Bachmann
BR Standard Class 4 4-6-0

EM Gauge Conversion

Author Pete Hill

This Technical Paper incorporates the original 77 photographs into the conversion notes. If members still wish to refer to the original photographs then they are available via this gallery link:- (use right click to open in a new tab)

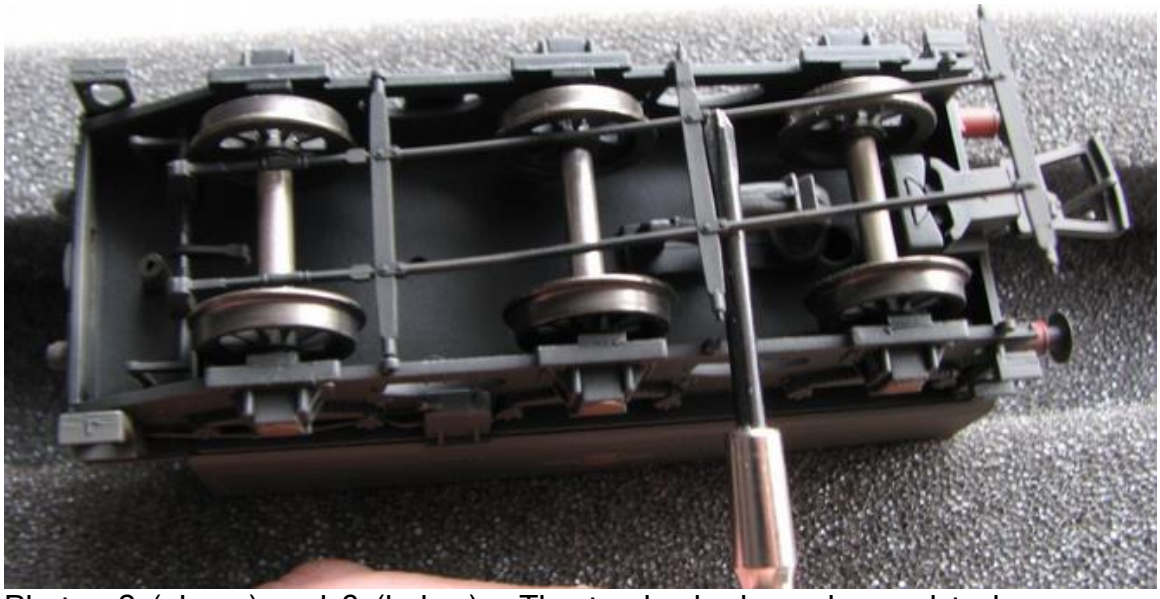
BR Standard class 4 4-6-0 gallery link

Photograph numbering in this document matches the Gallery photograph numbering.

This has been done to reduce the need for members having to flip from document to gallery and back whilst carrying out the conversion.

Photo 1 - The subject of these notes and photos before work begins...

Tender Conversion.



Photos 2 (above) and 3 (below) - The tender brake rods need to be sprung gently from the brake hangers and put to one side.

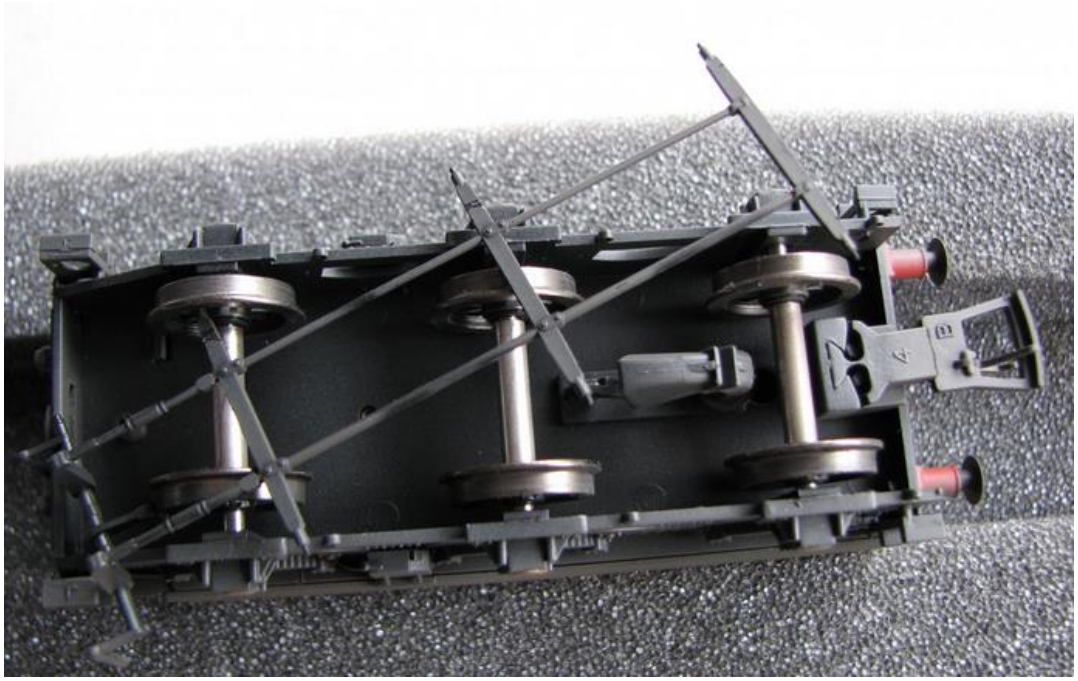


Photo 3 – Brake rods removed

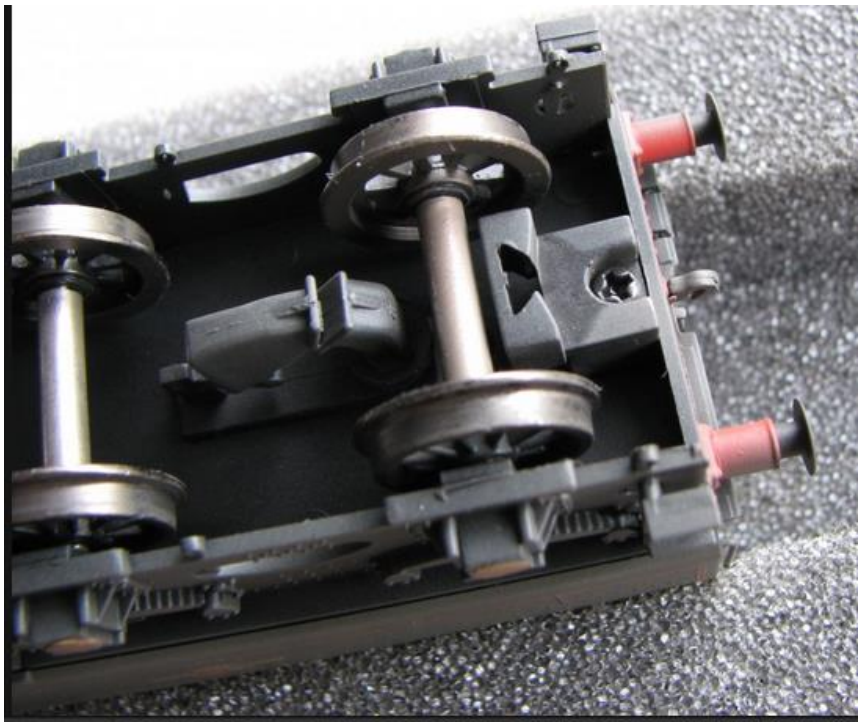


Photo 4 - The tension lock coupling can be prized upwards using a thin screwdriver to release it from the mounting block, which is in turn released from the tender chassis by undoing the screw revealed once the coupling was removed.

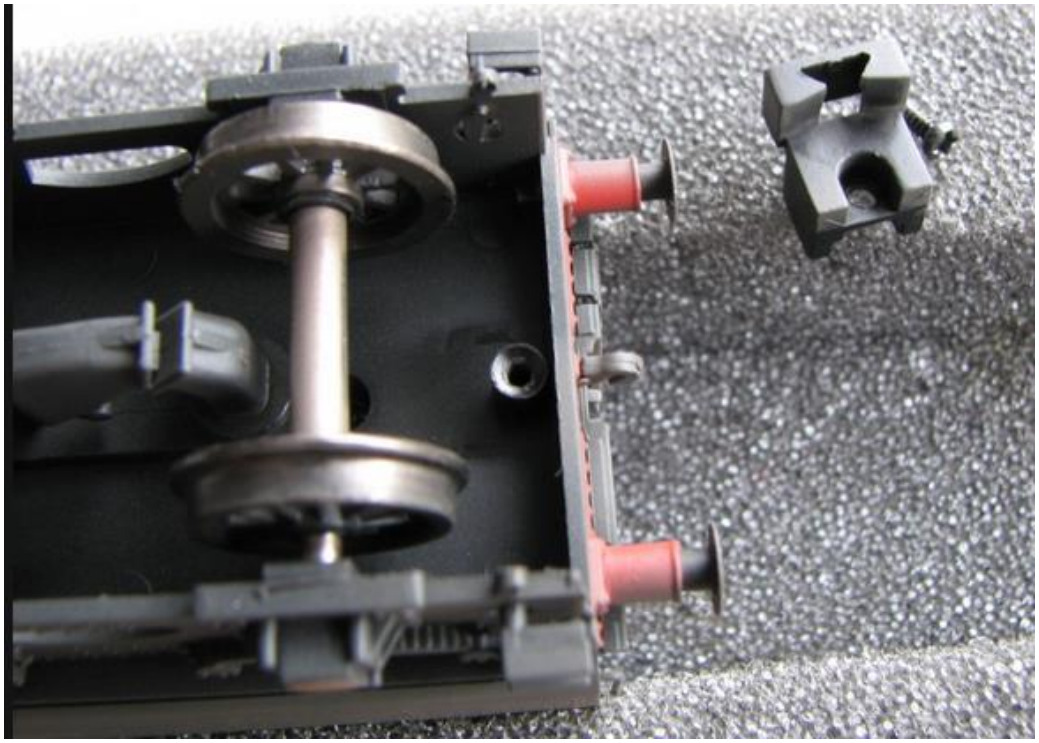


Photo 5 - Shows the removed coupling mounting block. This only requires removal if you wish to dispense with tension lock couplings. The remaining spigot that the screw locates in can be removed by snipping off with Xuron shears or similar, leaving the rear of the tender buffer beam clear for fitting couplings of choice. The Bachmann plastic draw-hook can simply pulled out using pliers.

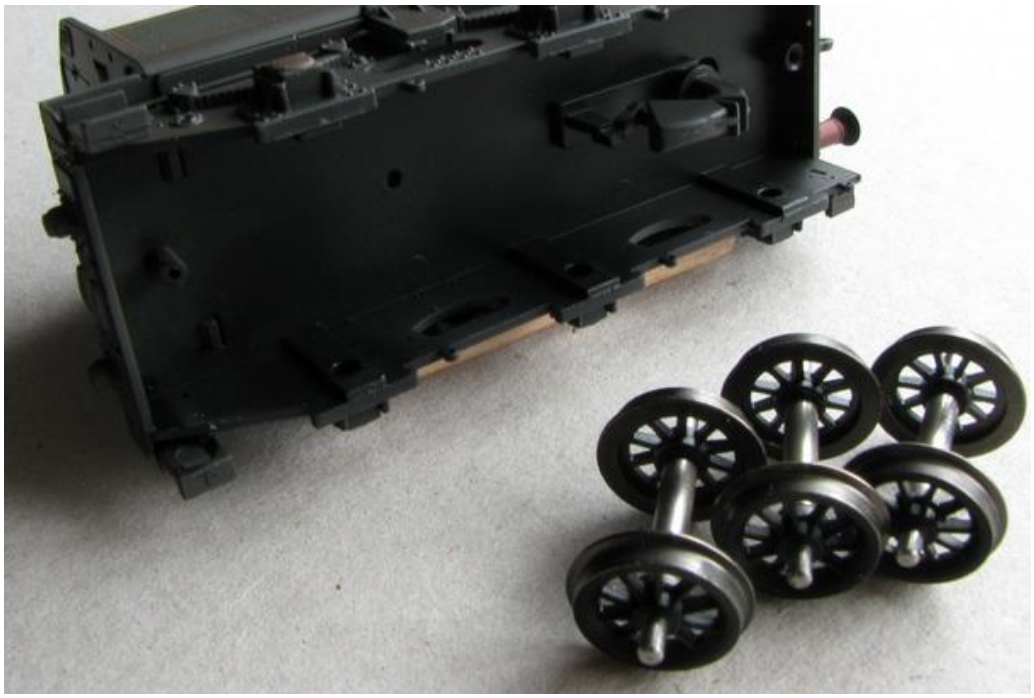


Photo 6 -The Bachmann wheels and axles removed from the tender chassis.
There are a few options in converting the tender.

- Re-gauge the Bachmann wheels to EM back to back on the existing axles.

- Replace the Bachmann wheels with any suitable fine-scale wheel, as the Bachmann axle is shouldered to 2mm diameter,
- Place pinpoint bearings into the tender axle holes, and use fine-scale wheel-sets on 26mm pinpoint axles. The main drawback with this method is there is very little side-play remaining.

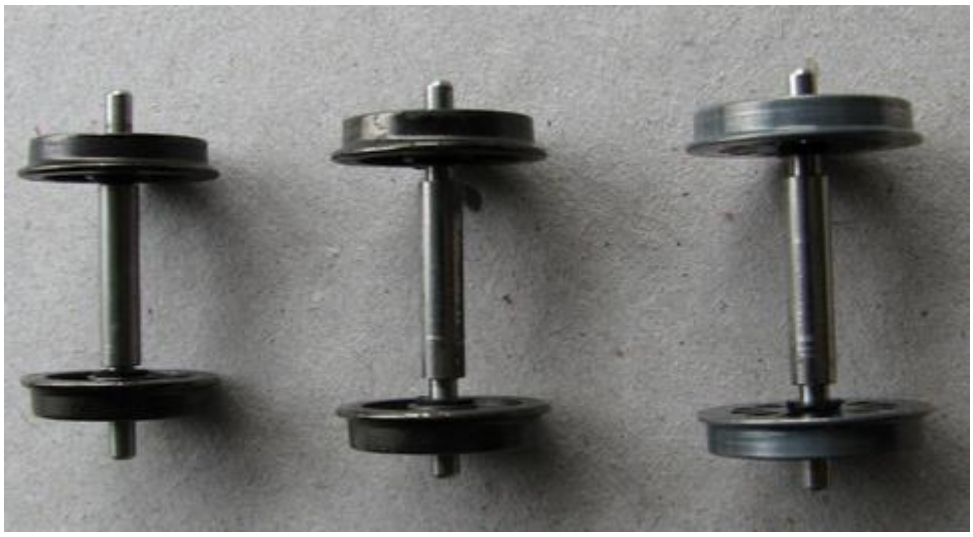


Photo 7 above shows:

- Left – Bachmann wheel-set as removed
- Middle - Bachmann wheels re gauged to EM
- Right – Romford/Jackson wheels mounted onto the Bachmann axle.

Photo 8 - Bachmann axle showing the 2mm shoulders, with the Bachmann wheels removed – simply twist them off whilst holding the axle firmly with pliers, or tap the axle through whilst supporting the back of the wheel over the slightly open jaws of a vice.

The following Photos (9 and 10) - are two views showing wheels re assembled into the tender and the brake rod moulding carefully sprung back into place.

Photo 9

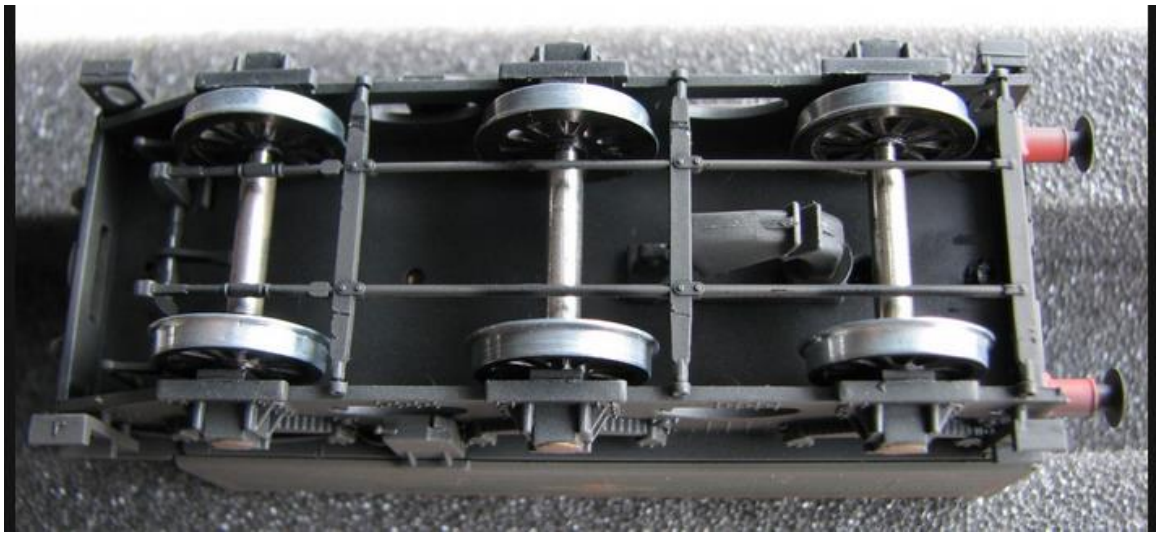


Photo 10

Photo 11 - View of the re wheeled tender completed. The coal load is removable, usually a tight push fit, and when removed reveals a detailed interior complete with fire iron tunnel. This leaves the modeller the choice of how full to fill the bunker with real coal!

Photos 12 and 13 (both below) - The Alan Gibson components used in this loco conversion. The only other parts used were EMGS spacing washers, 1mm and 0.5 mm, both with a 1/8 inch bore.

Photo 12

Photo 13


Photo 14 - the underside view of the loco, showing the brake gear which needs removing. Incidentally, the cradle the loco is sitting in is the Peco Loco Servicing cradle. I am always being asked that!

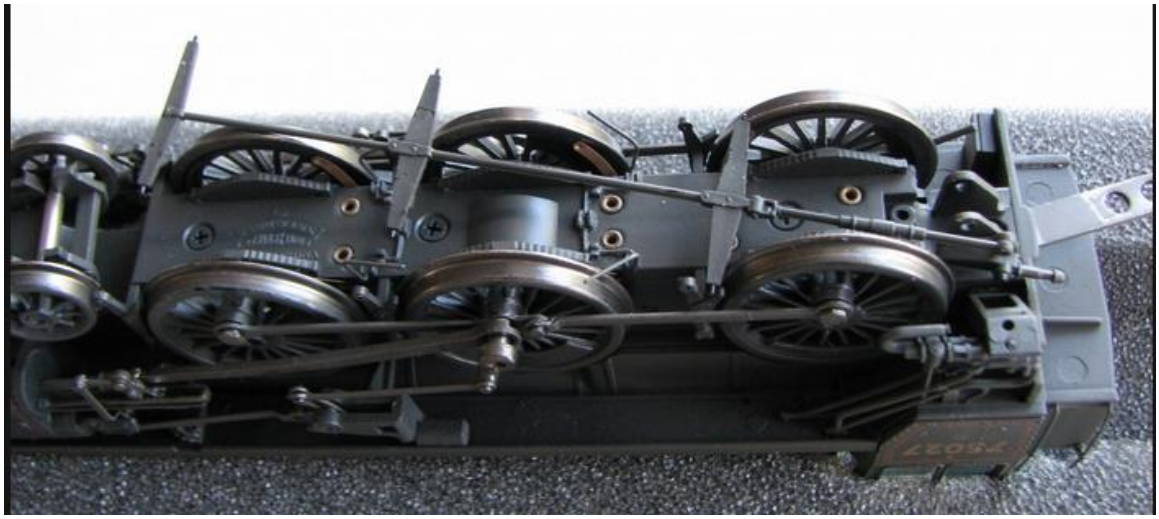


Photo 15 - shows the brake rods sprung out of the hangers.

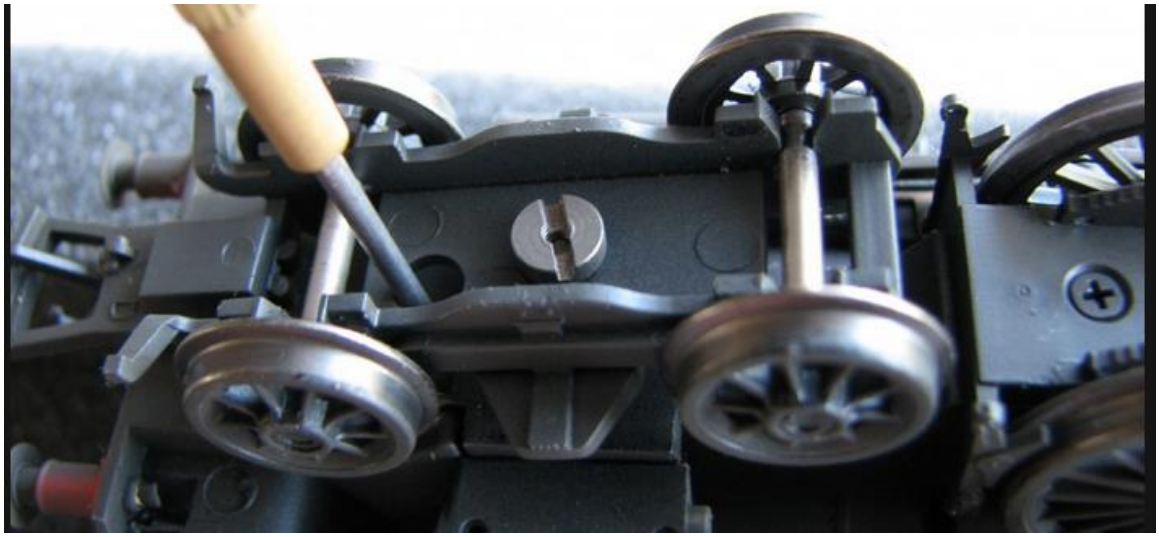


Photo 16 - Body removal is two screws. The front is accessed through the large hole in the bogie. To prevent the screw disappearing, put a small blob of blu-tack on the end of the screwdriver, it saves hours crawling round the carpet. How do I know.....

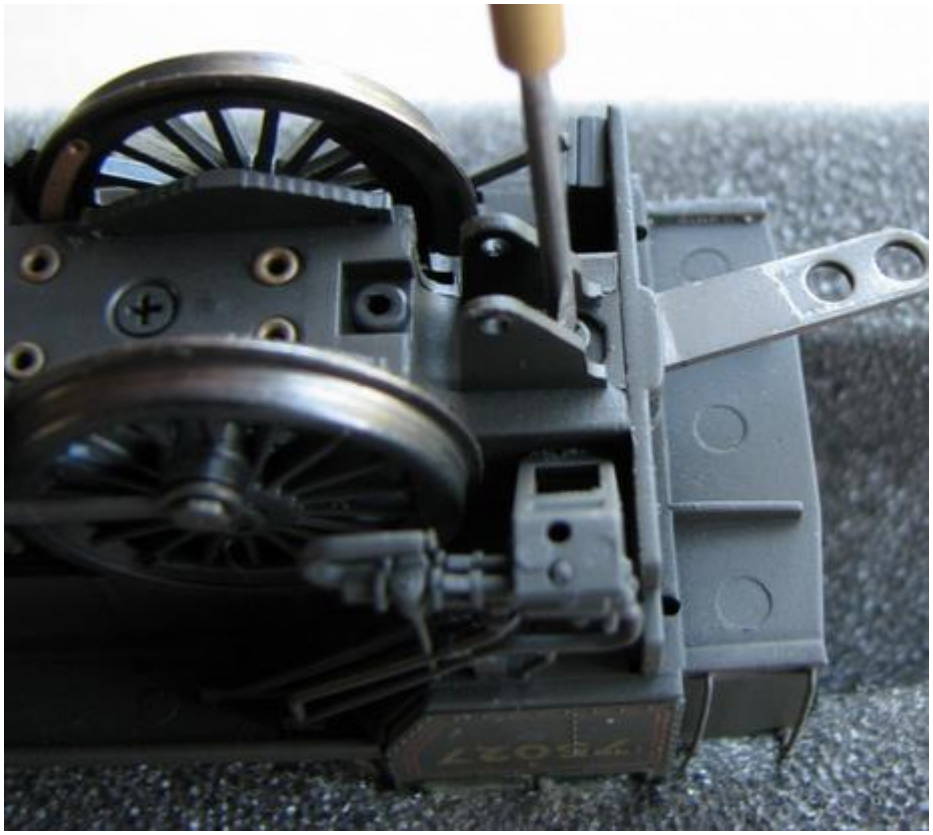


Photo 17 - the rear screw is under the cab, and also retains the tender coupling bar.

Photo 18 - Be ccareful removing the body as the body and chassis separate very easily, no tugging is required!

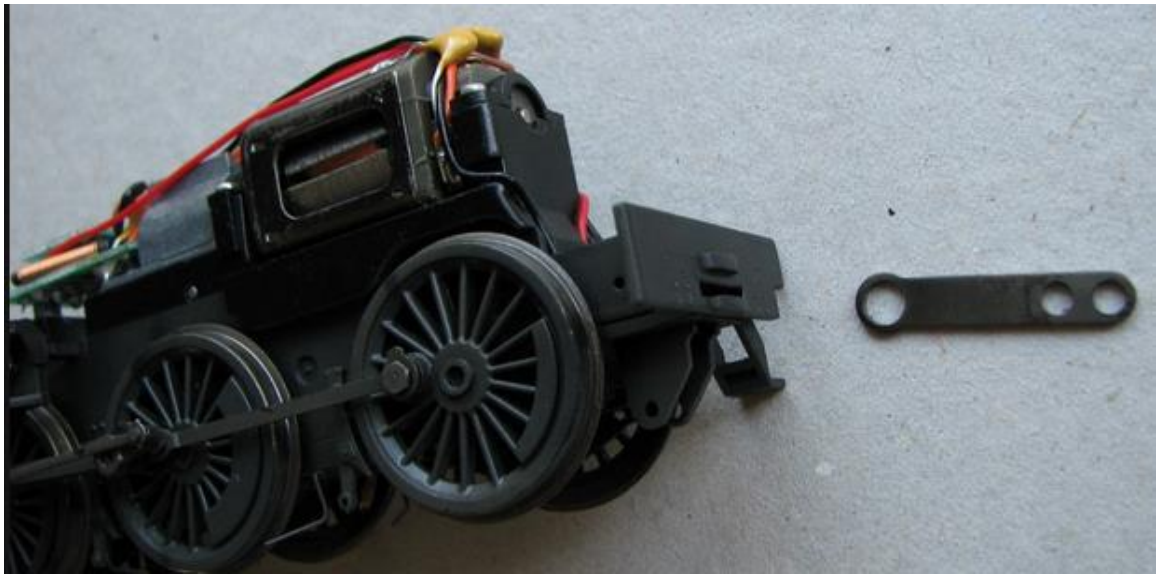


Photo 19 - the tender coupling bar just needs the rear of the keeper plate to be raised slightly to release it. The screw was the one holding the rear of the chassis to the body!

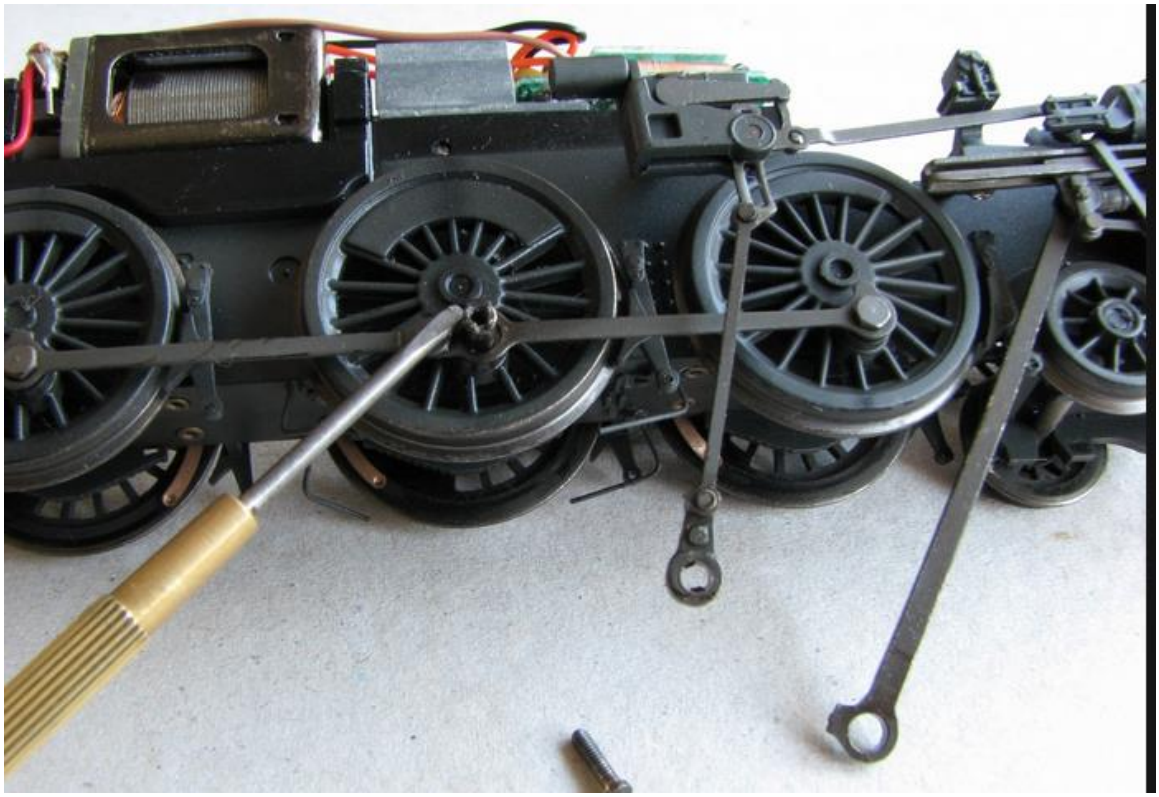


Photo 20 – Next is the disconnection of the valve gear from the wheels. Simply remove the screw from the centre crankpin, and the return crank and the connecting rod can be lifted off. Do this on both sides, otherwise the wheels will not want to leave the chassis!

Photo 21 - Undo the remaining three screws in the keeper plate...

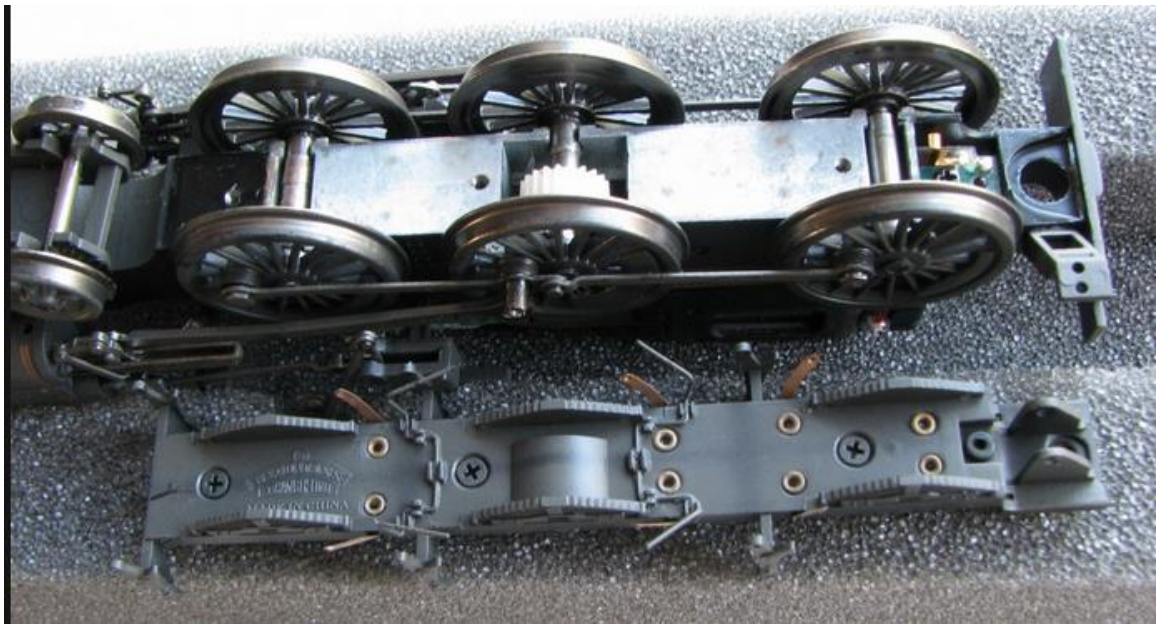


Photo 22 - ...which simply lifts away, no wires underneath to worry about. Take care not to damage the pickup wipers in the process.

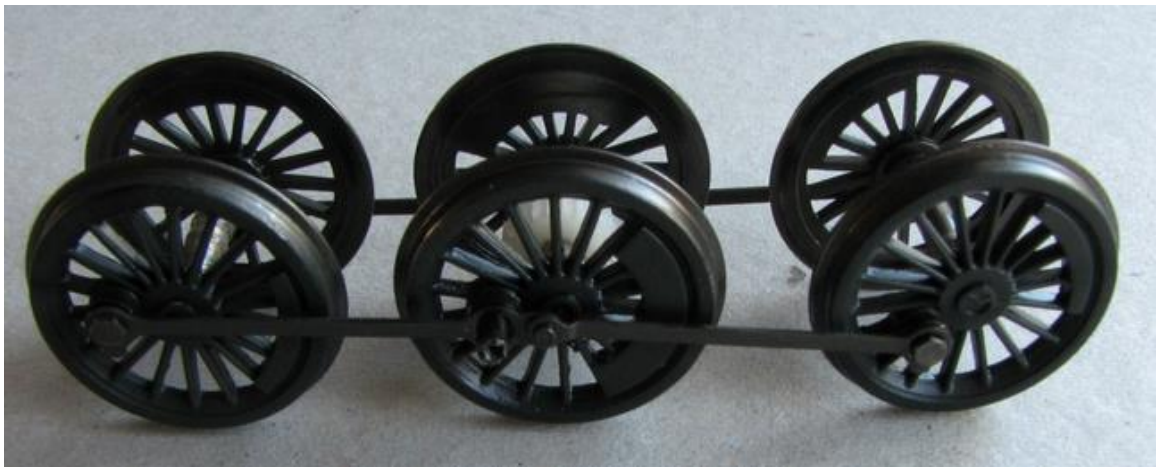


Photo 23 - The wheel sets simply lift out, still at this point connected together by the rods.

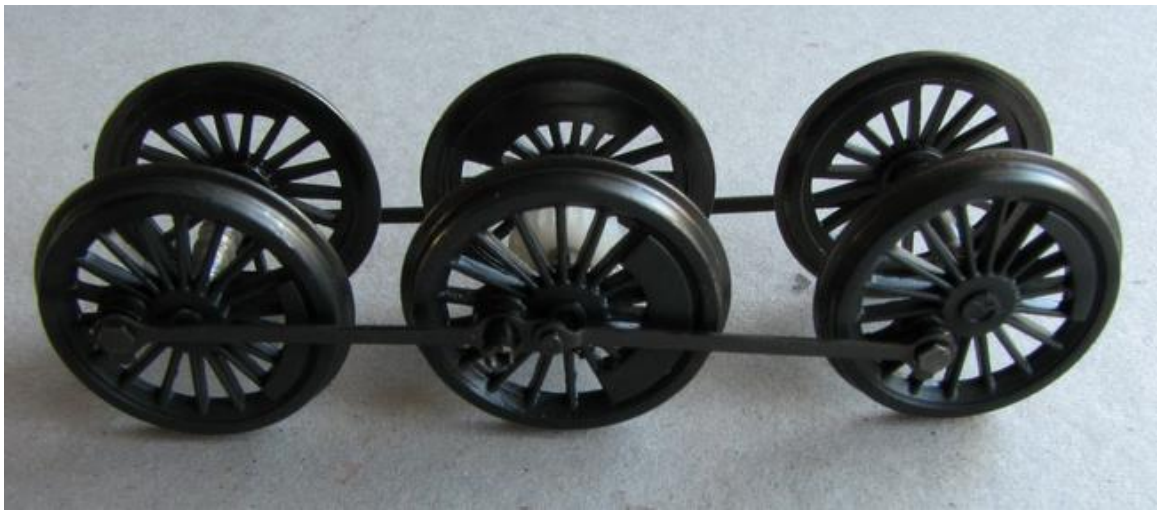


Photo 24 - as here. Next, the crankpins are unscrewed using pliers, and the coupling rods recovered and set to one side.

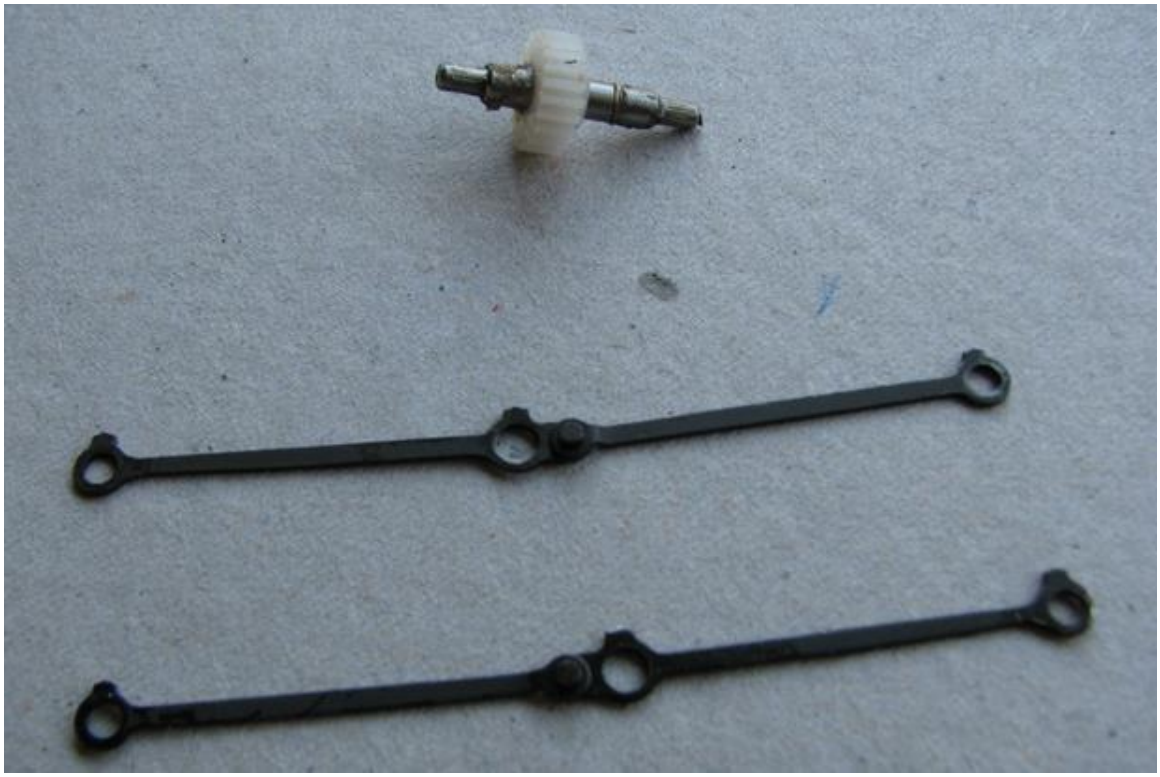


Photo 25 - Shows the recovered coupling rods and the centre axle complete with final drive gear. The driving wheels are simply twisted off the axle ends. All the driving wheels and axles are discarded.

Photo 26 - The gear wheel should simply push off the axle by standing the axle on one end, using both thumbs on the gear, and press directly downwards. Alternatively, rest the gear on the jaws of the vice with the axle between the jaws, but not tightened, and **tap the axle through the gear**. DO NOT TWIST the gear off the axle, as there are small splines, seen in photo 27 below

Photo 27 –The splines on the axle will damage the internal bore of the gear if twisted. Keep the gear and discard the axle.

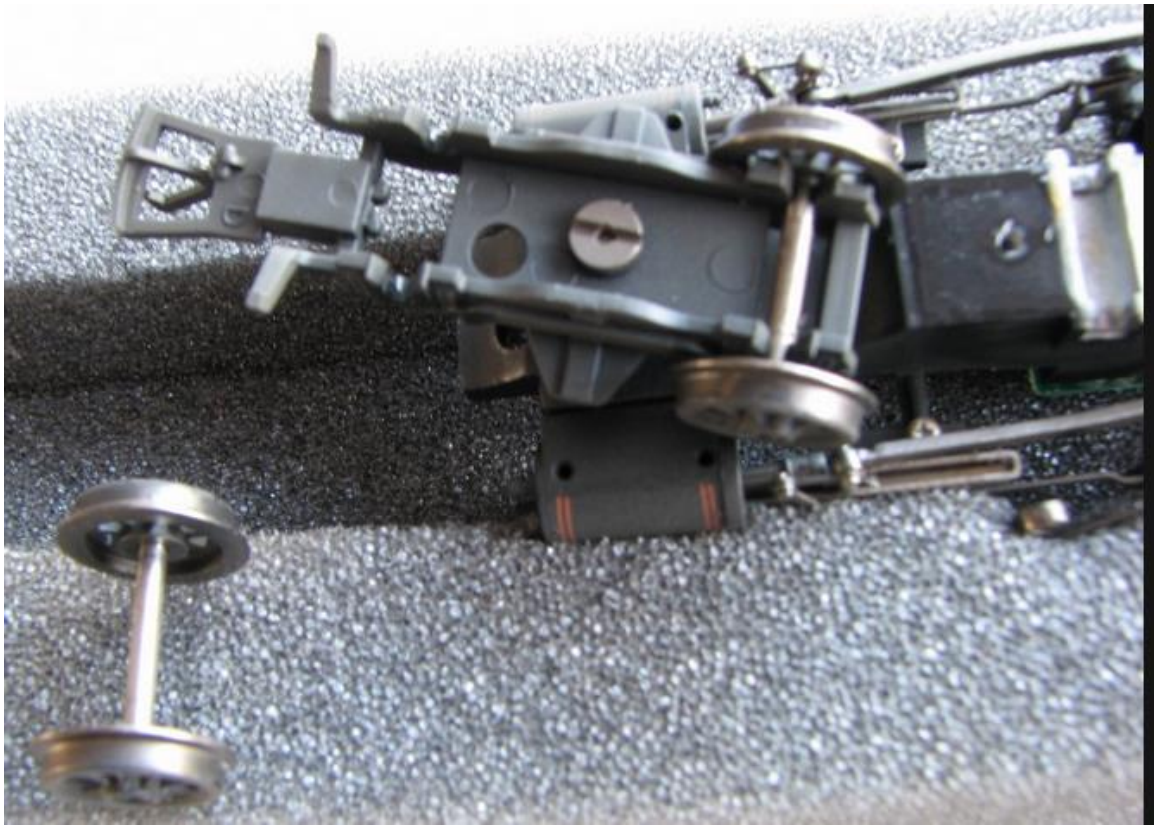


Photo 28 - Removal of the bogie wheels and axles is just a matter of pulling the axles out of the open bottomed bogie.

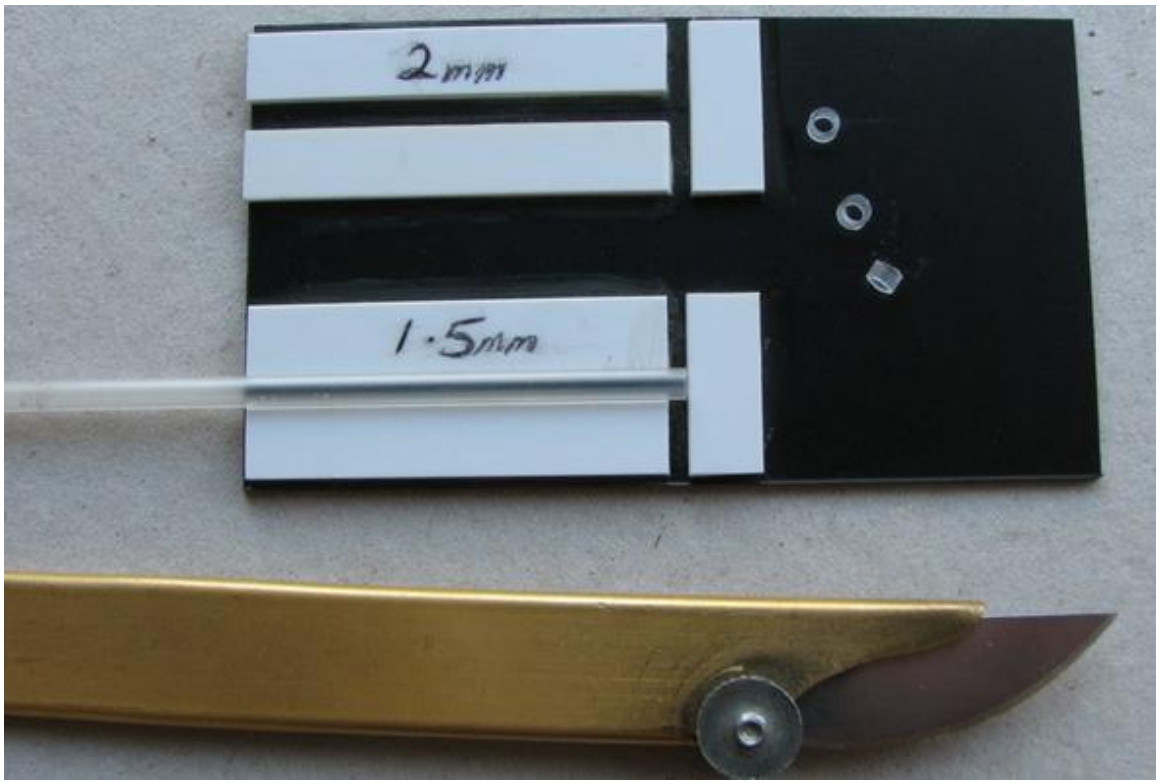


Photo 29 - these shows a simple plasticard jig used to make our own free bogie axle bushes.

Photo 30 - These are cut from the empty inner ink holding tube of a biro. Slice off spacers, 1.5mm approx in width, and we need 4 for the bogie, 2 per axle.

These biro spacers can be used in any situation where you need them on 2mm axles, diesel drive conversions are a typical use. The plastic seems extremely slippery and hard wearing, having given no trouble in many applications on Retford, probably the ultimate EM test bed.


Photo 31 - One assembled EM bogie wheel set, incorporating two of our biro spacers.

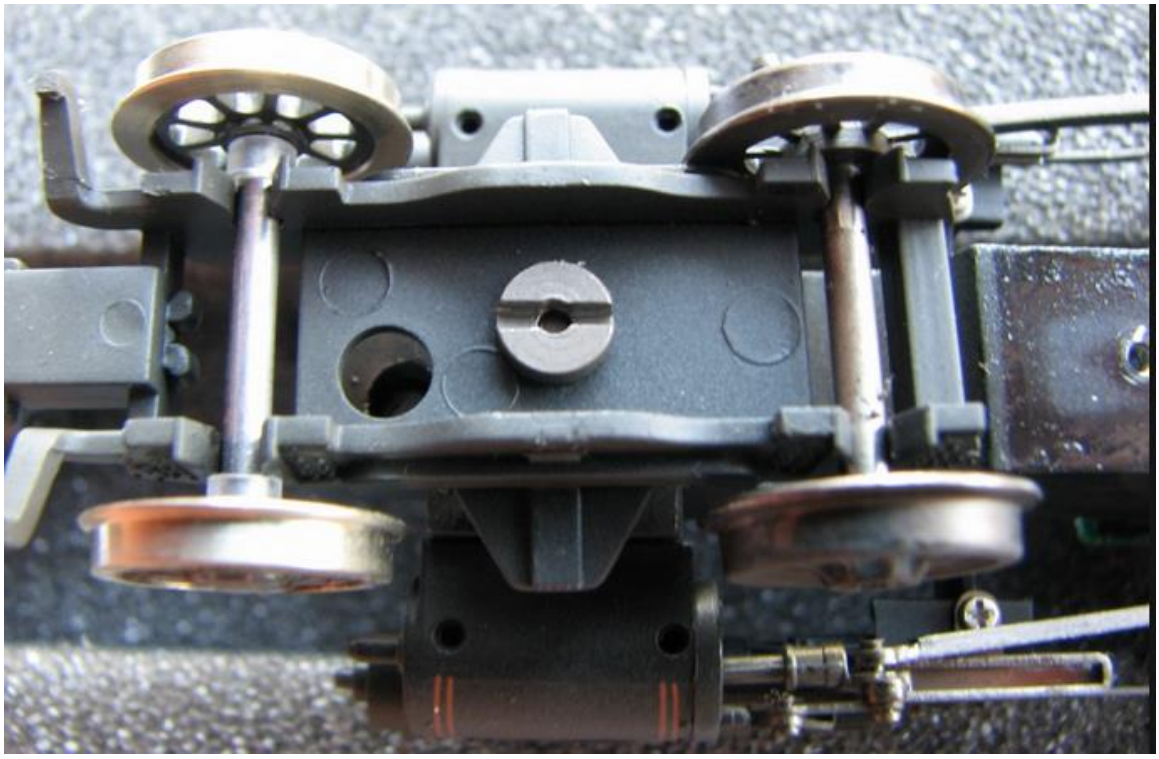


Photo 32 – Left hand axle is EM and the right hand one original Bachmann, for comparison.

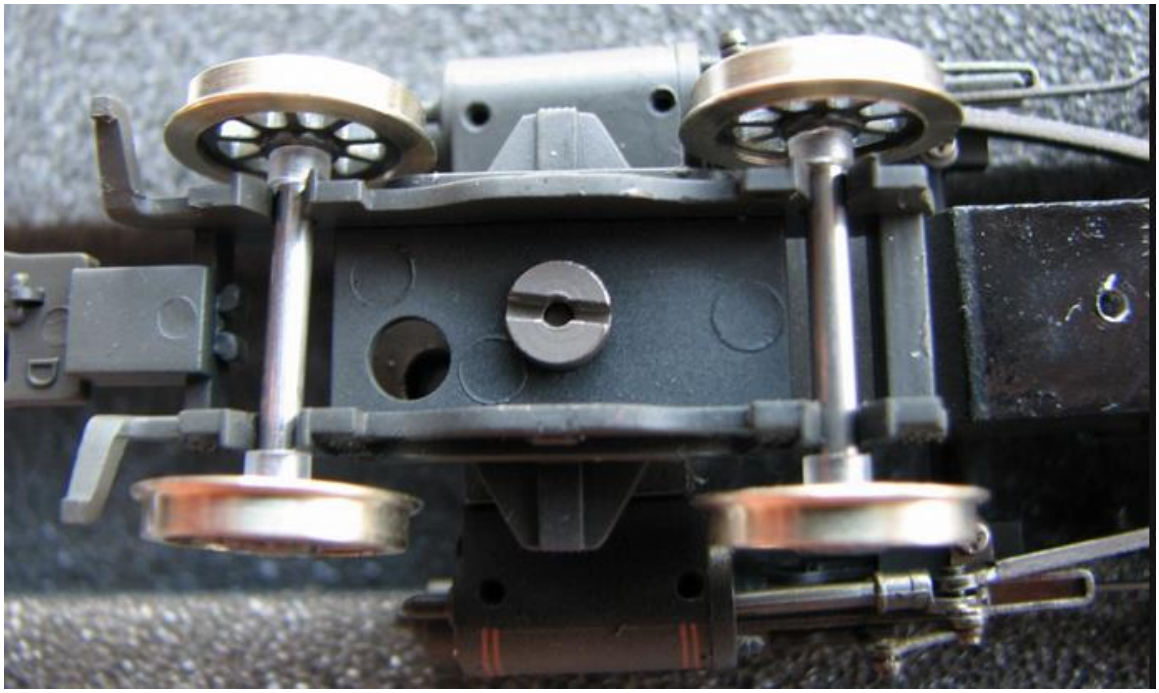


Photo 33 - Completed bogie, the axles pushing or “snapping” back into position.

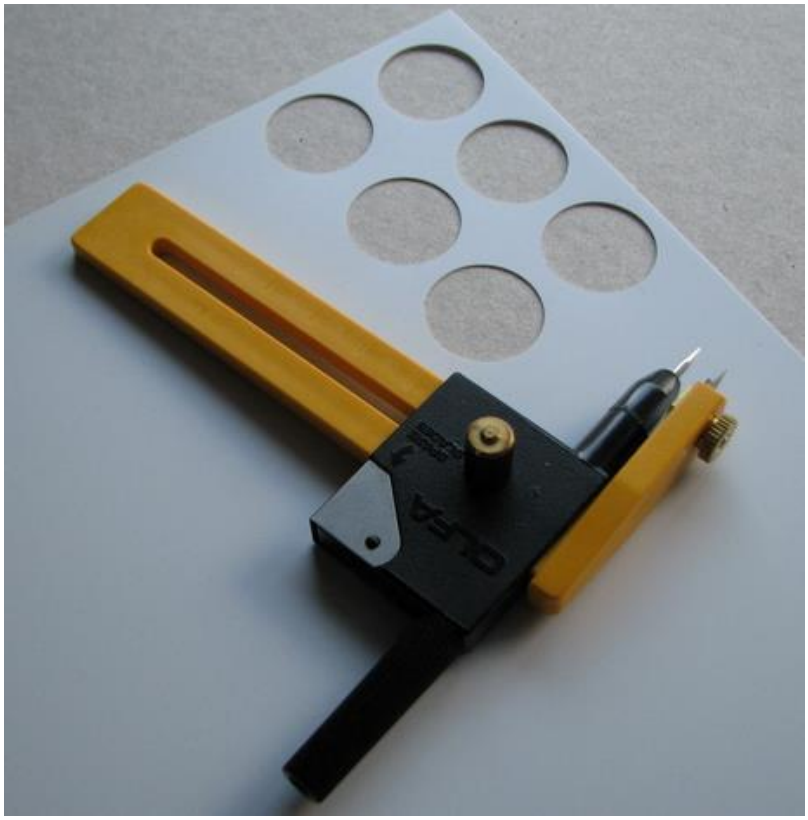


Photo 34 (above) and 35 (below) demonstrate the process of cutting out balance weights for the driving wheels from 10 thou plasticard using an Olfa compass cutter.

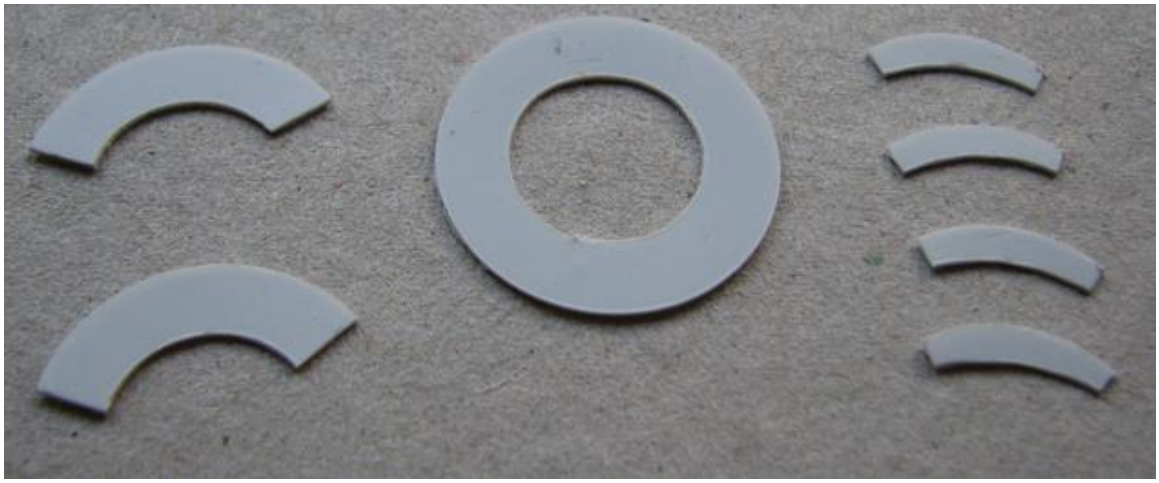


Photo 35 - The shape of the weights on the Bachmann wheels are correct, so these can be used as a guide to obtain the correct shapes, which vary depending on the wheel position

Photo 36 - shows the fitted balance weights

Photo 38 – shows close up of centre axle wheel balance weight

Photo 37 – the complete set with the crankpins fitted to the 6 driving wheels. Follow the Alan Gibson instructions supplied with their crankpins for this step.

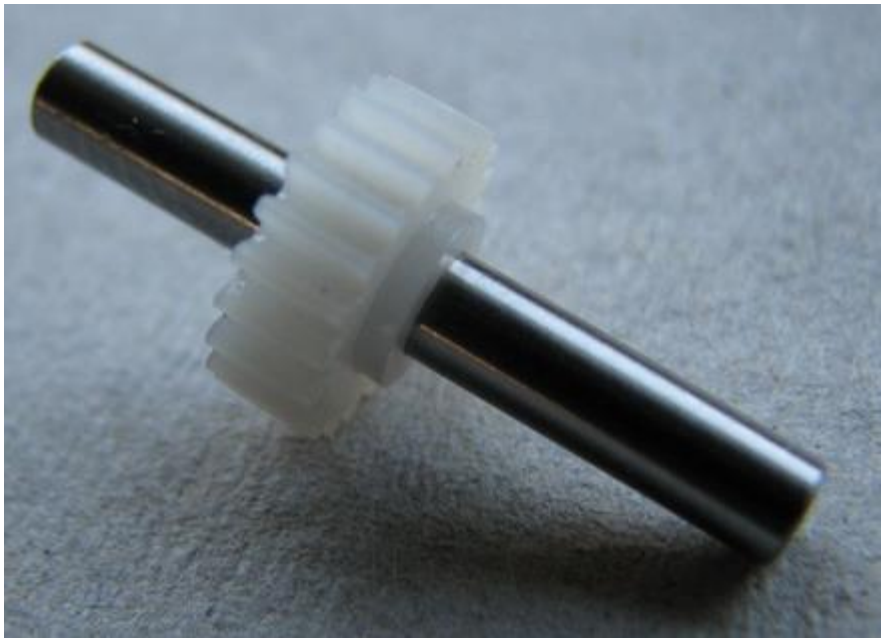


Photo 39 - The gear wheel is fitted to one axle, using Loctite 601 to ensure it remains in position. The gear needs to be 10mm from the face of the gear boss to the axle end. Leave to cure, and make sure any excess Loctite is removed!

Photo 40 - Wheel set assembly. This picture shows the spacers needed on axles to limit side play.

- Leading axle needs a 1mm spacer on each side.
- Driving or Centre axle needs a 1mm and a 0.5mm spacer each side of the gear wheel. Trailing axle needs a 1mm spacer each side.
- (Spacers are 1/8" bore turned items from EMGS stores)

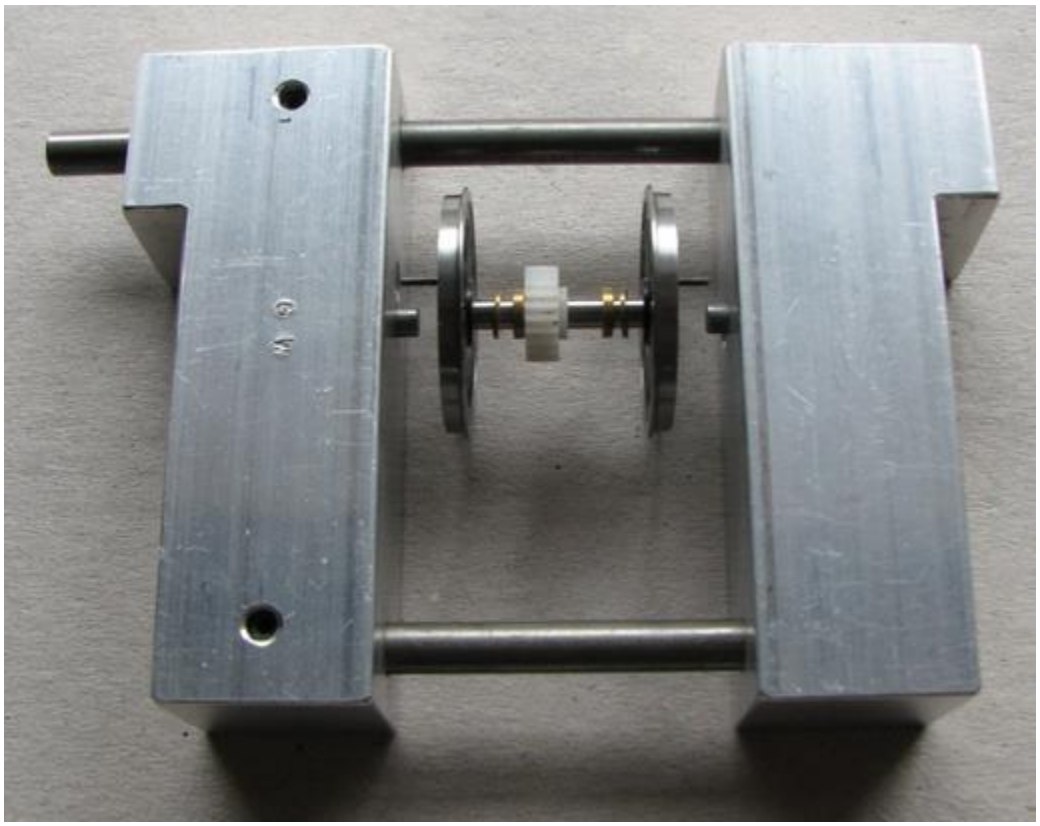


Photo 41 – This photo and the next (42) show the GW wheel press being used to mount the wheels to their respective axles. Do not forget the spacers before mounting the wheels!

I have found that the GW press is the best Jig or gizmo I possess. It is highly recommended!

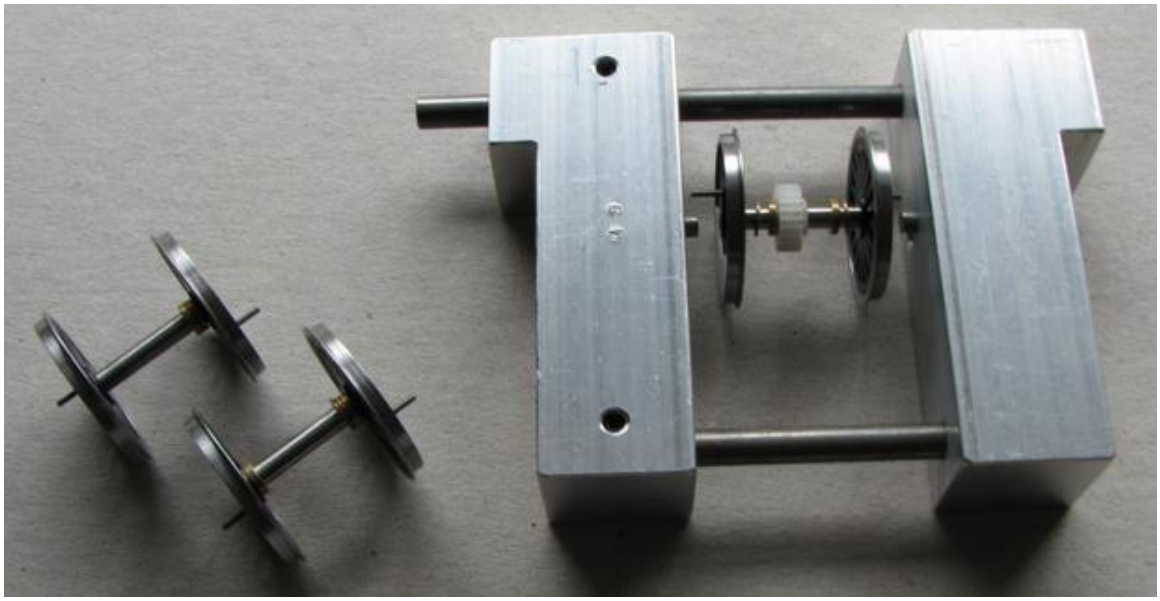


Photo 42 – the final set is mounted – note the washers are in place!

This is not meant as a criticism of the Alan Gibson wheels, but ***the axles were 1mm too long as supplied****. Another pack of identical wheels in my possession are also 1mm too large, and I know of several other modellers using Gibson wheels where the axle lengths were wrong. Easily corrected when you know, and these examples were altered with a file, twiddling the axle between fingers to maintain a square end!!*

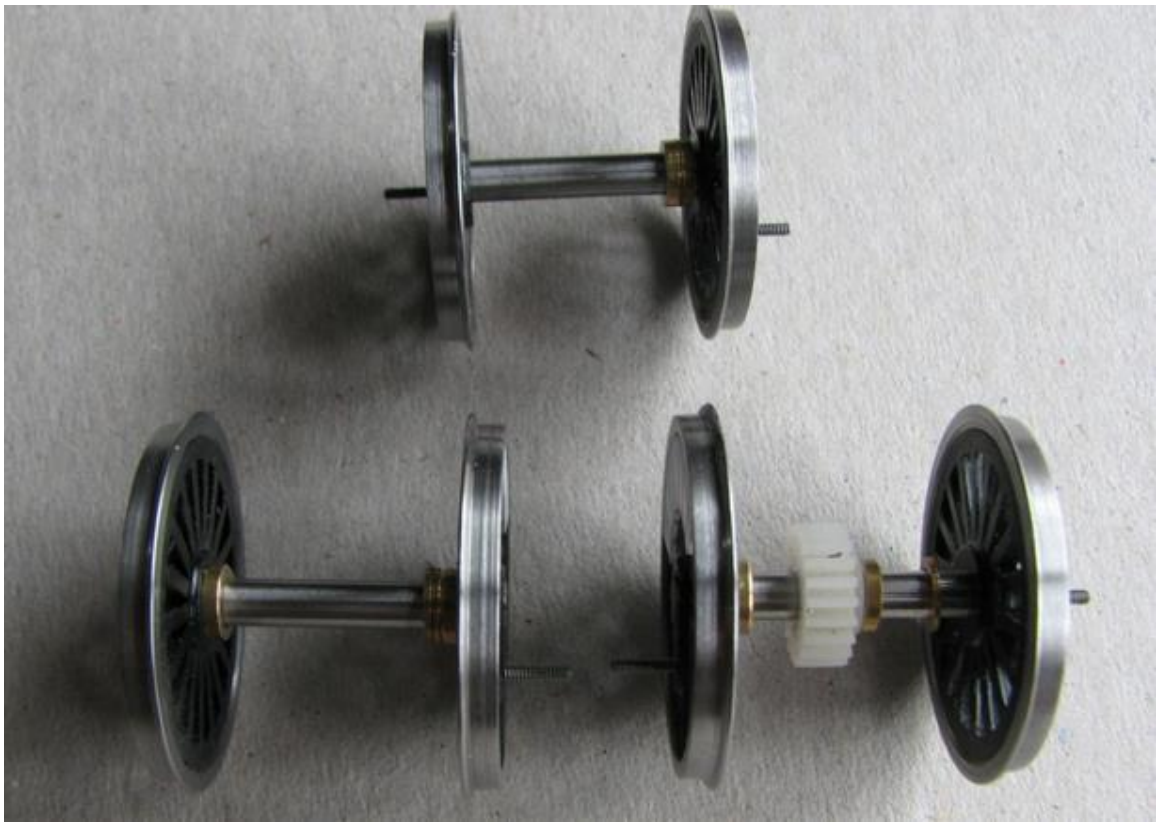


Photo 43 - The fully assembled wheel-sets.

Photo 44 - Showing wheels replaced into the chassis and the location of spacers.

Photo 45 - Replace keeper plate ensuring it is aligned the correct way round and that the pickups align with the rear of the steel wheel-treads.

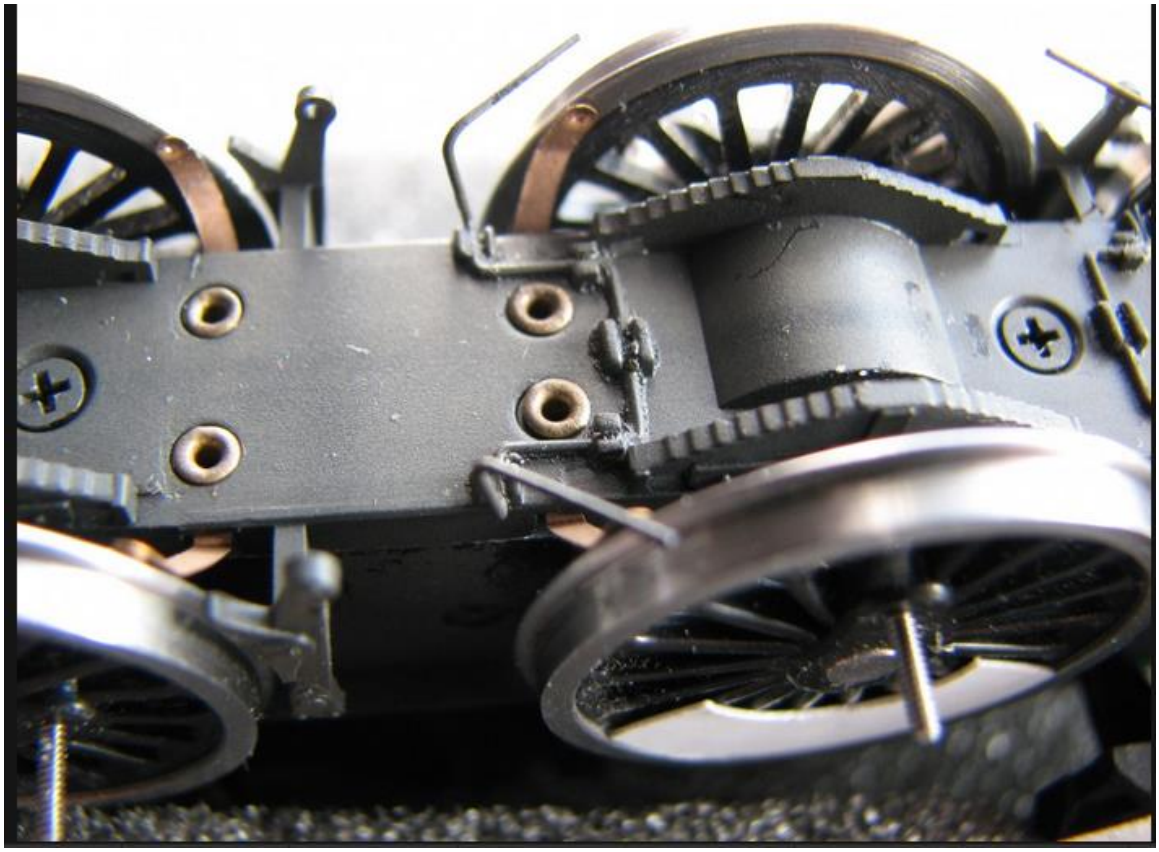


Photo 46 - These will need slightly bending outwards to allow for the wider gauge, and the wire sand-pipes can be tweaked to line up with the wheels, just be gentle with them!

Do not over-tighten the keeper plate, otherwise binding of the axles can occur.

Photo 47 – Connecting rod as supplied

Photos 47 (above) and 48 (below) show the modification required to the connecting rod. As it comes, it has a large lump cast on the rear face of the rod, and we need to file this flat. The metal is quite soft, and can be done by resting the chassis on its side so the rod sits flat on the work surface. There is no need to remove any of the valve gear or cylinders from the chassis to achieve this.

Photo 48 – Connecting rod modified

Photo 49 - Now for the hardest part of this conversion. The picture shows the return crank, which is a casting, rather a large lump of metal, but this material cannot be soldered, and it has far too large a hole in it. The simple fact is, we

need to replace it with a much thinner one that we can solder to, and the bonus is we end up with a much more prototypical looking end result.

Photo 50 - The rivet holding it to its rod is simply cut through by inserting the jaws of a Xuron cutter under the rivet head, and snipping off the rivet head. **You will, of course take precautions with your eyesight at this point** because there is little control over where flying rivet heads go!

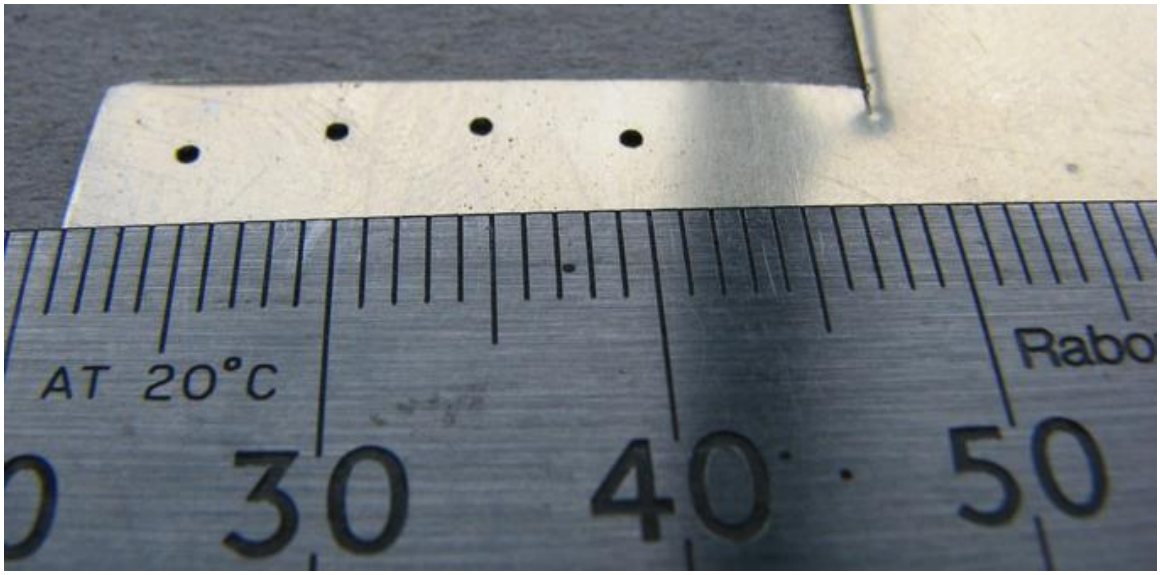


Photo 51 - Shows the drilling of a piece of 10 thou nickel silver sheet for the replacement return cranks,

Photo 52 - shows one crank cut out by tin snips and the second has been filed up neatly and straightened out with pliers.

Sadly, apart from raiding commercial valve gear etches, which becomes expensive just for these two parts, I know of no source of ready made return cranks, other than a very neat casting in the Alan Gibson range, (Gibson ref. 4M822), but I have had little success in tapping the cast brass easily, and I am trying to avoid soldering to the crankpin in the plastic centred wheels! If Markits metal centred wheels are being used, then I do use the Gibson cranks without hesitation as they can be soldered to their crankpins without any fear whatsoever! The hole sizes at this stage should be a loose fit over the replacement rivet (I use Comet nickel silver ones) at the little end, and a snug fit over the Gibson crankpin screw at the large end.

Photo 53 - next we need to solder a Gibson crankpin nut to the large end. This is achieved by passing a spare crankpin screw through the crank and screwing the crankpin nut flat face to the crank, or boss facing outwards. Tighten this with a screwdriver. Then flux well and apply solder. On cooling, undo the screw part way, and then push hard on the screw to ensure you have a sound join. Because we are soldering steel, it does not always take first time. Sometimes, if you are unlucky, you successfully solder the screw into the nut as well! In this case, it is sometimes easier to make another crank, rather than undo it and clean up the crank for another go. In any case, you would need a new screw and nut, because you will not remove all traces of solder from those fine threads.

Photo 54 - shows the longer Gibson crankpin bush on the right, and on the left is our shortened version for the centre crankpins only. Grip with pliers and a few strokes of a file will shorten it by about 1mm. If it pings out of the pliers into the ether or the carpet, do another one; its quicker than groveling around trying to find it. Life is too short!

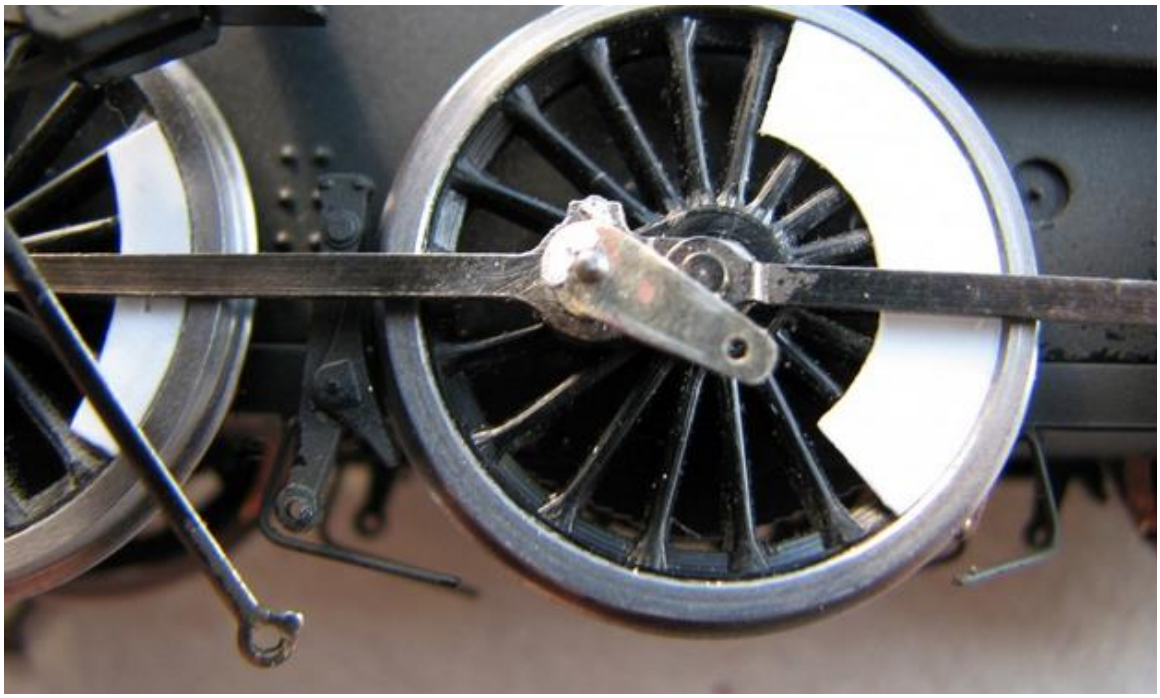


Photo 55 - Although the picture shows the coupling rods fitted, that is jumping ahead, but it demonstrates how the crank is wound on to the crankpin, and naturally, when tight, is because of Murphy or some other perverse person, pointing in any direction but the correct one. This is easily corrected by filing a very small amount off either that crankpin bush, or the boss face of the soldered on crankpin nut. By removing a little at a time, and reassembling, you will eventually arrive at a tight return crank, pointing where we want it, as in the picture.

Photos 56 – 58 address the re-bushing of the Coupling rods. We need to bush all the holes in these rods, as they are now, they are far too large. (See photo 56 below.

Photo 56 – original coupling rods – un-bushed – holes too big.

Photo 57 - Simply file the rod rear face until the plating is removed to expose clean metal.

Photo 58 - Also, twist a round needle file anti clockwise in each hole just sufficient so that the Gibson bushes, or 14BA washers can be push in and so that the inside of the hole is clean metal for soldering the bush in place.
Solder the bushes/washers into the rods as per Photo 59 below.

Photo 59 – Coupling rods with bushes soldered in place. You will fill in the holes more likely than not,

Photo 60 - but notice that the solder forms a neat depression in the centre of what was the hole. This is used as a centre punch mark to drill out the hole. Using a

tapered cutting broach, or a needle file rotated anti clockwise, open out the holes to a running fit over the Gibson crankpin bushes.

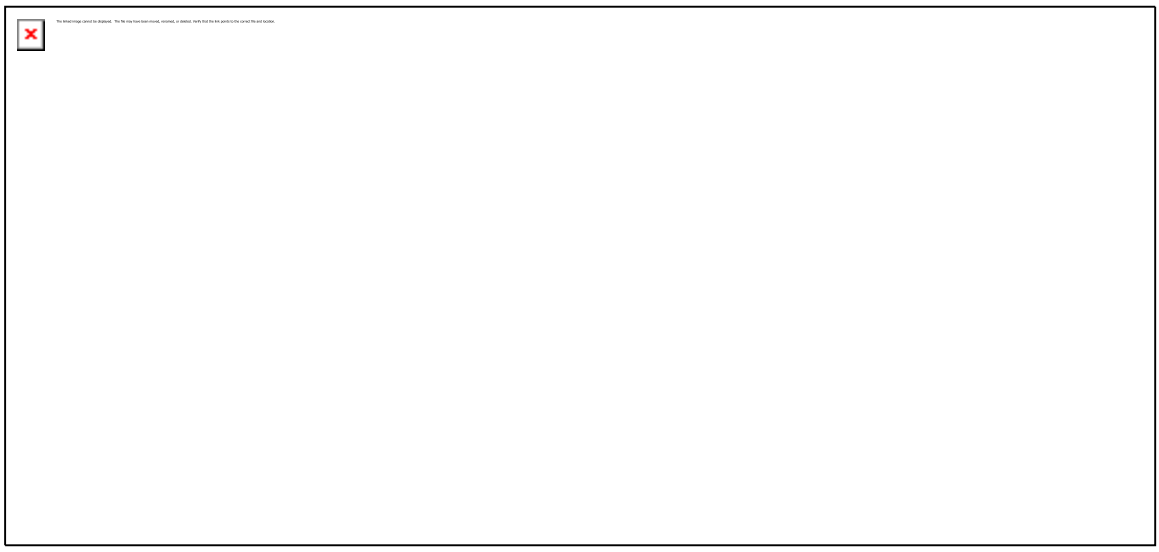


Photo 61 - One completed coupling rod. These can now be assembled to the wheels using the short crankpin bushes on the front and rear wheels, with our modified long bushes on the centre wheels. Fit crankpin nuts front and rear, tighten up, and trim any excess screw off, and clean up.

We now need to bush the hole in the connecting rods, so that they fit over the centre crankpin bush correctly. From a piece of 1.5mm id, 2.3mm od brass tube, cut 2 bushes the thickness of the modified connecting rod. These are not a tight push fit, but a running fit!

Photo 62 – Connecting rod bushes

Photo 63 – Connecting rod bushes in place – as a running fit!

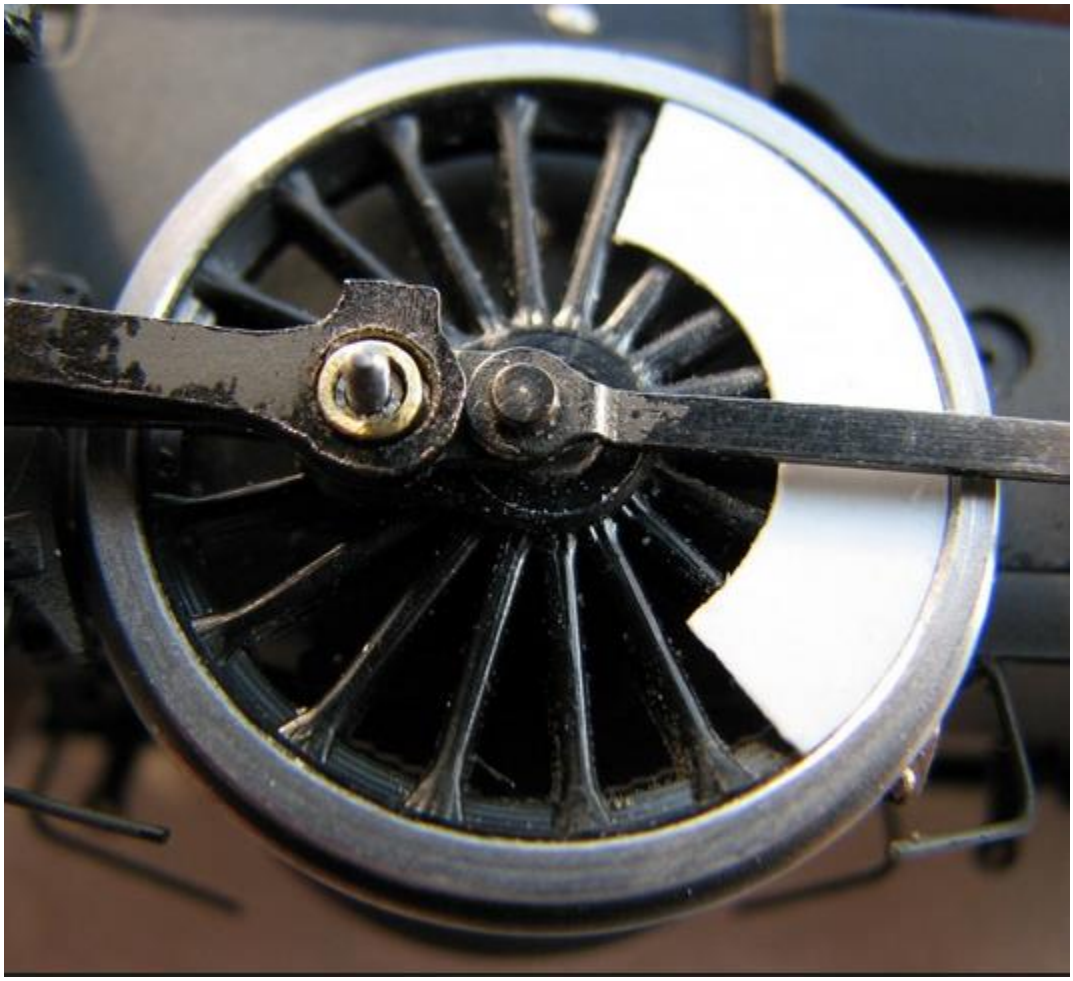


Photo 64 - Shows the rod and bush assembled over the centre crankpin, but first we need to fasten the return crank to the valve gear.

Photos 65 – 70 below show the stages in riveting the crank to the rod. Some may wish to use a hammer and rivet properly, I prefer to solder, using a paper washer to prevent everything becoming solid.

Photo 65

Photo 66

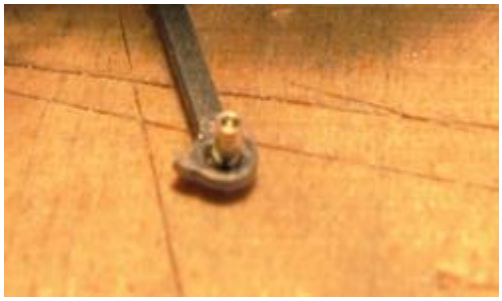


Photo 67

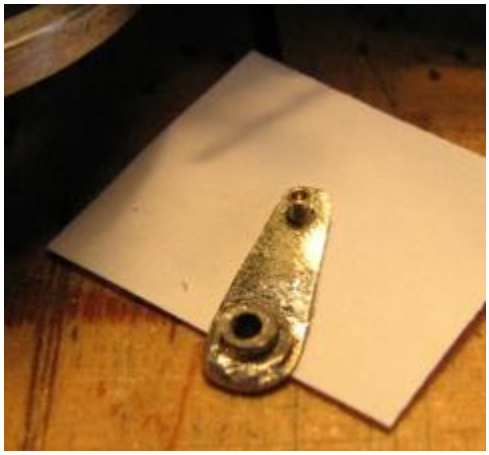


Photo 68

Photo 69

Photo 70 shows the completed join.

All that remains is to wind on the return crank over the bushed connecting rod, and it should now look like the following two photos!

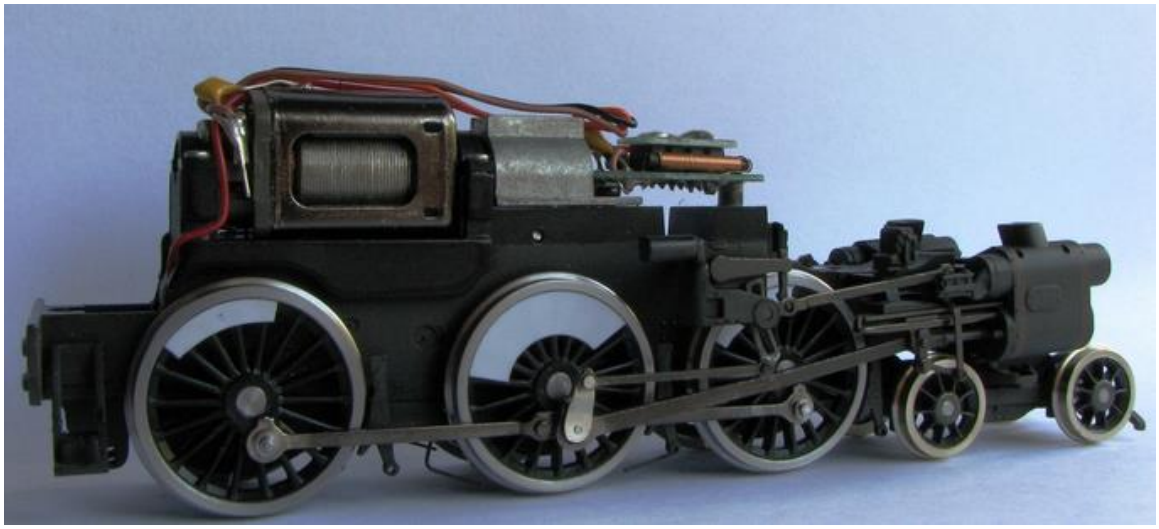


Photo 71 – Crank fitted

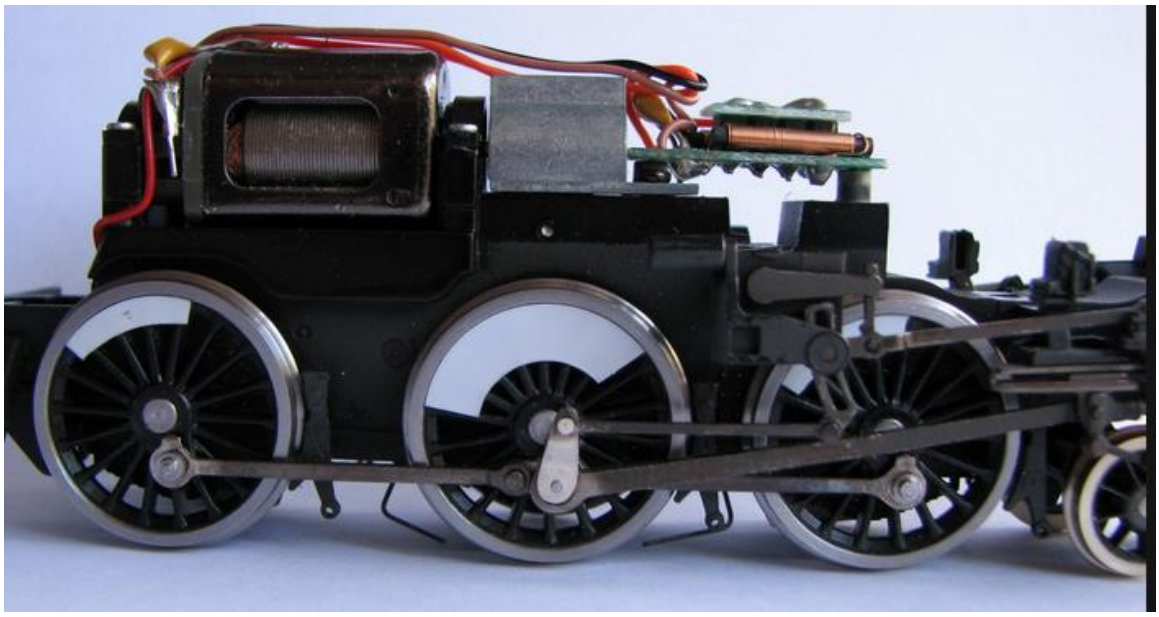


Photo 72 – Crank fitted

"Wind" the motor round by hand so the wheels do a couple of revolutions to check all is well, with no obvious binding. If all is well, then track test slowly, check that the quartering is ok and adjust as needed, this example was right first time, thanks to the GW press.

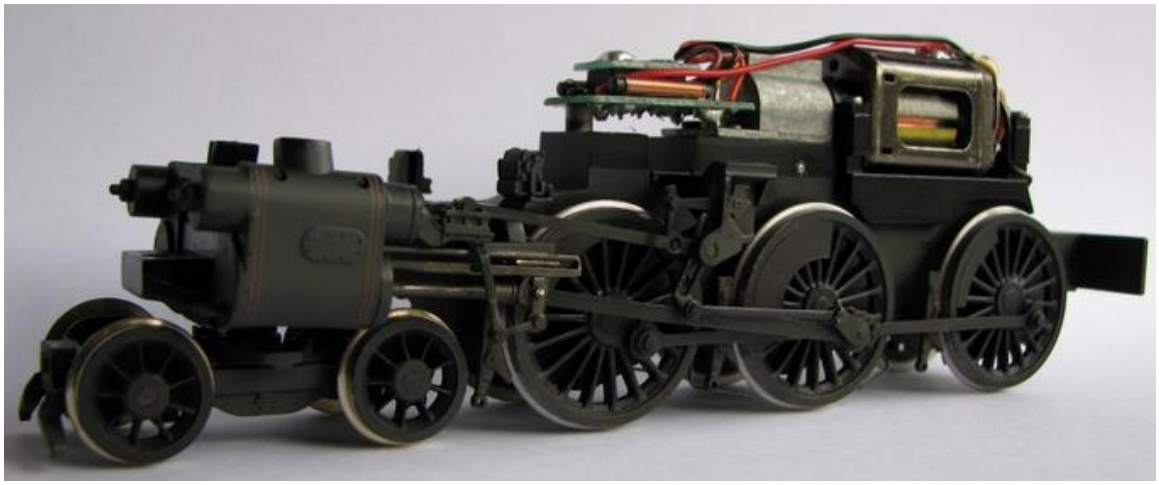


Photo 73 – Once happy with the running, paint the wheels now, and it begins to look the part.

Photo 74 - if you wish, prior to putting the body back on, the engine tender drawbar can be modified to reduce the engine to tender chasm. It needs another hole drilling as close as possible to the Bachmann one, and the little engine to tender buffers on the tender front need snipping off as well. Replace the engine body, slipping the tender drawbar through its slot prior to replacing the screw under the cab.

Photo 75 - A much closer engine / tender coupling. It will negotiate pretty tight curves at this spacing!

Photo 76 – and again this time a rear ¾ view

Photo 77 - OK, where's my train?

N.B. This conversion approach method is valid for most Bachmann outside valve geared locos.