction within the calorimeter.

angle factor *See* VIEW FACTOR

angle of advance 1. For a propeller, the angle between the relative velocity of the air-stream and the plane of the propeller. The relative velocity is the vector sum of the free-stream velocity (in flight, the aircraft speed) and the propeller rotational velocity. 2. (ignition advance, spark lead) In a spark-ignition engine, the angle before top-dead centre at which the spark occurs.