GWR Armstrong (Class 7) 4-4-0

Manufactured by: Modern Outline Kits, 27 Hall Drive, LINCOLN, LN6 7SW. Tel: 01522 531 861. E-mail: sales@modernoutline.co.uk  http://www.modernoutline.co.uk/

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I have for some years admired the MOK 'Coffee Pot', SR Q class 0-6-0 because it looks like a well designed kit that would be interesting to build. When passing their stand I would stop and examine the methodology - rather reminiscent of the Kiel Kraft airplanes I built in my youth. However, their offerings were either the wrong company or the wrong period and so I could never justify the investment.

At the 2011 Reading Trade Show I stopped by again but this time with credit card at the ready to collect their new kit for the GWR Armstrong 4-4-0; then to Slater's for the wheels and ABC to order the motor/gearbox, which arrived two days later. The kit has been designed around Slater's wheels and a specific ABC motor/gearbox combination that is completely invisible from any normal viewing position in the finished engine. My Christmas present to myself also included CPL couplings and a set of Guilplates. However, I did not envisage having to spend anything further aside from Ian Rathbone's fees for painting and some Laurie Griffin tools and lamps and a proper wooden box to carry it in. A crew is already waiting to get to work.

So what’s in the box (which is a superior type of pizza box and, rightly, totally useless for holding the finished model)? Seven packs of high quality lost wax castings in brass and nickel silver – there are no white metal castings, Oh joy! A packet containing numerous nuts, bolts, handrail knobs, etc., etc. and another containing the machined parts for the crank axle and outside cranks; the kit comes complete with provision for working inside motion.
Four etched sheets of nickel silver and one of brass produced to the highest standard I have seen. A ring bound and colour-printed manual, excellently laid out using numerous pictures of parts being assembled and various line drawings. 26 pages for the engine and 14 for the tender including detailed pictures and listing of all the cast parts; this is a typical example page. A letter explaining that some parts of the tender etch contains dimensional errors and replacement parts will be forwarded on return of the letter. However, this was taken care of when I collected the kit and the parts were on their way to me when they had been etched, a couple weeks later, later editions will no doubt have them in the box. This is the most impressive box of goodies I think I have seen and promises to be a most enjoyable build. A holiday in fact!

There is no prototype information provided; one is –not unreasonably - expected to do some research. I have all the necessary books upon my shelves. The four Armstrong (No: 7 Class) 4-4-0’s were built in 1894 and were nominal rebuilds, though the RCTS considers that only the wheel centres were used again. They were the first double framed 4-4-0 engines of their type to be built at Swindon for the 'narrow' gauge and very handsome engines they were until the turn of the century when modernization to improve efficiency meant that between 1901 and 1911 they were rebuilt with new standard boilers and Belpair fireboxes. No doubt they were more effective as engines but it did, I think, rather spoil their graceful lines. No: 8, Gooch, remained as built until 1911 (It
was photographed in original condition at Paddington in 1910) and so it fits my period perfectly. The kit does not cater for the rebuilds.

Generally, when I get a new kit to build I read through the instructions to see how the designer thought out his or her work and make a note of any important deviations from the 'norm'. Then I largely ignore them and do it my way. I started this time by spending two of my three hour train journey home reading the manual from cover to cover. It has clearly been written by someone literate, used to technical writing who has largely built the model too. I decided that I would build it, in the main, as the designer intended, and follow fairly closely his instructions and the use of Slater's wheels. Also I would keep a record of how many hours the whole project took.

In addition to the tools the instructions suggests as necessary one also requires taps for 6, 8, 10, 12 and 14BA plus a 14BA die. The instructions assume a certain level of experience and need to be read carefully (as you will see later where I failed so to do). They are not a step by step hand holding exercise, or even completely accurate (later editions will be added too or corrected) but, a good guide to how it was designed and how to put it together. The builder still needs initiative and an ability to plan the work. However, since ALL the parts fit properly, everything can be dry-run before committing to solder, which is not always necessary anyway. At various points I decided to alter the construction from that suggested in the instructions; entirely because that was how I wanted to do the build, they are not criticisms of the designer's original ideas.

THE TENDER.
The kit comes with a Dean 3000 gallon tender. I began with the tender because it generally proves simpler and is a good introduction into the designer's methods; though the instructions assume one will begin with the engine.

I have never built a kit with so much tab and slot fitting but the really enjoyable part of it is that all the parts fit first time, mostly without filing down the cusps (in fact the instructions say not to for most of the parts) and a good deal of these joints do not even need to be soldered, simply twist the tabs. There is very little 'edge' soldering. This is also my first exposure to a kit almost entirely made in nickel silver and what an improvement it is over brass. The accuracy of the art work and etching is the best I have seen without exception. The whole kit is based upon building
modules so one does not have necessarily to follow exactly the sequence in the manual provided one takes care to ensure parts are not fitted so far out of sequence as to prevent other parts going in later, so a careful reading of the designer's intentions is essential.

The etched sheet is of 0.4mm thickness, which seems pretty flimsy at first however, there are, for instance, three thicknesses that go to make up the floor of the tender. Also I think that nickel silver is intrinsically stronger and stiffer than an equivalent section of brass. All the parts fit together perfectly and parts go together to produce rigid boxes of one sort or another. One single footstep contains six parts and is fitted with tabs to align correctly under the footplate. Needless to say, it goes together with ease and fits first time. There was far less need to make soldering jigs with the rare earth magnets for this build.

The side frames are made up of a double thickness and fitted using tabs. They are not soldered together but are fixed with twisted tabs and their combined tabs fit and are soldered into slots in the foot plate. I fitted the castings for the axle boxes and spring mountings while in the flat rather than as suggested when the body is largely complete.

The suggested method for the springs and hangers once assembled is that they are left off until after painting and then glued in place. I would rather they were bolted in place and so decided to modify them; I avoid glue and painted surfaces wherever possible. However, the designer has left the option open for the builder.

The cast long bolts that hold the spring against the mounting are a little too fat easily to fit through the turned steel dampers. They must be close on the limits of lost wax casting for thin rod. I used 14BA bolts, which fit perfectly, having first tapped the spring shackles before fitting them to the springs. Having proved the concept with a pair of brass bolts; the final fittings will be replaced with polished steel bolts and nuts, cut to length and the bolt head cut-off. Prior to painting the springs can be removed, painted and then re-fitted afterwards with shiny steel fittings.

I began work on the chassis which is, in my
view, a very well designed piece of miniature engineering and all the parts fit perfectly, which means one has to take care over their fitting. Clearances are tight when assembling so it is wise to dry run it first. The rear two pairs of wheels are compensated in two axes. Each axle pivots around its own centre but the pair of axles also pivot around their common centre. The underside view shews how the axle bearings and supports protrude through the floor. There is little movement, no more than a couple of millimetres but that is quite enough to maintain the contact of all wheels with reasonably well laid track.

Many of the parts for the brake gear are here partially dry-run assembled. The instructions suggest fitting the brake hangers to the body using pins or, 14BA bolts (not supplied) by tapping the holes in the body side. Pins would have meant having to spring the rigging out but bolts would make them easier to fit and remove. I baulked at relying on just 0.4mm of thread to hold the bolts bearing in mind the number of times they will have to be removed and refitted during construction and painting. Some small pieces of nickel silver bar 1.5mm thick were soldered over the holes on the inside; drilled and tapped 14BA to which the hangers were fitted having been drilled out 1mm for the top and 0.9mm for the lower holes. Some spacers were needed to hold the brake blocks out far enough from the frames; I used some 14BA nuts with the threads stripped out. Later I soldered them over the holes in the chassis, lining them up with the pointed end of a cocktail stick, thereby making fewer bits to get lost!
The brake components in place on the chassis, which will be joined to the components fitted to the body via the transverse rod that goes through the brass bushes visible on the right. These have been threaded 14BA and bolt to the pull rod ends. The side frames and main body box are now fitted along with the excellent corners castings, (brilliant idea) which were pre-drilled 1.3mm for the handrail knobs. This is much easier to do before fitting to the body. (The holes are not out of alignment, it is a trick of the light.)

The piping under the tender could be a little confusing. The vacuum pipe, according to the drawings I have and the diagram in the instructions goes on the opposite side to the steam pipe. However, the etching suggests that they both go on the same side. I decided to follow the drawing and fitted the vacuum pipe in line with the vacuum stanchion on the buffer beam by bending the tabs that should fit in the etched slots 90º and soldering them to the base of the chassis.

The vapour trap for the steam pipe is the wrong size and, though a new one is being mastered I decided to modify the one provided by cutting about 1.5mm out of the centre. It fits well now between the cast operating levers. The brake pull rods are bolted to the transverse pivot that is fixed to the body, which hold the brake shoes at the correct angle. The pull rods are adjustable to a degree by the three holes. The operating rod for the water scoop also fits in a lever on the main pivot rod but this one is left as a simple push fit in the slot since there is not room to get a bolt in.
There are no buffers provided for the front drag beam so I turned up a representation of buffers but on reflection decided they needed to be sprung. The holes in the buffer plank were opened out and some brass tube soldered in. Two buffers were made up from brass rod and half a spring soldered to a turned end, the other end being rounded off. They are not fixed; pressure against the engine will keep them in place.

I came across some etches for tender tool boxes not mentioned in the instructions and checked the pictures of Armstrong engines I have. Sure enough, in 1900 the tenders had tool boxes fitted so I made them up to be glued on after painting. The padlocks came from a Mitchell 517 kit in my 'to-do' cupboard, I hope I can get some more.

Finally, the drawbar. The kit provides a pair of castings for the ends of the drawbar to be tapped 6BA but these were misshapen. I could have sent for new but decided instead to turn some up, tap them and connect them with some 1.6mm nickel silver rod and here is the completed drawbar.

The tender now finished, almost ready for the paint shop. The bolts holding the springs still need their heads cutting off.
It just needs a full set of tools and a bucket the crew are in a box waiting their time. One of the fiddliest jobs was fitting the beading around the top of the flares. The new buffers have now been shortened to fit the coupling distance and the drawbar fitted and the handrail knobs changed for some in nickel silver (from Markits) usual disclaimer.
THE ENGINE.
THE BOGIE.

The frames for the bogie are of three thicknesses. The spring hangers fit neatly into holes behind the slots in the outer frame side; a simple and elegant basis on which to build the bogie. Being a 4-4-0 I expected that some form of springing and possibly side control would be necessary, though there is precious little room for any since tolerances are very tight. Peter Roles has since indicated that the method employed works well so I look forward to seeing it running in due course (which it did perfectly, see later). The wheels and bearings rest in beams that fit into slots in the main frame and are then held in place by 10BA bolts. Each axle has limited vertical movement but enough to compensate the unit. It is attached to the chassis with a pin through the central hole in the cross member. This is a close fit with little vertical movement in action. The wheels take a time to fettle and remove all the excess plastic from the spokes but the effort is worth it. The instructions make no mention of the wheel splashers, which are part B014 on the brass fret.

THE CHASSIS
The frames look a little flimsy at first sight but once the various spacers are fitted, it makes up into a rigid structure. The compensation is very elegant, except for that enormous 6BA cheese head bolt head which holds the bush. I misread the instructions here and merrily opened out the hole in the side to take the bush. Not a bright thing to; it was a bit of a fiddle correcting the error but it all works fine now. The frames are also handed to allow for the etched lines that make up the joggle. I got mine wrong and it was by now far too late to go
back so the joggle had to be done by bending against the etched line instead of into it. Therefore it was not possible to add a fillet of solder to this potentially weak area. I got round it by soldering some wire into the etched line and filing it down to match the contour of the frame, as will be visible in a later picture. At the time this picture was taken, the frames were not soldered up as I was doing a dry-run.

The ash pan is a separate item with provision to hold the motor in place and adjust the position in relation to the axle. There is also space in the base for some ballast. I used liquid lead with some 2 part liquid resin glue from Ripmax to hold it in place (an idea from Bob Alderman). A repeat of the problem I had with the Prairie (See Gazette Vol. 17 No: 7 Page 42) would be a major disaster. The ash pan is simply clipped in place using the tabs provided.

I decided to modify this and drilled frames and the sides of the ash pan to clear 12BA, soldered some pieces of brass on the inside of the ash pan and drilled and tapped them 12BA. The tabs were removed and now it is a simple matter to drop the ash pan out to release the motor. However, I had to modify this later because the bolts need to be inserted through the wheel spokes and the original holes were not in the correct place. At the same
time I replaced the 6BA screw with a short length of studding to which I had soldered a nut, filed to about half its thickness. I am happy now with how it looks.

Part of the rigidity of the frames is imparted by the cylinder head and motion bracket, which need the holes in them tapping 10BA to bolt into place in the frames. This also allows all of the inside motion to be removed. Once happy that all parts fitted correctly the frames were soldered solid and the etched lines of the joggle filled.

THE INSIDE MOTION
Work progressed on cleaning up the castings for the motion. It is not a huge amount of work because the castings are of high quality but the bearings do need careful fettling to obtain a smoothly running set of motion. Never previously having built a set of working inside motion this part proved interesting.

Slide bars are here fitted with pistons and connecting rods in dry-run mode, hence the rough pins holding the bearings on the cranks. Underneath, the valve chest is fitted with its moving parts in place, rather too soon as became apparent later.

The cast slippers and piston rods were modified. I have

never understood why designers incorporate the rod when making a master for casting the piston rod/slipper part, better a slipper with a suitable hole for some proper nickel silver rod to be inserted. I cut off the rod and drilled the slipper 1.6mm right through, then force fitted and
soldered a length of rod into the hole and then re-drilled the pivot hole 1mm for the pin.  

When I suggested this to David Sharp at MOK he said that normally their kits have slippers cast with a hole but that this set had been bought-in from Peter Roles as there was no point in producing new masters when an excellent set was already available.  

and I am not confident with silver soldering so used Loctite 603, recommended during a discussion on the 7mm E-group and it proved a very simple exercise once the parts were mechanically and chemically clean. To help ensure a really secure joint, the webs were drilled 1mm and nickel silver pins set in place with Loctite 603. I managed to break one expensive stub drill bit doing this.  

I initially used pins to hold the straps for the valve gear rods in place on the crank axle. However, this method proved unsatisfactory, producing loose, inelegant, joints making it difficult to determine when the parts fit the crank. I scrapped the first pair and sent for replacement parts. A far better way is to use bolts to hold the parts together thus allowing relatively easy removal. I began by turning down some brass rod to 10mm diameter to match the crank on the axle. Once the
parts were cleaned up the larger strap was drilled 0.8mm and tapped 14BA and the other drilled out 1mm. The parts were bolted together and one pair of ends marked to ensure consistency when reassembling. A rolled tube of 240 grit wet & dry was used to open the hole until it fit the previously turned brass rod. It is then a simple matter to polish them up for a good fit on the crank axle. The parts can be disassembled as required. The forked rod is soldered to the strap and the pins reduced in size. It is important that the straps are fitted to the crank axle with the two oil pots at the top and the forks facing outward from the centre.

The manual is far from clear on how the gear goes together but David came to the rescue with some advice. Fitting the forked ends to the valve slides takes a little effort. There are four lift links provided among the etched parts but, only two are needed. Three of the four ends had some thick scrap etch soldered over the hole, shaped, drilled and tapped 14BA. This gave a basis for most parts to be bolted in place, a poor move as it turned out.

The forks at the top are bolted but those at the bottom are pinned with 0.8mm rod. The eccentric links are also pinned to the valve slides but with 1mm rod. Each lift link is fitted to the outside fork at the top of each eccentric; the excess thickness of the tapped block being filed down to obtain clearance, which is very tight. The bottom ends of the lift links are then bolted through the weigh shaft arm.
It was necessary here to introduce some spacers to keep the lift links vertical so I used a couple of 14BA nuts with the thread stripped out. I had also to unsolder the slide valve box to fit the slides to the eccentrics. Having got thus far the time had come to drop the whole lot into a bath of Viakal, followed by several minutes in the ultrasonic cleaning tank.

Fitting the wheels and bearings came next and I used the lathe to push the wheels on to the cranked axle as it needs considerable force to seat them home, they are not likely to come loose however, the other axle needed Loctite 603 to fix the wheels and one of them wobbled badly so had to be changed. Cutting the axle out for the piston rod bearings looked as though it could prove problematic. How to hold the thing in a vice while sawing? A few minutes thought and I realized that the lathe would again serve; with the axle supported in the chuck and tail stock it was an easy matter to cut using an, oiled, fine piecing saw, there was little to clean up afterward. These two pictures shew the valve gear from top and bottom. The whole unit, crank axle and valve gear, fitted into the frames perfectly; a credit to the designer. Now it was time to make the coupling rods so that it could be tested properly and run-in.
COUPLING RODS, CRANKS & PINS

Each rod comes as three pieces of etch to fold up and laminate. I used cocktail sticks to line them up in a vice, applied a liberal dose of flux while trying to avoid it reaching the sides, tightened the vice up fully and then used a 75watt iron with a 179º 2% silver eutectic solder wire. The ends are clamped with aluminium hair grips. The extra bosses however are soldered after this operation, despite what the picture may suggest. (Taken after the rods were all soldered up.) It is then simply a matter of cleaning up, filing to shape and polishing. I got the method from Malcolm Mitchell and it is now the only time I use a soldering iron aside from electrical work. The finished rods ready polished and partially reamed out for fitting.

I had first considered using CPL crankpin nuts designed for Harris wheels, which come as a bolt but they did not suit for the job so instead fitted a 10BA bolt through a clearance hole in the crank and then screwed a bush, tapped 10BA tight on to that, similar to my method for Slater's wheels generally. The crankpin nuts are CPL for Slater's wheels and need to be opened out and tapped 10BA, fiddly but worth the effort. The completed set, with mirror finish cranks ready to be fitted to the wheels.
Unfortunately, the test run exposed problems with clearances in the motion. My lack of experience and precision, combined with the attempt to make it all disassemble easily was not an ideal combination. In addition the valve crosshead slides had lateral movement of almost half a millimetre, with the result that the gear simply would not run. It had to be taken apart, modified and rebuilt.

The valve crossheads were easy; each crosshead had two pieces of 0.1mm phosphor bronze strip soldered to the outside face, which cured the side slop. I thought about how the motion operates and decided that, since the reverser did not operate, there was no need for the eccentric links to be able to move in the vertical plane. The centres had small pieces of nickel soldered in place and the pair were drilled together in the drill press 1mm and then assembled to the valve crossheads again.

There is now no side slop in the valve chest and no wobble in the eccentrics. The rest of gear was reassembled using soldered pins. CPL locomotive couplings come with a small etch containing far more small nickel washers than needed and so some spares
were used, with slips of paper to prevent soldering the joint solid, while assembling all the pivots. A much neater job resulted and finally the gear ran pretty much like a sewing machine but the rods were tight and needed further work.

This then produced a further problem. While reaming out the rods with a broach, the bosses began to de-laminate, rendering them useless. I think it is caused by the burrs raised while using a broach that does the damage. As a result I tried for the first time a set of Precision rods. Ordered via their new website on a Saturday, they landed on my doormat on the following Tuesday; excellent service. They ran first time, though a little tight but a few minutes with a broach sorted that out.

When I fitted the balance weights to the wheels I also used some Milliput between the spokes to represent the lead that was used, molten, between the holding plates. It all helps to add authenticity.

THE BODY

The cab goes together very easily and, as usual, all the parts fit first time. The unit then slides into the footplate from underneath. The tabs allow precise positioning and trial before soldering.

The two units now assembled and ready for the cosmetic sides to be fitted, which are tabbed for precise alignment.
Preparing all the parts for the horn guides takes a little while since there are good many holes to be opened up and tapped. The springs come with the hangers cast in place and are a little too fat to take the dampers. I decided that I wanted the dampers to be removable anyway, not glued in place, and so cut off the hangers, carefully drilled out the spring leaf ends and soldered in some 1mm nickel rod threaded 14BA instead. This is not nearly as difficult as it sounds.

Here are all the parts bolted into place. It is important to ensure that the springs go in the right place, those at the rear have more leaves and bigger dampers that those at the front.

BOILER, FIREBOX & SMOKE BOX
After several weeks break due to other commitments I got to grips with the smoke and fire boxes, both relatively simple, and the boiler, which required several attempts at annealing to persuade it to fit together. The instructions for
the fire box state to remove the two lower tabs at the rear where it fits to the cab front because otherwise it is next to impossible to fit due to the tabs on the bottom of the fire box needing to be seated first. However, I did not cut them off completely but left a vestige, which helps to seat the unit on the cab front and gives a positive 'click' once it is seated correctly. Here are the three units ready for the next stage:

The boiler has the saddle fitted to take the dome, which is secured with a 6BA bolt. The firebox has the safety valve fitted onto which is pegged the safety valve bonnet; held in place with a sliver of Blue Tack, as is the lubricator on top of the dome. The brass disk is fitted between the firebox and boiler and is removable for polishing.

David at MOK rang me the day after I had restarted work to warn me that the holes in the cab front where the handrails enter the cab were probably in the wrong place. The holes are too high by 3.5mm. Fortunately I had not yet fitted the splasher tops or, altering the holes could have been a little problematic. The holes have now been filled and new ones drilled at the correct height. No doubt, future versions will be corrected. The handrail knobs were all changed for nickel silver ones from Markits.

Now the boiler is soldered to the fire box, the chimney soldered in place and the dome and safety valve bonnet polished and fitted along with the brass ring between the smoke box and boiler (the safety valve is incorrectly aligned, corrected later). At this stage the lower portion of the boiler is removed between the centre splasher but not the base of the transition ring.
An area of some little concern was the smoke box. For the brass disk to be removable, the 6BA bolt between the smoke box and boiler needs also to be removable. Leading on from a method on the Piercey J27 I built recently, I considered that it ought to be relatively easy to arrange for the door to be removable. Well it was; by carefully drilling out the rear of the boss of the dart to take a 12BA bolt, soldered in place with the head cut off and the end dressed. Then a substantial piece of brass, suitably drilled and tapped, was soldered in behind the door. There is sufficient flexibility to ensure that the dart will always be correctly aligned when tightened. It is now possible to remove the door for access to the 6BA bolt joining the smoke box and boiler.

**CLACK VALVES & ROSCOE LUBRICATORS**

These are intended to be glued in after painting but the joint will depend only on the junction between the seat of the valve and the boiler side. The instructions also suggest using some tube to mount the clacks and the Roscoe valves. Not having any suitable tube to hand I used some 3mm rod cut a fraction longer than the width of the boiler and drilled out the ends 1.7mm in the lathe. This made a nice firm fit for the spigots and was then soldered in across the boiler, after opening out the boiler mounting holes, and the ends dressed. Both clacks now fit firmly without glue. The Roscoe lubricators could not be done this way as the tube across the smoke box would have made removing the holding bolt impossible to get at so I soldered some 2mm brass square
section rod across the holes inside the smoke box. Then, very carefully, the hole was drilled 0.8mm to take the spigot on the lubricators. The Proxxon drill press came in very handy.

SPLASHERS
The splasher ready to be fitted having been through the rolling bars along with some of the beading. The beading needs to be the exact length of the splasher so I measured the brass wire against the splasher edge that faces outward and then ran them through the rollers. However, that did not work well because when I came to offer up the wire later, it was a fraction short so it was back to trial and error to get the length right; it is important also to file the ends at an angle to fit flush with the footplate. Were I to build another I would file notches in the footplate where the beading meets it so that the pre-rolled wire could simply be fed in place and cut off underneath later (having suggested this to David it may be an etched feature in future batches). It would also make fitting the beading slightly easier but the designer has anyway produced an elegant method of achieving this. The splasher sides and top when fitted produce a step into which one fits the wire; using plenty of flux and the heat from the RSU tip then draws the solder used to fix the splasher tops into the beading joint. The only place this does not work of course is where the splasher sides cover the cab; a few tiny dabs of solder cream did the job. This picture shews how neat the completed job is when finished.
THE BACKHEAD

A pleasant diversion for an afternoon or two can be spent simply getting small castings ready for use and the best example of this is probably the back head as it usually involves some complex work drilling out all sorts of different holes and inserting various strands of copper wire. This back head is no different. A good many holes needed drilling and, for once, I managed the lot without breaking a single drill bit. The new Proxxon drill proved useful in cleaning up the parts using a circular brass bristled brush.

The parts are all now fitted and ready to try out in the cab. The gauges are attached to the back head by soldering their pipes in place. Here the parts are mocked up in the cab, only the pep pipe tap is fixed, the rest will be glued in after painting. The reverser effectively prevents the back head going in if soldered in place now once the roof is added.

BALLAST
While it is still relatively easy to access the inside, I gave some thought to ballast. There is not a great deal of room inside the engine to fit much lead. However, if the finished engine is as well balanced as it seems it will be, a great deal of ballast should not be required. As noted earlier, the ashpan is full of liquid lead. The firebox
is quite roomy and the motor takes up less than half its width so I used lead flashing. Shaped to fit round the wheel arches and bent to fit the contour of the firebox. In fact I made four since there is room for them; four more pieces were shaped up to fit in the rear portion of the boiler. All eight pieces were glued in place with UHU. I managed to get about four ounces in this space thus:

I also added liquid lead inside the backhead and went back and added more to the ashpan by shuttering off the space for the motor and filling the remaining space to the top, which has increased the weight by more than 50% in this area. All this weight is directly over the driving wheels and the centre of gravity is still at the centre of the engine. A little more ballast was added by filling the sand boxes with liquid lead too.

BRAKE RIGGING
Some work on the brake gear can be done prior to fitting the wheels. The pivots have been soldered to the frames after being drilled and tapped 14BA. The hanger tops were drilled to clear so removal of the rigging should be relatively easy. The pull rods should simply clip onto the brake cylinders, which are soldered to the rear of the frames. The brake blocks are separate items fitted to the hangers with 0.8mm rod. Once the brakes are set up with the wheels I intend to solder the blocks solid in their correct positions.
Unfortunately, one of the vacuum cylinders turned out have been incorrectly cast and it will take a little while for a new part to be re-cast. Never-the-less, it was possible to set up the brakes for one side of the engine. The blocks needed spacers either side, some 2.5mm lengths of brass tube to bring the rods out to a 7mm spacing. This also has the advantage that there is plenty of clearance for the wheels. Removal is simply a matter of unbolting the brake blocks from the frames and unclipping the rods from the vacuum cylinder.

Here is a view of the, almost, completed locomotive.

There are no brakes or underhung springs on the other side. I still have sand pipes to make and fit, the drawbar needs shortening a little and the fall plate adjusting. I am very pleased with the progress so far. It is without doubt the most impressive kit I have ever built and has been most enjoyable.
There is no provision for steam operated sand pipes in the kit for the front drivers but they are easy enough to scratch build. The main pipe is 1mm nickel rod bent to shape following the drawing in Russell’s' book (suitably enlarged) and then adding more bends so that the unit could be soldered directly to the frames. It needs to be fitted so that the mounting cannot be seen once the body is in place. The steam pipe is simply run behind the brake shoe and not soldered or it would be impossible to remove the brakes.

A trial run later on the rolling road, in the dark, indicated that the brake blocks were shorting so a little adjustment was required firstly, by slipping some paper between the blocks and the tread and soldering the blocks solid. If there is still shorting then it is an easy matter to file more off the inside of the blocks to clear the flange.

The port-hole windows in the cab need glazing but this is easily achieve by gluing the provided brass rings to some glazing material with cyano and carefully shaping the glazing to a circle. The units can then be fitted after painting.

Engine and tender now joined, including all the pipes between them.

Some more pictures of the completed engine.
I am very pleased with the result, definitely the best kit I have ever built.

**Test Run**

On Saturday (25/8/12) I took it to the Epsom club's test track to see how it performs in the real world and to find out if it will pull the more than the skin off a rice pudding. Despite my cock-ups during construction it ran like a sewing machine, which was most gratifying.
The bogie guides the engine through curves very well indeed and allayed my fears about tight clearances. It also pulled three heavy, but free running, bogies and a long rake of Ian Hopkins scratch built four wheelers. A little more lead over the drivers will improve on that and enable it to haul prototypical length trains.

Since the bogie clearly supports its share of the weight I shall try inserting shims in the mounting to raise the front fractionally. This should tilt a tad more weight over the rear drivers. That's the theory anyway as expounded by Doug Thomas, who has far more experience in these matters than I.

Apologies about the poor quality of the last two photographs but they were the best I could do with a mobile ‘phone.

I have no connection with MOK other than as a, very, satisfied customer.

**The Manufacturer's Response**

*Your model drew many admiring comments and attracted a deal of interest. I must say it looked magnificent and as the Americans say 'Outstanding' or is it 'Awesome' anyway many thanks again for allowing us to have it on the stand. The article looks excellent to me, I have re-read it this morning. There are only a couple of very minor things; the 6BA screw holding the beam bearing in place (there so you can withdraw the beams for painting) is unsightly but not visible when the chassis is assembled to the body and the other comment is regarding the brake hangers for the tender. It was in my mind that as suggested on p9 of the instructions that the hanger boss would itself be tapped out to accept a screw from the inside of the chassis. Thus the thin wall of the chassis was not an issue. Incidentally, I take on board the comments about the removability if the axle box/springs etc., for painting. If I have to retool I'll have to take a look at it. Thank you for the chance of commenting and for the compliments within the article.*

*David Sharp*

*PS. I look forward to seeing it, as no doubt you do, when it’s painted.*

Raymond Walley
Bexhill 2012