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## An Interesting Valve Gear

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During a short holiday in the spring of this year I took the opportunity to visit the Didcot Railway Centre. Among the static exhibits at the Centre is a very interesting little locomotive incorporating a most unusual version of Walschearts valve gear. (Photo 1)



The locomotive itself is the only survivor of a class of two built by Kitsons of Leeds in 1898 for the Cardiff Railway. This railway, owned by the Marquis of Bute, was the smallest railway to be absorbed into the Great Western in 1923 and operated a "main line" of eleven and a half miles connecting to the Taff Vale railway together with 120 miles of dock and colliery sidings. This little engine was built as Cardiff Railway number 5, and together with its twin number 6 was inherited by the GWR who renumbered them 1338 and 1339. Number 1339 was scrapped and cut up in 1934 but 1338 was retained, initially in store but then on loan to Stewart's & Lloyds Ltd. during the Second World War. It returned to GWR in 1943 and served in various dock locations until being finally withdrawn from service in September 1963. It was in fact 22 the last standard gauge locomotive absorbed by the GWR to be withdrawn from service having run 354,000 miles in GWR and BR service.

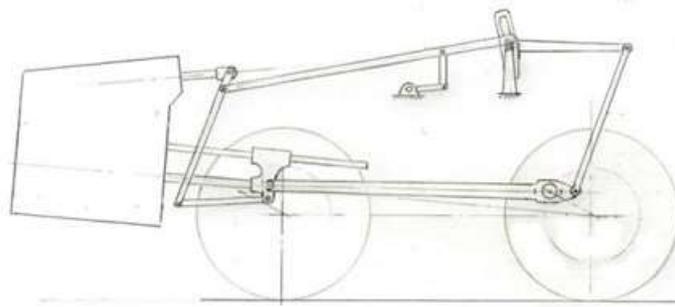


Figure 1

The feature of the engine which particularly attracted my attention was the valve gear (Figure 1). This is described as Kitson-Hawthorn valve gear and is a version of Walschaerts gear originally developed by Kitson's for use in tram engines, of which they built about three hundred. As will be seen from the diagram and photographs, the drive for the expansion link is derived from an extension to the end of the connecting rod (Photo 2) rather than the usual return crank.

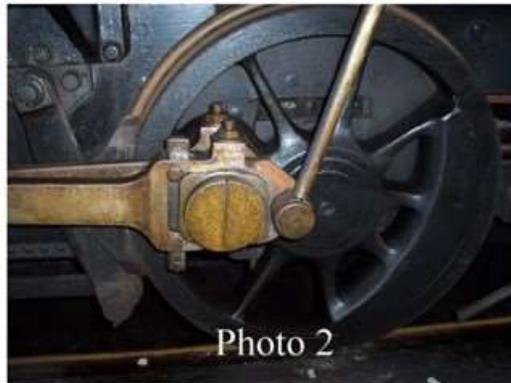


Photo 2

As readers will appreciate, it is the quadrature component of the valve motion which is derived from the expansion link in Walschaerts gear. The drive for the link is normally obtained from a return crank set at 90 degrees to the main crank. The link drive derived from the end of the connecting rod is, of course, in phase with the main crank and the 90 degree phase shift necessary to drive the link is achieved by using a connection at right angles to the motion centre line (Photo 3).

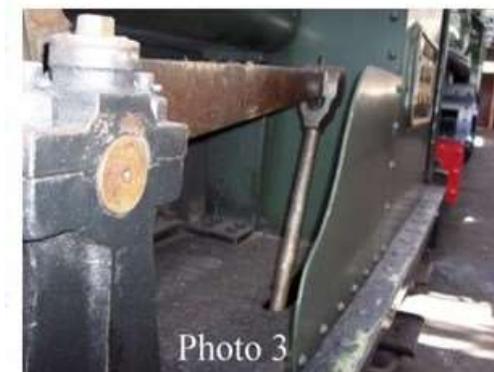


Photo 3

The connecting link which does this performs the function of the eccentric rod in a conventional Walschaerts gear but because it is attached to the outer end of the connecting rod its linear motion is even greater than the cylinder stroke and the drive arm of the link must be made long enough to ensure that the link swings through an acceptable angle (Photo 4).



Photo 4

The in-phase component of the valve motion to achieve any lead required is provided by the usual combination lever driven from the cross head (Photo 5). These dimensions estimated from photographs. The disadvantage of driving the link in this way is that, as with radial valve gears such as Hackworth, Marshall and Joy gears, the valve events are upset by movement of the axle within the engine frames. This is unlikely to have been of great concern for this little locomotive however, which would have spent most of its time in shunting wagons in the docks. The idea of a model of this unique prototype is very appealing. It would be quite quick to build (“quick” being a relative term!), would be light and easily handled and “different”!

### Specification

	Prototype	5" Gauge model
Overall length*	22' – 9"	24"
Wheel base*	6' – 6"	7"
Cylinders	14" x 21"	1 1/8" x 1 3/4"
Driving Wheels	3' – 2 1/2"	3 7/16"
Boiler diameter	3' – 10"	4"
Weight	25 tons – 10 cwt	Estimated 65lbs

The table shows the principal dimensions of the prototype together with suggested sizes for a 5" gauge model. Even a 7 1/4" gauge locomotive would still be relatively light and easily managed. Wheel castings for one of the many standard designs could probably be pressed into service and the boiler for one of the small tank engine designs could no doubt be adapted without difficulty. Cylinders and other parts could be fabricated to avoid pattern making. The prototype incorporated a well tank between the frames, and this could be filled with lead on the model to improve the adhesive weight. The prototype was not superheated but anyone building a model would probably fit a super heater of some type. Unfortunately, there do not appear to be any drawings of the prototype available and it would be necessary for any prospective model builder to spend time at Didcot with a camera and a pencil, paper and measuring tape. Anyone interested?