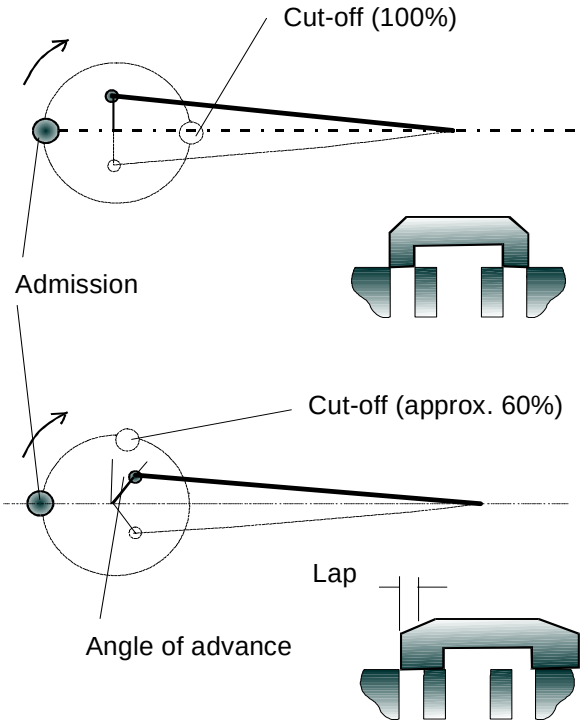
The ‘Simple’ Slide Valve

The original idea was to have the valve driven by an eccentric which was set 90 deg. in advance of the main crank. The first diagram shows this arrangement: the slide valve just closes the two (outer) steam ports when the main crank is at its extreme position (‘dead centre’). The slightest rotation of the crank will open to steam the port leading to one side of the piston, and open the other port to the central exhaust chamber. (Check that with the direction of rotation shown the correct ports are opened). Notice that the ports are not closed again until the crank has rotated 180 deg. and the piston has reached the other dead centre. Steam is admitted for the whole of the stroke and discharged to exhaust whilst it is still at full pressure, and thus no advantage is taken of expansion of the steam.

Clearly, if the ***cut-off*** point for steam admission is to be advanced it will be necessary to advance the eccentric further in relation to the crank; however this would mean that the port would be opened to steam before the piston had reached dead centre, thus opposing the motion of the piston. Consequently each end of the slide valve must be lengthened by an amount defined as the ***‘lap’***, so that the port is once again opened when the piston reaches its dead centre position. (See the second diagram). The ports will be closed again, cutting off the steam, when the main crank and eccentric are in the positions shown by broken lines and it will be seen that the main crank has to rotate through a smaller angle to achieve this than was the case with no lap (i.e. the first diagram)



(In practice it is found to be advantageous to open the valve slightly before dead centre - by an amount known as the ***‘lead’***.)

The valve motion can be represented by a combination of two motions: one at right angles in advance of the main crank (i.e ‘out of phase’), and a second which is 180 deg. in advance (i.e ‘in phase’ but reversed in direction).

The so-called ‘reversing’ valvegears are designed to vary the out of phase component so that as the engine is ‘notched up’ the cut-off point occurs earlier and the engine runs more economically (although this is achieved at the cost of a lower power output.)

The method of achieving this mixing of the two components is most clearly seen in Walschaerts gear, in which the out of phase motion from the return crank is ‘scaled down’ as the die is brought towards the centre of the expansion link. In Southern gear, the magnitude of the out of phase motion is varied by changing the position of the pin in the curved guide. When this pin is moved from its central position the end of the eccentric rod ‘kicks up’ more in response to the out of phase motion of the return crank, thus increasing the out of phase motion of the valve. The in phase motion (sometimes called the ‘lap and lead motion’) which is caused by the angularity of the eccentric rod is hardly changed as the gear is notched up. Indeed, when the engine is placed ‘on dead centres’ the reversing lever can be swung without moving the valve - a characteristic which all ‘radial’ gears (eg. Walschaerts, Hackworth, Heywood, Southern, etc.) have in common, and which results in a gear that gives a constant lead at all positions of the reversing lever.