A 5” Gauge EWS 67010 - Part 2

By James Thirsk

In my previous article, I described the beginnings of my current project, an EWS class 67 Bo-Bo, and some of the problems, trials and tribulations I have encountered so far. I had by this stage (November 2004) got the loco to a stage where I had successfully test-run it on our track, and I was fairly contented with its performance.

Cue a complete change of tack.

It was at about this time that James Mander was nearing completion of his petrol-hydraulic test chassis, ‘Bitsa,’ which I am sure you will have read about. I was designing some parts for the ‘Skip’ one evening when it suddenly dawned upon me: Why don’t I make the Skip petrol-*electric*?

Skip’s First Test Run

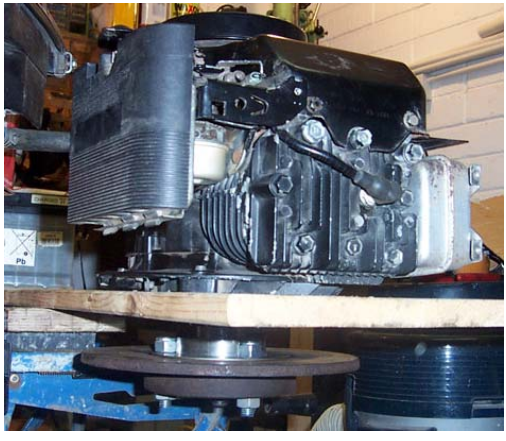
I pondered for a while and surmised, as James had, that the best engine for the job would be a vertical crank single cylinder lawnmower engine. This would not only be able to fit inside the body with little butchering, but with the addition of a sizeable flywheel it could be made to run quite sweetly at low revs.

With these criteria set, I started thinking about where I could source an engine. We happened to have a ‘Hayterette’ lawnmower in the shed with just such an engine fitted. Upon broaching the subject with my Dad of ‘repossessing’ this engine, he immediately shunned the idea: “ya can’t have that engine, that ‘mower’s got sentimental value, I’ve had it for *thirty* years!” I am quite glad, now, that I wasn’t allowed to have this engine: Thirty years old it may have been, but this could have been confirmed just by inspecting the thick fog of blue smoke which emerged from the exhaust upon starting and under heavy mowing.

I eventually found a suitable engine which I picked up quite cheaply, a Briggs and Stratton 149cc 3.5hp 'Quantum.' It is a fairly modern unit at around five years old; I was reliably informed that it had been professionally serviced annually since new: and judging by the size of his lawn, it had hardly been used.

Once I had stripped the engine off the mower and discarded the plastic carcase, I hurriedly pressed into service an old pine shelf as a test bed, which I cut holes in and bolted the engine to. I fired it up: whilst being rough due to running without an external flywheel, everything was taut, it didn't leak and didn't smoke; not even when under heavy acceleration. What's more, it had a proper carburettor and air filter. My dad saw this and offered me a swap for his knackered, clapped out old engine which he was so emotionally defending before. So much for sentimentality!

The petrol-electric principle I am using is similar to that of a standard gauge diesel-electric loco, in that the power produced from the generator is directly fed to the motors. This is contrary to several suggestions I have received that I should have a 'float' battery. I originally decided on using a car dynamo, salvaged from a Triumph Vitesse my Dad once had, to provide the traction current. I attached this to my earlier mentioned engine test 'shelf,' mounted vertically with a 'V' belt providing the drive underneath the board. The engine was by this stage fitted with a flywheel, an old car disc brake (see right), a boss and a pulley.



One of the practical upshots of having chosen a dynamo was that I could 'motor' it in order to start the engine. The engine test shelf complete with dynamo was screwed onto the Skip's chassis, and test-run at 'the park' (February 2004). At the time, I had no idea how I was going to control the dynamo output, so I simply had series/parallel control on relays during this run. This proved to be both interesting and comical to drive, and provoked me to think carefully about how I was to control the motors, as I had welded one of the relays by the end of the day.

I suddenly realised that I was missing the blindingly obvious, which was to control the low current side of the dynamo, the field. This would regulate the traction output from the dynamo, thus solving all my control problems. A second track test, using a pulse-width modulation controller on the dynamo field, proved that this would work: you could very smoothly accelerate from a stand. This track test also proved to me that the dynamo wasn't up to the job of providing the traction current I needed for passenger hauling. Back to the drawing board, I thought.

My next idea was to have an alternator to provide the traction current, with the dynamo providing engine starting and, once started, it would charge the loco battery. I made an engine mounting plate from 5mm steel which also supported the dynamo. The alternator was then mounted further along the frame from the engine. There were now two belts, one for each device, with a double pulley fitted to the engine shaft.

The alternator proved to be much more successful than the dynamo out on the track, but a few problems still remained. Firstly, the alternator got intolerably hot. Whilst it had had a shaft driven centrifugal cooling fan, it seemed to be almost ineffectual. I later found that this alternator was rated as '23/65A,' which I can only assume to mean 23A continuous, 65A peak. Little wonder it was overheating.

The other problem I had was that, having pulled away with a load, the load on the engine apparently increased suddenly and caused the engine to stall, unless you quickly backed off the alternator control. To me, this was reverse to what I expected: that the electrical load would decrease as speed increased due to the increasing back EMF from the motors, causing the engine to speed up. I decided that the alternator wasn't totally to blame here, as I eventually concluded that it must have been belt-slip which was causing the problem. Little wonder, really, I was asking too much of the 10mm section 'V' belt. The theory was that the belt would slip easily if too much power was applied (much like loco wheel slipping) but once the load dropped off a little the belt would 'catch up' again, requiring more torque than the engine had available causing a stall.

I thought about these problems and considered my options. They seemed to be very limited, the obvious one being to replace the alternator with a suitably rated one, and to use an automotive Poly-V section belt, which could handle greater torque. I duly purchased a Bosch 120A alternator from eBay which was already fitted with a 6 groove Poly-V pulley. I sourced another, larger, pulley from a Ford Scorpio power-assisted steering pump at the scrap yard which I fitted to the engine shaft. The significant disadvantage of using the Poly-V type belt was that I only had space for one belt-run, so I could no longer run the dynamo. This meant I had no means of electrically starting the engine or charging the battery.

I have tested the new alternator out on the track, and things seem to be much more promising than before. The new alternator also has a duct on the rear to accept forced cooling: to this I attached my Vauxhall screen blower which was originally intended to be a traction motor blower. Due to space constraints, I have decided I will fit PC type fans to the tops of the motors instead.

As it stands, the plan with starting/charging is to fit a Briggs and Stratton starter motor which will act on a gear-cut ring on the lower flywheel of the engine. The charging will be taken care of by a small dynamo which will sit in the slack side of the main Poly-V belt, the practical upshot being that it will also act as a belt tensioner, thus reducing the effects of belt slip as detailed above.

Several people have commented that the carburettor, exhaust and fuel tank are out-of-gauge. I have re-plumbed the carb' and air filter so that they lie inside the body outline. The exhaust will be plumbed towards the rear of the loco where I will fit a bespoke silencer. This will have a small take-off pipe which will be used to pressurise the fuel tank, thus alleviating the need for a dedicated fuel pump, as the fuel tank will sit lower than the 'carb.

Next time, I will talk about bogie developments, progression of the petrol-electric idea and starting/charging.

James T