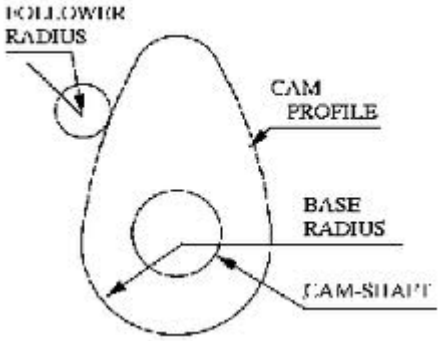
Camshaft

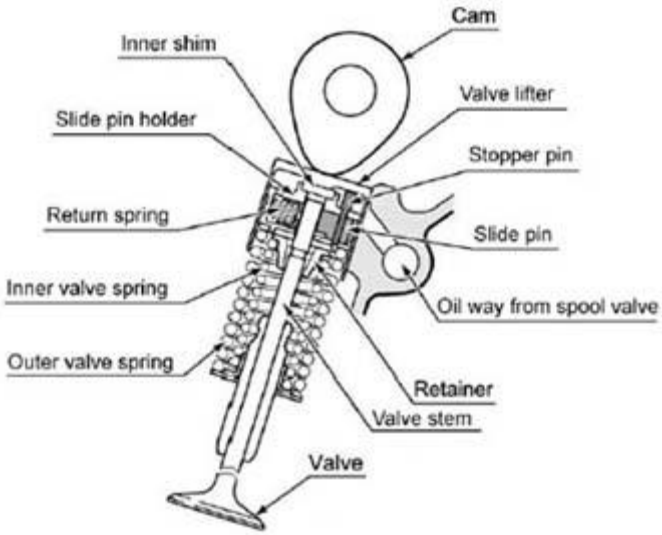
For the fictional characters of the same name, see Camshaft (Transformers).

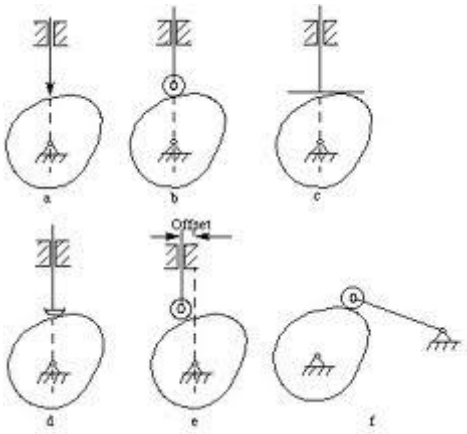
Computer animation of a camshaft operating valves

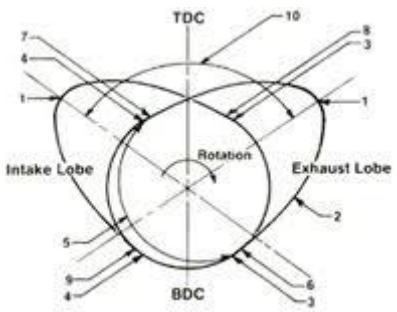
A **camshaft** is a shaft to which a cam is fastened or of which a cam forms an integral part.

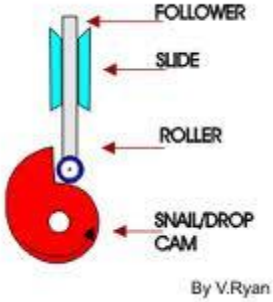
CAMPROFILE

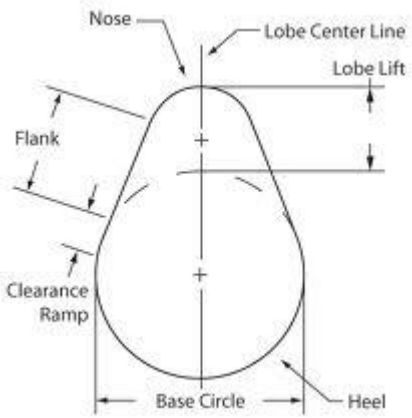

FOLLOWER
RADIUS
CAM
PROFILE
BASE
RADIUS
CAM-SHAFT


Cam
Inner shim
Valve lifter
Slide pin holder
Stopper pin
Return spring
Slide pin
Inner valve spring
Oil way from spool valve
Outer valve spring
Retainer
Valve stem
Valve


a
b
c
Offset
d
e
f

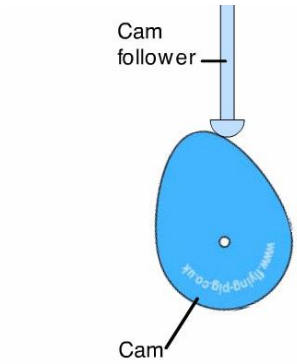

TDC
BDC
Intake Lobe
Exhaust Lobe
Rotation





- **Cams:**

Type of cams, Type of followers, Displacement, Velocity and acceleration time curves for cam profiles, Disc cam with reciprocating follower having knife edge, roller follower, Follower motions including SHM, Uniform velocity, Uniform acceleration and retardation and Cycloidal motion.



Cams are used to convert rotary motion into reciprocating motion. The motion created can be simple and regular or complex and irregular. As the cam turns, driven by the circular motion, the cam follower traces the surface of the cam transmitting its motion to the required mechanism. Cam follower design is important in the way the profile of the cam is followed. A fine pointed follower will more accurately trace the outline of the cam. This more accurate movement is at the expense of the strength of the cam follower.

18. <u>Classifications - Displacement diagrams</u>

- **Cam Terminology:**

Physical components: Cam, follower, spring
Types of cam systems: Oscilllating (rotating), translating
Types of joint closure: Force closed, form closed
Types of followers: Flat-faced, roller, mushroom
Types of cams: radial, axial, plate (a special class of radial cams).
Types of motion constraints: *Critical extreme position* – the positions of the follower that are of primary concern are the extreme positions, with considerable freedom as to design the cam to move the follower between these positions. This is the motion constraint type that we will focus upon. *Critical path motion* – The path by which the follower satisfies a given motion is of interest in addition to the extreme positions. This is a more difficult (and less common) design problem.
Types of motion: rise, fall, dwell
Geometric and Kinematic parameters: follower displacement, velocity, acceleration, and jerk; base circle; prime circle; follower radius; eccentricity; pressure angle; radius of curvature.

19. Parabolic, Simple harmonic and Cycloidal motions:

- **Describing the motion:** A cam is designed by considering the desired motion of the follower. This motion is specified through the use of SVAJ diagrams (diagrams that describe the desired displacement-velocity-acceleration and jerk of the follower motion)

20. Layout of plate cam profiles:

- Drawing the displacement diagrams for the different kinds of the motions and the plate cam profiles for these different motions and different followers.
- SHM, Uniform velocity, Uniform acceleration and retardation and Cycloidal motions
- Knife-edge, Roller, Flat-faced and Mushroom followers.

21. Derivatives of Follower motion:

- Velocity and acceleration of the followers for various types of motions.
- Calculation of Velocity and acceleration of the followers for various types of motions.

22. High speed cams:

- High speed cams

23. Circular arc and Tangent cams:

- Circular arc
- Tangent cam

24. Standard cam motion:

- Simple Harmonic Motion
- Uniform velocity motion
- Uniform acceleration and retardation motion
- Cycloidal motion

25. Pressure angle and undercutting:

- Pressure angle

A camshaft

The relationship between the rotation of the camshaft and the rotation of the crankshaft is of critical importance. Since the valves control the flow of air/fuel mixture intake and exhaust gases, they must be opened and closed at the appropriate time during the stroke of the piston. For this reason, the camshaft is connected to the crankshaft either directly, via a gear mechanism, or indirectly via a belt or chain called a *timing belt* or *timing chain*. In some designs the camshaft also drives the distributor and the oil and fuel pumps. Some General Motors vehicles also have the power steering pump driven by the camshaft. Also on early fuel injection systems, cams on the camshaft would operate the fuel injectors.

In a two-stroke engine that uses a camshaft, each valve is opened once for each rotation of the crankshaft; in these engines, the camshaft rotates at the same rate as the crankshaft. In a four-stroke engine, the valves are opened only half as often; thus, two full rotations of the crankshaft occur for each rotation of the camshaft.

The timing of the camshaft can be advanced to produce better low end torque or it can be retarded to produce better high end torque.

Duration

Duration is the number of crankshaft degrees of engine rotation during which the valve is off the seat. As a generality, greater duration results in more horsepower. The RPM at which peak horsepower occurs is typically increased as duration increases at the expense of lower rpm efficiency (torque).

Duration can often be confusing because manufacturers may select any lift point to advertise a camshaft's duration and sometimes will manipulate these numbers. The power and idle characteristics of a camshaft rated at .006" will be much different than one rated the same at .002".

Many performance engine builders gauge a race profile's aggressiveness by looking at the duration at .020", .050" and .200". The .020" number determines how responsive the motor will be and how much low end torque the motor will make. The .050" number is used to estimate where peak power will occur, and the .200" number gives an estimate of the power potential.

A secondary effect of increase duration is increasing *overlap*, which is the number of crankshaft degrees during which both intake and exhaust valves are off their seats. It is overlap which most affects idle quality, inasmuch as the "blow-through" of the intake charge which occurs during overlap reduces engine efficiency, and is greatest during low RPM operation. In reality, increasing a camshaft's duration typically increases the overlap event, unless one spreads lobe centers between intake and exhaust valve lobe profiles.

Source : http://nprcet.org/e%20content/mech/KM.pdf