Kent & East Sussex Railway

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Walschaert Valve Gear

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The Walschaert valve gear was invented in 1844 by the Belgian engineer Egide Walschaerts. At first this valve gear was not we received but it soon became popular with locomotive engineers finally emerging onto the UK scene in 1878. During the 20th Century it became extremely popular on larger, more powerful locomotives where the Stephenson's Link Motion was not favourable. The valve gear was also readily adaptable to operate with outside or inside cylinders and with outside or inside admission piston valves and slide valves.

With this type of valve gear the movement is derived from two distinct sources, as follows:

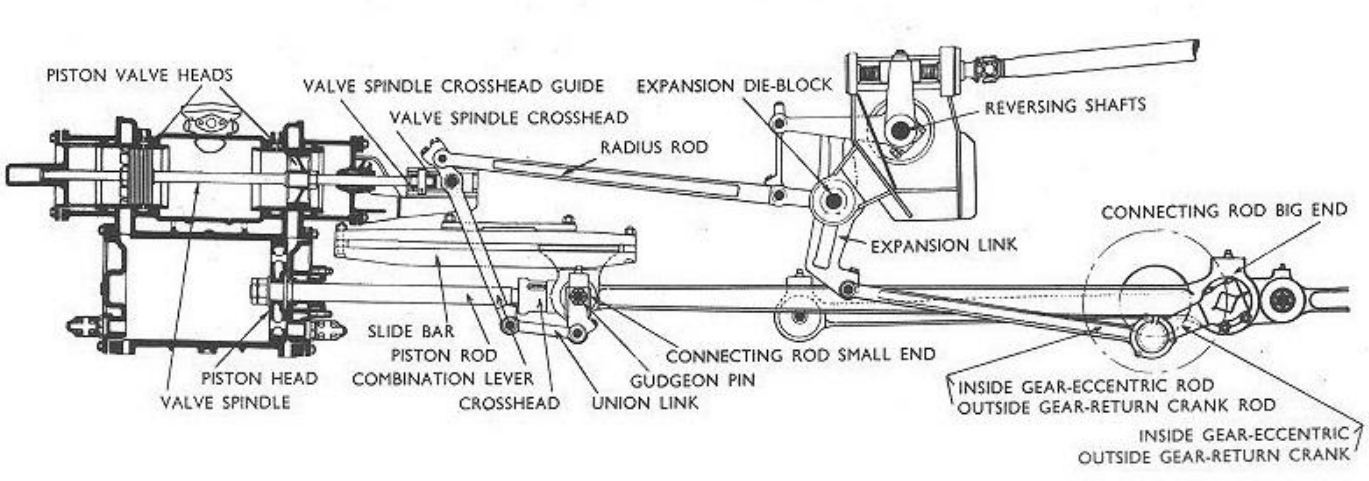
- A single eccentric or return crank, eccentric rod or return crank rod, expansion link and radius rod which provides for the movement of the valve equal to twice the steam port opening, the expansion link being provided for varying the cut-off and reversing the direction of travel.
- A combination lever attached at its lower end to a union link which is connected to the piston crosshead, the upper end of the combination lever being coupled to both the valve spindle and the radius rod, the latter being attached above or below the valve rod, depending upon the use of inside or outside admission valves respectively as per the diagram below.

The point at which the radius rod is attached to the combination leaver becomes the fulcrum of the whole motion, and the relative movement of the two ends of the lever must be such that the full movement of the cross head imparted to the lower end of the combination lever will give a movement to the valve spindle equivalent to twice the steam lap plus the twice lead.

The arrangement of the eccentric or return crank to provide movement to the valve beyond that already provided by the combination lever for lap and lead steam depends on whether inside or outside admission valves are employed.

With inside-admission piston valves the eccentric or return crank is set at 90 degrees behind the crank. With outside admission valves the eccentric or return crank is set at 90 degrees in front of the crank.

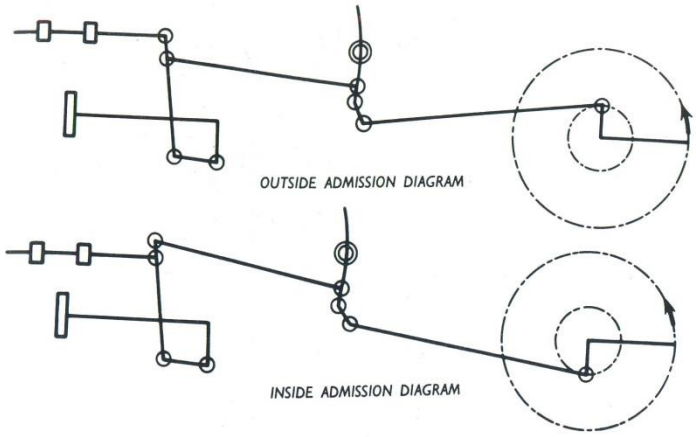
The expansion link, suspended at its centre by trunnions, is oscillated an equal amount forward and backward by the eccentric or return crank through the medium of the eccentric rod or return crank rod. An expansion die block slides in the expansion link and is attached to a radius rod which, attached at one end connects with the combination lever and is attached to the other end to the expansion die block in the link. The raising or lowering of the rear end of the radius rod causes the die block to be raised or lowered in the link.



Normally the bottom of the link is used for fore gear and the top of the link for back gear working, giving a direct movement for fore gear and indirect movement for back gear.

When the die block is in the centre of the expansion link for mid-gear position, the expansion link does not transfer any movement to the radius rod. Intermediate positions of the expansion, with the die block above or below the centre of the link allow for proportional transfer of movement from the link to the radius rod and valve allowing the cut-off to be varied.

The combined movements of the two sections of the gear result in a total movement of the valve equal to twice the amount of steam lap plus twice the port opening for steam, for each revolution of the driving wheels.



Variations of this gear are used to operate outside cylinders with the valve gear inside as on former G.W.R locomotives, also outside valve to operate inside cylinders as on the later builds of former L.M.SR. 4-6-2. Another variation is that used on former L.N.E.R 3-cylinder locomotives in which the Walschaerts' valve gear for the outside cylinders operate the inside cylinder through a system of levers.