G3 Locos -Robots in Disguise?

To quote the late Arthur C Clarke “Any sufficiently advanced technology is indistinguishable from magic”… The G3 loco has progressed from Clockwork, through Steam, Electricity Diesel and Gas Turbine. Each of which has given rise to the problems of remote and on board control systems. I have a book from the 1950’s by Earnest Steele which details the remote control of clockwork loco, (forwards and backwards with “throttle”), by the use of AC pulses fed down the two rails. Nowadays we would look curiously at what would be the use of such a system -would it not be simpler to use a two rail DC electric and remove the clockwork?

But within its strange covers is an idea that has merit. As the spring unwinds it makes connection with a switch which uses the AC pulses to power a motor to rewind the spring! This is a version of on board self reliance and extended working -or a simple feedback loop.

I have an electric loco which I am building which is based on an LMS Black Five -but I have modified it to resemble a Jubilee with splashers and other bits and pieces. What sets this model apart from my usual electric models is the type of ESC used. I have used the Dimension Engineering SYREN25 device on another large loco -but I have never used the X2-Kangaroo controller board that plugs into it. This uses sensors, (in this case a quadrature encoder on the axle), to provide information about its environment. It also detects the voltage and power draw on the motors -thus if the train goes uphill it detects the fall in rotation and additional current drawn by the motors. It steps up the voltage to restore the speed and brings everything back to the status quo. If the train runs down hill the system shunts power from the motors using them as dynamos to the battery -using them as brakes. The system them cuts down the amount of current during constant speed running to conserve battery life. Although the SYREN25 runs at a PWM rate of 32kHz it has the capacity with the X2 board of varying this.

This is the speed and power feedback loop.

The onboard “sound effects” are provided by a MyLocosound system. This too has been modified. Programming the board is done with a modified TV remote control, (honestly!), but the board has several “ports” that can be adapted for other sources of control. The setting that it lives with is the standard Stanier LMS loco “hooter” and the chuff rate is determined by a chuff cam on the same axle as the quadrature encoder. The exhaust beat is set for a 2 cylinder simple. The hooter port is controlled by a simple One Chip Computer examining the feed from the receiver. A BASIC loop runs; one hoot for forwards, two hoots for reverse, and three hoots for stationary engine. It also hoots SOS if the tilt switch activates after de-railing!

This is the sound and alarms feedback loop.

The receiver has a few as yet unused functions. I use the normal turn pot for speed. The transmitter has an “inertia” control that is quite dangerous to use on anything other than starting(!) If signal is lost, (the range of the 4mW transmitter is about 10m), then the system defaults to “hold current speed” until contact with the transmitter is regained. The R/C system uses the now common place 2.4GHz “BIND” system. I have a large loco that uses this and it went “mad” at a GTG I attended. Unbeknownst to me at that time there was a person inside an adjacent building demonstrating their 2.4GHz equipment and in the 30 seconds “transmitter search period” it found a transmitter sending “BIND” pulses -so my loco “bound” to that controller. There was nothing I could do and it went forwards backwards fast and slow even with my transmitter switched off...

This is the control feedback loop

All of the above relate to control of an electric powered loco. But what if the loco is steam powered? There ARE electronic components that will take 200 degrees with ease -but these are rather expensive military devices… Far simpler and cheaper to use simple mechanical feedback loops.

BIX sell a device (part number 029) that regulates the amount of gas fed to the burners in your boiler. This works by the steam pressure cutting down on the amount of gas passed to the burners. This is shown on the left. Clevedon Steam sell a similar device except theirs has remote electronics rather than being purely mechanical (see right). The prices of the two system are roughly the same.

This is the steam pressure to burner feedback loop.

There are available 12V electric powered water pumps for model steam boilers. These use a standard force pump found on an axle, powered by a electric motor with a reduction gearbox. These are somewhat rare and hard to find outside of the US -where I got mine from. However they **do** exist. The “Orange Book” lists them as one of the required forms of water pump for the boiler. The others being; the hand pump, the axle pump and the steam injector. Using some form of simple optical pickup it should be possible to “read” the water gauge by the coloured liquid interrupting the light beam.

This is the water level feedback loop.

Radio control of the steam throttle is nowadays a very simple thing. Clevedon Steam sell a simple ball cut off valve with lubricator to an arm that connects to the “horn” of a servo.

This is the one used by my steam loco. It is of the conventional “butterfly” disc type.

The other type is the “needle” valve. This would require a “winch” type servo with a gearing system to operate it.

This is the throttle feedback loop.