



5" gauge Ruston

Three generations of small diesels. By Andy Probyn

Maxitrak has been making small battery powered diesel engines since 1978, this article is intended to show some of the changes and developments that have shaped the range of five inch gauge diesels over that period.

The story starts some time in the early 70's when I was doing a teacher training course. The idea was to design a simple battery powered engine that might be suitable for use in schools where it could be used to encourage youngsters in the model engineering hobby. For ease of manufacture a glass fiber body was used, with a four wheeled chassis using jack shaft drive, based on a Hudswell Clark dock shunter prototype.

The motive power was a converted car dynamo driving a jack shaft through bevel gears with outside frames and coupling rod drive to the wheels. This engine proved successful though heavy on battery use. Various ideas were tried to improve performance culminating in a double ended version running the dynamo on 24 volts. This engine was also a success, and was even timed at a scale 100MPH using weak

field on the dynamo. Both these engines are still in use but both have been re motored to obtain better battery life.

We now come to the subject of the first part of this article, the first Maxitrak locomotive, "Simplicity".

In 1978 my friend and business partner Bill Bridges and I decided we would have a go at making a commercial battery engine for 5" gauge. We used the knowledge from the first Hudswell Clark locomotive to design a simple chassis. An angle iron frame was brazed up complete with buffer beams and couplers, the wheels were mounted on steel brackets and coupled with chain, the front axle was adjustable for chain tension.



The original 5" gauge Simplicity

This was quite different to the Hudswell engine but was much simpler to make than the outside rods and spring suspension of the original design. What was the same was the vertical motor in the cab with a bevel gear drive, and the use of a simple resistance controller. As you can not sell new engines powered by second hand car dynamos we went looking for a motor, and found a suitable 100 watt permanent magnet motor to do the job. This was a bit of a find as the same basic motor has been used right up to date on the last of the second generation of engines. It has grown from 100 watts to 120 watts and made by four different suppliers over the years but still the same basic motor.

The body design chosen for Simplicity was based on a narrow gauge Fowler diesel of the early 50's, cast in glass fiber with a wooden frame round the base. The cab had open sides and the controls in the cab were reached through these, though the speed handle could be extended through the roof.

Bill and I made a batch of five engines in the winter of 1978, I worked on the mechanics while Bill, who was a car bodywork man by trade, set about the glass fiber bodies. Once they were done we put an advert in the Model Engineer and waited to see the results.

You have to remember at this time there were no commercial producers of electric engines in five inch gauge and there was quite a lot of ill feeling at their introduction amongst the steam fraternity. I think they were still smarting from the Beaching cuts and the demise of steam in full size and thought we might do the same in miniature. (It was not until two years later that our first steam engine went in to production.) "It is not steam and I don't like it" was one memorable remark, however I think that now we know that the model diesel engines are a popular part of most model engineering clubs. They are a useful addition to the steam roster and get new

comers in to the hobby young and old alike, as was the intention with the very first Hudswell design.

In the event we need not have worried as the engine was well received and we soon had to set about the next batch of ten engines. From 1978 to 1983 we produced over two hundred locomotives to this design, many going abroad including a batch of five to Japan.



A batch of Simplicities ready for export to Japan

There were a number of minor design changes mainly to the body, those made in a three part mould had a bar down the centre of the radiator while the five part mould bodies had a single radiator panel. On later engines the wooden base to the body was replaced by an all glass fiber molding. Two speed options were offered giving four or six miles per hour, this was achieved by putting a larger or smaller reduction gear on the drive to the bevel gears. All of these first generation locomotives were made with single speed resistance controllers, they were intended to be run most of the time at full speed and were geared to suit the type of track they were to be used on. The controller switch consisted of a brass contactor running over brass 2BA cheese head bolts, the resistors were originally wound from the elements taken from old night storage heaters. (These were very useful as the fire bricks were used in the brazing hearth and the steel sheet used to put a new floor in my Austin Seven!)

This controller had the advantage that it could be fixed by the most un electrical person as all the working parts were self evident. However it does not give the controllability and economy of battery power that an electronic controller can, a conversion to this type of controller is the most common modification to these engines.

The standard finish for Simplicity was in green with a yellow stripe, with other colours done to special order. As Bills background was painting Rolls Royce's, Bentleys and other vintage cars the finish was top class, and has set a tradition with Maxitrak products. Proper finishing is labour intensive and expensive, many customers are happy to have a go them selves and this is where the popularity of the kit has come in. In the early 1980's Simplicity was available as a kit where the customer could do their own assembly, painting and wiring. This saved £30 on the ready to run price of £245, (about £1000 by today's standards). Standard gauge style spring buffers and hook were also offered as an option instead of the centre buffer coupler. To me a narrow gauge engine always looks wrong with buffers even though they were occasionally used in full size, (sorry Tallylyn fans!) Having said that a set of Tallylyn or Corris railway buffers is quite different to standard gauge buffers scaled down.

Around this time we also scaled up the 5" engine to give us the 7 ¼" gauge version called "Simplicity 2". This engine has a similar construction though with sprung suspension, ball race bearings and chain transmission. In its third decade this is now the oldest Maxitrak design still in production and has been built in 4 wheel, six wheel, petrol hydraulic, electric and rack versions. Examples have been exported to Europe, North and South America, Japan, Taiwan and Australia. The London Toy Museum bought three which they used every day (except Christmas day) for about ten years, We serviced them but never had to replaced motors or bearings, they are currently in Japan with the rest of the museum collection where I hope they enjoy a more peaceful life. The National railway museum had a hydraulic one for a while and one was bought by the Danish railway museum as well, painted in Danish colours. The engine in Taiwan has its electricity generated by a power cell and can be seen running in the technology museum in the video clip on our web site.

Second Generation Locomotives

The old design had some drawbacks, the chassis was labour intensive especially cleaning up after the brazing operations, and the bevel gear drive was difficult to set up correctly and ran noisily if out of adjustment. The glass fiber body was not very robust and lacked fine detail. We also wanted to have the option of a more scale standard gauge engine.

Up to the end of the first Simplicity design Maxitrak had used as few castings as possible, even our first steam engine "Ruby" only had the cylinder and steam chest cast. Like Saul on the road to Damascus we were to undergo a complete transformation and started to use castings in a big way. By careful design of the chassis we were able to mount the motor transversely under the cab floor with a direct gear drive to the back axle. The front axle was then driven by coupling rods though the three point suspension remained the same. The biggest change was the body which was now cast in aluminum panels, four for the cab and a complete one

piece radiator and bonnet. With castings you can change the core forming part of the casting so two versions of a particular item can be cast from what is essentially one pattern. This allowed us to have both standard and narrow gauge versions of the new locomotives.

The new standard gauge engine was "Coronation", based on the North British diesel hydraulics built in the early 50's. British Railways had three to the design we followed and more to both a similar design with a square back cab and to a completely new design with a much smaller bonnet. The original number series was 11700 with black livery, this was later changed to D 2700 with green livery.



A special 3.5" gauge Coronation. Swiss livery 5" gauge Coronation

The BR examples are long gone however there were a number of industrial users and several of these survive. Coronation herself worked in a steel works in Eritrea, and was photographed along with the 5" Coronation when on the East Kent Railway at Sheperdswell. There are a number of reasons why this is a good design to follow, it has a good size bonnet so there is lots of battery room. The shaped back or "boot" makes a good point to mount controls and it has a nice sturdy look to it.

By using different cores in the chassis mould we were able to produce both standard and narrow gauge versions of the buffer beams. With the bonnet the Coronation version had a North British radiator while the Simplicity bonnet now had a radiator more closely following the Fowler prototype than before. Both versions of the bonnet had suspiciously similar looking sides! The two cabs came from completely different patterns though the lengths and widths are the same to fit the same space on the chassis.

Autumn 1983 was when these new engines first appeared and were both well received from the start, Coronation as a standard gauge BR shunter and Simplicity now with all metal body and improved detailing. In fact virtually nothing was interchangeable with the old Simplicity except the motor! Both engines were still available with different gear ratios and the standard controller was still the old resistance type. The first of the electronic control systems came in as an optional extra, which meant that the high gear engines could be used satisfactorily at slow speed.



Mk 2 Simplificities

Congress

When you have two standard set of parts it is not long before a bit of "mix and match" comes to mind. The first such creation was an American version of the Coronation using a Simplicity bonnet on an otherwise standard Coronation. The American coupler gave us some problems however as the normal narrow gauge chassis has the coupler pocket too high, you would not credit the difference in height on US stock. In the event we had to make another third variation on the chassis with US coupler height and American detailing, the complete locomotive being called Congress.

We sold Congress in small numbers here in the UK as well as in the USA though British customers had to be provided with a cranked bar coupler to get the correct height for coupling up. The original chassis was designed to accommodate 4 3/4" gauge from the start and a number of the other types were built in this gauge along with the majority of Congress engines for the American market. Not to be left out we also made Coronation for the European market with standard spring buffer chassis and simplicity bonnet. Most of these were in Swiss brown livery, this variation did not have its own design name.

Coronation appeared to be particularly popular in Japan, several large batches being sent. The Japan Coupler Friends Club ordered twenty five at one time, a couple were finished as standard but the majority were "kit bashed" in to a great variety of different versions. We even sent a cup to be awarded to the builder of the best example!

As both standard and narrow gauge engines were built on the same chassis the width of both had to be the same. The standard gauge loco scaled out to just under nine and a half inches, this meant that the new Simplicity was about one inch narrower than its predecessor. I always felt that the proportions of the new Simplicity were not so good on the narrower chassis, and decided to try a more open style cab which would balance the look of the engine better. In the event a complete new engine was built, called Ruston. This is not a model of any particular Ruston but is of the general type made from the 1920's through to the 50's and typical of this type of industrial locomotive.

Our Ruston used a standard Simplicity chassis but all the other components were new. There was a valance over the wheels, a half height cab with brass trim and a roof on four supports. The cab was open back making access to the controls easy, all the bonnet panels were folded from steel sheet and there was a large Ruston style radiator

Cast in aluminium. Unlike the other engines the top of the bonnet lifted off to give access to the battery, all the others had the body lift off as a complete unit. Ruston was also the only diesel to not be equipped with any lighting.



The original Ruston with open cab

A large exhaust was mounted on the bonnet and the complete engine finished in light brown and chocolate with an orange line between. This was the colours used for a short time on some of the southern electric stock running in Kent and was known as "Jaffa Cake" livery.

Ruston also looked quite tasty in his new colours, if you like Jaffa Cakes (which I don't!). In any case customers liked the look of it though most engines were by now sold as kits and I don't recall any others in this colour scheme.

By 1991 the Ruston kit cost £565 and the ready to run £250 more, indicating the increasing gap in the ready to run price, at this time Simplicity cost just £20 more and Coronation £95 more both as kits. An electronic control kit added another £108 to these locomotive prices.

From the late 1980's Ruston was beginning to out sell the other small diesels, in order to build on this success two more versions of Ruston were introduced, for the German and American markets. They were both a standard Ruston except for the cab and radiator.

The American version "Plymouth" had a full height cab, open back, with side and front windows. A sand dome, headlight and square cast Plymouth radiator were also fitted.

The German version "Deutz" had a full height cab with front window, cut away sides and open back. The exhaust was run up the front of the cab and there were three headlights mounted either side and on top of the cast Deutz radiator.



The original Deuts and Plymouth

Deutz has always sold in steady numbers here as well as in Germany while Plymouth did not do as well as Congress had done before. This is always dependent on what local dealers are doing for you as well as the appeal of the actual locomotive.

This marks the end of the second generation of small diesels, making six designs in all. Coronation and Congress in standard gauge, with cast aluminum bodies, Simplicity in narrow gauge with cast aluminum body and Ruston, Plymouth and Deutz in narrow gauge with steel bodies. The only real change through the production period of twenty years is the controller which went from resistance to electronic in early and late versions. Early ones have a good loud buzz when they start and a fearsome array of transistors to wire up when sold as a kit. Some small parts went from aluminum or white metal to resin moldings as this technique came in.

It is difficult to put exact production figures on the second generation of locomotives but the number series for all electric locomotives was approaching nine hundred at the end of 1999. In 2000 a new series was started including all locomotives steam and diesel, road and rail making a guess at figures for particular locomotives even more difficult.

The third generation, in a new millennium.

Over the decades production methods change, since the start of the aluminum chassis engines we have seen the introduction of laser and water jet cutting, and CNC machining of small components. These either did not exist or were not economic for the kind of quantities we needed for engine manufacturing when the second generation of engines were designed. Twenty years later castings were becoming expensive and erratic in supply, in addition every chassis needed quite a bit of machining along with all the wheel quartering and setting up for the rod drive. All this conspired to up the price to the point where by 2002 the cheapest kit was over one thousand pounds. One of the main ideas of this type of locomotive is that it should be an introduction to passenger carrying garden lines and as such it should be as cheap as is practical. We were in danger of losing sight of this with the then

current range.

On a visit to Sinsheim exhibition in Germany I was struck by the popularity of some of the very small 5" engines, the K.O.F. diesel in particular. This loco was far too small to get the battery in to the engine so it was carried in the riding car, which did not appear to inhibit its performance.

I looked around for a suitable British loco of this size with an idea of reducing the over all cost. The Sentinel range of diesel shunters came to mind, their stylish body design had always appealed to me and to industrial users as well judging by the popularity of the prototypes. The body was designed to be made in steel sheet with scored fold lines to form the cab and footplate shapes. The sloping faces of the cab were quite a challenge, the back in particular has to be folded in five different planes.

The two valances and footplate sides are also a good bit of metal origami, incorporating sides of the battery tray and the end footsteps.



The new Sentinel shunter "Jubilee"

We were by this time also using cold cast resin for many small parts. This lent it's self well to the detailing on this engine including sand boxes, lifting eyes, steps, distinctive exhaust etc. and was even used to do the front radiator and fuel tank rear with their heavy iron protective frames. A lot of detailing was achieved in a cost effective manner. As the bodywork was quite light a good substantial steel chassis was called for, along with 6mm thick buffer beams.

To power the new engine I was looking for a different motor setup, one motor on each axle with a direct gear drive, this was eventually found in a permanent magnet motor designed for large model boats. This motor is rated at 80 Watts, two of them giving 160 compared to 120 Watts on the old single motor. On test a single new motor has given 125 Watts and runs at about 80% plus efficiency right up to maximum running speed.

Watts alone are a crude judge of a motors capability, in the first place the limiting factor is the heat that the motor will take without burning out. And in the second Watts measure the power going in, not the work coming out so no idea is given of how efficiently the motor is running. We are well pleased with the power of this little motor considering it to be a generation up in efficiency compared to its predecessors.

The motor is mounted on a small frame along with the axle and bearings, the whole assembly being spring mounted on the chassis, doing away with the three point suspension of all the earlier small diesels.

An electronic control was supplied as standard continuing on from the last engines though as the controller gives all speeds from crawl to flat out it was not considered necessary to offer the two gear ratio options. This was "Hobson's choice" really as there was no room for the extra gear reduction once the motor had been squeezed between the backs of the wheels, especially in the American 4 3/4" gauge where it all literally only just fits.

The design was called Jubilee to celebrate Maxitraks 25th year of loco manufacturing, the first examples going on sale in 2003. It has proved quite capable of hauling four adults though extra adhesion weight is required if no battery is fitted to the locomotive. The kit price of £895 was a good reduction on the cheapest second generation engine and pushed sales up, soon only the Coronation was still listed from the older locomotives.



My weathered Jubilee

My own Jubilee has now seen five years of hard work, visiting tracks in Germany and Switzerland several times, it has also acquired a good dose of weathering. This is not to every ones taste but to me has an authentic industrial appeal; including what my son assure me is an authentic and original graffiti "tag". It also has LED headlights and an all singing and dancing sound system with engine start up, brake squeal and station announcements (in German!). The smallest engine definitely makes the most noise.

The Jubilee wheel and motor setup has been so successful that even the larger mainline locomotives were converted to use this system, doing away with their old tooth belt drive. The new design Class 66 heavy freight locomotive had six of these wheel sets from the start, giving it prodigious pulling power.

Once the Jubilee chassis design was proved it was then adapted to a new version of Ruston. No longer restricted to the dual use cast chassis we were able to widen the buffer beams near to the original Simplicity size. The valance on the side of the old Ruston chassis became integral with the footplate with the battery tray bolted to its under side. The outside coupling rods were gone, replaced with a molded axlebox

and spring set up from the Jubilee. The only familiar item left was the body though even this now used the full front cab from the Deutz. In spite of having more metalwork this cab was cheaper to make than the old Ruston open cab with its brass trim and shaped roof supports. While early engines had the old aluminum radiator it was not long before this item found its self made in resin like much of the other detailing on the new designs. I did think there might be some complaints with this but once painted it looks identical and there has never been a single comment on the subject. It may be because the new Ruston has the battery under its bonnet or because it stands a lot taller with easier access to the controls but the new Ruston has always out sold the Jubilee. I am quite sure the fact that it was £100 cheaper had nothing to do with it!



Third generation Ruston and Deutz

Like the second type of Simplicity before it there was virtually nothing interchangeable between the old and new Ruston apart from the bonnet, radiator and controller.

Both Deutz and Plymouth were given a dose of the same treatment to increase the third generation locomotive family to four, Deutz has the same cab as Ruston with only the radiator and headlight changed while Plymouth has a cab change as well.

It was with the popularity of the new Ruston in mind that we chose this design for our first venture in to Far East production. The design was sent out and after an appropriate length of time a sample engine returned. It was pretty good, some parts made from stainless or brass while ours were mild steel or resin molded. The only thing of less than the usual Maxitrak standard is the quality of paint finish. At a painted kit price of £750 and ready to run at £795 customers have been happy to accept the less than Rolls Royce paintwork. We have always used the same motors and controllers as the UK built engines, fitting them after the engines arrive from China.



Simplicity 2, petrol hydraulic and rack versions.

We started by sticking our necks out and ordering a batch of thirty, these were gone in eight months so the next batch was fifty! These lasted barely a year, making total production figures for the new generation of loco about three hundred so far (Spring 2008). It was one of the first batch of these imported Ruston's that appeared in the Guardian news paper with a water tanker train in Mr Douglas Dick's garden keeping the flowers in bloom during the 2006 water shortage.

So far new generation engines have found their way to customers in France, Germany, Spain, USA, Taiwan and Japan.

Not to be out done by the smaller engines a larger version of Ruston now replaces the original Simplicity 2 in 7 ¼" gauge. This is also an all steel body engine and uses no less than four of the new high efficiency motors, two on each axle. On test this engine has pulled 17 KG on the drawbar, adhesion being the limiting factor rather than the power of the motors. The chassis on this engine is a folded steel channel section and it runs on ball race bearings with spring suspension like it's predecessor. At an introductory price of £1195 was also about half the price of the older design!

Due to the new chassis design it was not possible to fit the petrol hydraulic version of the Simplicity 2 to the new Ruston design. However we have now developed a petrol generator set to go in this engine, and others of a similar size. This set fits in the cab and bonnet and is capable of producing more than enough current to supply the needs of the four motors. Getting enough power from this type of generator has been a problem in the past, hence the popularity of mechanical and hydraulic transmissions. We now think we have this problem sorted, and at a reasonable cost. The alternator and motors cost less than the hydraulic gearbox with it's tooth belt and chain drive. The complete setup can be fitted in place of the battery in an otherwise standard locomotive, unlike the old design which had to be built electric or petrol powered from the start.





The new Plymouth



7 ¼" gauge Ruston 2

I like to think that we have been able to keep our little diesel designs abreast of a changing world and kept people starting in to the hobby with an economical way in.