“*But there’s no kit?”* - Building S&DJR ‘Small’ 4-4-0s Nos.16 and 77.

Part 1. A pair of sprung P4 chassis with Continuous Springy Beam (CSB) suspension.

A combination of scratch-build, a pair of milled frames, two sets of etched coupling rods, a tender kit, a few drawings, lots of photos…… and covid lockdown-times.

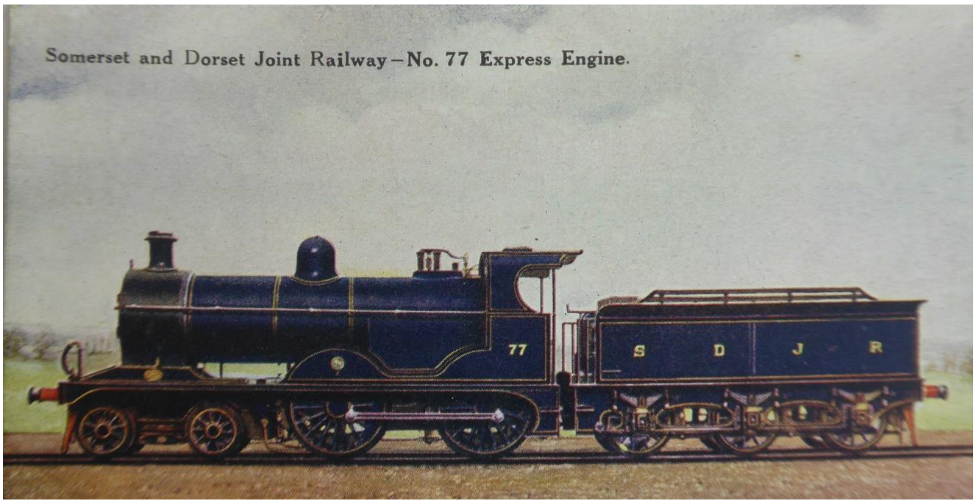
By Steve Duckworth

Preamble

Following the completion of Avonside 0-4-4T No.31, chronicled in the October 2020 ‘Virtual Missenden’ and updated for March 2021 in a separate contribution, my next loco-build project again addressed my under-strength passenger loco stud. No. 31 had doubled this (!), alongside my earlier SDJR 2P 4-4-0 No.68, one of the MR ‘483’ type with 7ft drivers, a nominal ‘rebuild’ in 1921 of an 1896 SDJR build.

The most glaring omission from my 1923 stud was any representative of the three SDJR ‘Small’ 4-4-0 classes. These comprised: eight members of the Johnson 5ft 9ins class of 1891/6/7, (14-18, 45, 67,68) later rebuilt with larger H boilers or ‘rebuilt’ as above; the trio of Johnson 1903 6ft engines (69-71), all ‘rebuilt’ before my period, and the pair of H1-boiler Deeley 6ft engines from 1908, Nos. 77/8. None of these types has existed in 4mm scale as a kit, which is one reason why I had deferred tackling them; absence of full drawings of either design was another factor. But I did so need members of the first and last groups!

SDJR Johnson 4-4-0 No.16 at Broadstone Junction ca 1923/4, as rebuilt with H boiler.



SDJR Deeley 4-4-0 No. 77, a ‘F. Moore’ coloured postcard. Note how ‘warm’ the SDJR blue appears here.

However, the original 1891/6 engines featured in a fine set of drawings by Bill Ibbott in the June 1968 Railway Modeller. There were a couple of modeller's drawings in pre-WWII issues of MRN and MRC. I also had copies of official SDJR weight diagrams, which gave basically accurate leading dimensions. Vitally, I also had an extensive collection of period photos of all these locos, courtesy of Russ Garner in Australia, and various MR loco kit spares gathered over the years.

I already had suitable etched coupling rods for both classes and a set of milled brass frames for the smaller engine, all obtained from Alan Gibson Model Railway products. The larger engine would need scratch-built frames, but I already had a George Norton kit for the 2,950 gallon tender as originally fitted to this pair. In reality, they donated their original tenders to 'rebuilt' 7ft 4-4-0s delivered in 1921, whose smaller 2,200 gallon tenders they received in exchange. However, I would have to scratch-build my third example of such a tender, albeit enlarged to give 2,600 gallon capacity, for the smaller 4-4-0, so I decided the larger engine would 'take the short cut' – at least initially.

Rationale

Given the existing covid lockdown situation, and the inevitability of further such lockdown after any 'Festive Season' relaxation, I decided to bite the bullet and tackle *two* 4-4-0 builds, one of each of the above types. The similarity of these designs meant that they would be mechanically very similar, so progress would be more rapid, but the differences between the rebuilt and new-build locos meant they would have sufficiently different superstructures to avoid being too 'samey'. Completion of the pair would then give me 'full coverage' of the mainline SDJR passenger stud (I already had an 'Armstrong', the MR 4F type, which the S&D tended to use as a passenger, rather than goods, loco).

Since these small 4-4-0s would be hauling relatively heavy, if short, rakes of etched coaches, I decided to use a tender-mounted motor, with as much lead weight as I could fit in above the driving wheels. For suspension I am now a firm convert to the Continuous Springy Beam approach (CSB).

Identities? My print of No. 16 at Broadstone Junction dates back to 1964, way before I became a SDJR devotee; mum's sister used to live there and a neighbour of hers kindly let me choose one card out of his album! It is also the date of my birthday, so an obvious choice for the smaller engine. Similarly, No.77 was the date of my graduation (actually 7/7/77!), so that was another obvious choice.

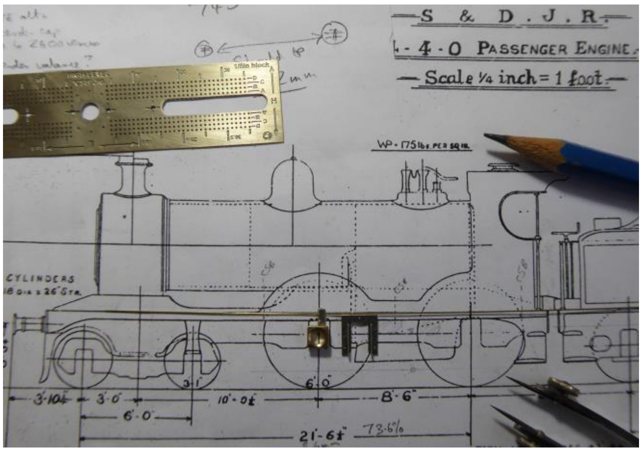
The chassis build

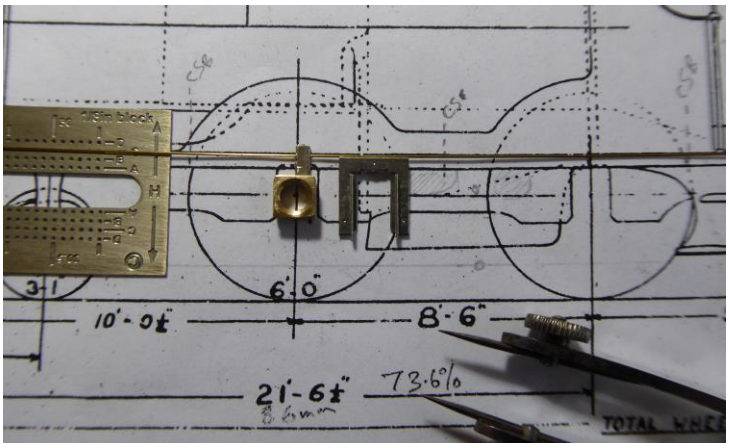
Since I had a suitable tender kit for No.77, I started on this build first, soon assembling the basic bodywork to give a sense of momentum. However, I will describe this later in the sequence, along with the tender frames for both No. 77 and No.16.

I have laid out the following sections thematically, rather than strictly chronologically, to make comparisons easier between the two models. Broadly, I 'lead' each section with No.77, and follow up with any variations for No.16.

Frames preparation

No.77 - a scratch-build project





We start by exploring the CSB suspension arrangements, using the official SDJR weight diagram, some bearing suspension components from High Level Kits (Chris Gibbon), and their CSB fulcrum drilling jig.

Principle of a CSB suspension: *The suspension tags which have to be soldered to the bearings are dimensioned so that they will set the bearing 0.5mm below its true position in the frames, as seen above, right. The CSB wire diameter is chosen so that when the weighted loco is placed on the track, the CSB springs will deflect enough to bring the loco's buffer height down by 0.5mm to the correct level.*

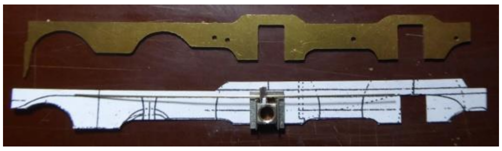
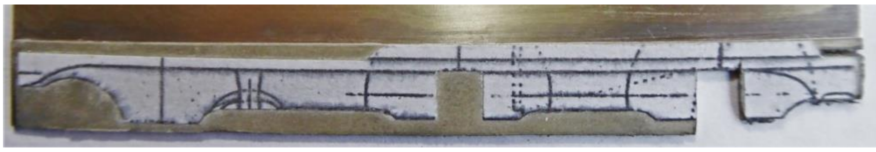
The invaluable CSB section of the CLAG* website shows that, for a four-coupled chassis, the optimum CSB fulcrum placement is relatively simple. There is a fulcrum mid-way between the axles, with the outer ones symmetrically placed, at a distance 0.35X beyond the axles, where X is the coupled wheelbase. In this case, the wheelbase is 8ft 6ins, ie.34mm, so the outer fulcra are located 12mm beyond the axle positions. I have marked these on the drawing in pencil.

The fulcrum drilling jig allows the fulcrum holes to be set and drilled at a consistent height and offset, relative to each axle position. One side is drilled at 4.0, 5.0, 6.0mm etc. intervals from the axle centre, the other side is drilled at 4.5, 5.5, 6.5mm etc. intervals. The jig allows the CSB wire to be positioned at four heights A-D above the axle centreline, depending on the chassis depth available.

Row D is reserved for 2mm axles MiniBlox bearings only, so the bearing suspension tags seen here only have three holes, to match rows A-C of the jig.

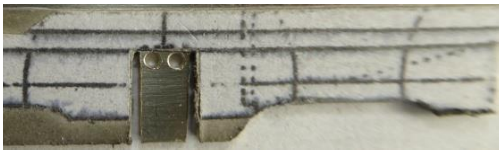
Use of the lowest row, A, is broadly intended for shallow framed locos, eg. small industrials or early types, and requires the top of the hornguides to be ground back. For most 'mainline' applications, there is thus a simple choice between rows B and C to be made. I chose row B, because it leaves more frame material above the CSB fulcrum hole than Row C would have done.

* **C**entral **L**ondon **A**rea **G**roup of the Scalefour Society

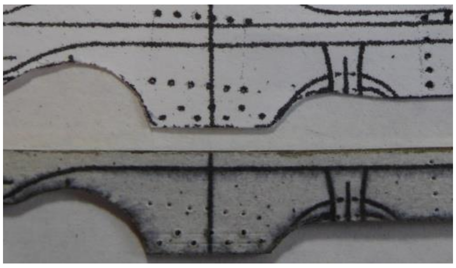
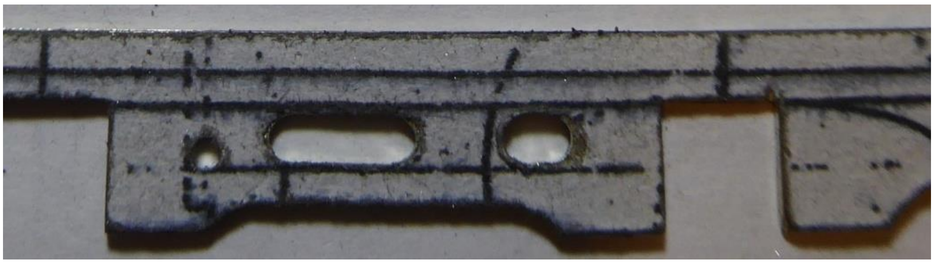



Having established from the drawing, how and where the CSB suspension should run, the next priority was to create a pair of identical side frames. On the left, a copy of the weight diagram has been trimmed to the profile of the frames, and an HL hornguide, with a length of NS wire set in the B hole of the bearing tag, is used to assess at what height to cut the 6mm wide slot for the hornguide. The rear slot has already been cut, matching the ones seen in the bought-in milled Gibson frame for No.16. Note that, unlike No.16's frame, I kept a simple straight line for the raised section of frame over the driving axleboxes, since it is anyway non-prototypical, and will be an easier profile to cut.

On the right, the paper profile has been attached to a soldered double-laminate of 15 thou nickel silver sheet, using double-sided tape; that curve is a camera lens distortion! The frame profile is being cut; you may prefer a fretsaw, but I use a wetted grinding disc in the craft drill WITH SUITABLE EYE PROTECTION.




At the hornguide slots, after making the vertical cuts I drill two holes and enlarge with a broach, till the excess material can be easily bent and snapped off, tidying up with a file. The complex lower frame profile was cut using a combination of shallow triangular cuts, followed by disc-grinding and shaping by rounded files. Two offset straight cuts, linked by another drilled hole, eased the final separation from the sheet.

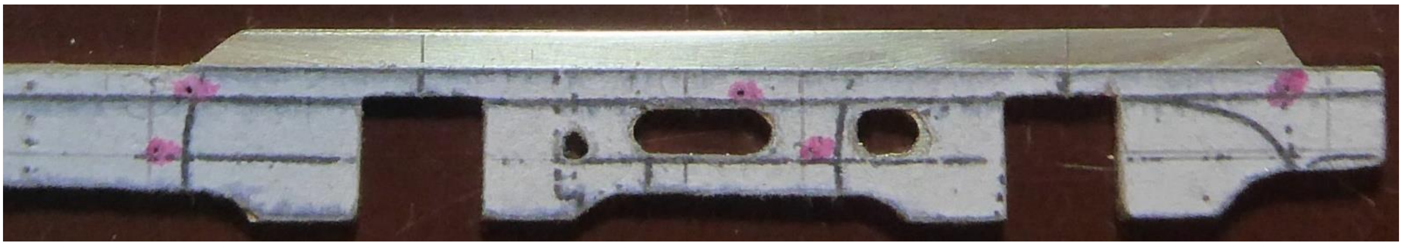
 

We now add some frame details, and discover a drawing/photos discrepancy. On the left, a fresh copy of the front frames had been used to overlay the now-smudged frame profile drawing, to ease the marking out and drilling of a series of 0.4mm holes, where prominent wire ‘rivets’ will be added later. In the absence of other details, these delineations of the bogie rubbing plate and the inclined cylinder block are very evident in photos of these engines. That vertical line delineates the alignment of bogie centre and chimney.

Now - *‘The camera never lies’* - at least not in pre-digital days. We-eell… Official photos of these engines, lined out in photographic grey, clearly depict a frame cut-out over the rear bogie wheel, as for the front one; just like many older commercial 00 models which had to accommodate tight curvature. This official weight diagram shows no such cutout; the frame is a straight line across to the down curve at the bogie platform. The drawing extract shown above, left, does show the top of the rear bogie wheel, with a glimpse of the rear of the bogie frame, hidden behind the front step (which was a later addition). Which is correct?

After *very* close examination of the official photos, broadside and front three-quarters, I am certain that the weight diagram *is* correct, there *was* no rear bogie cut-out, and the Derby paint-shop created this illusion for a harmonious official photograph. I wonder what other such examples exist…?

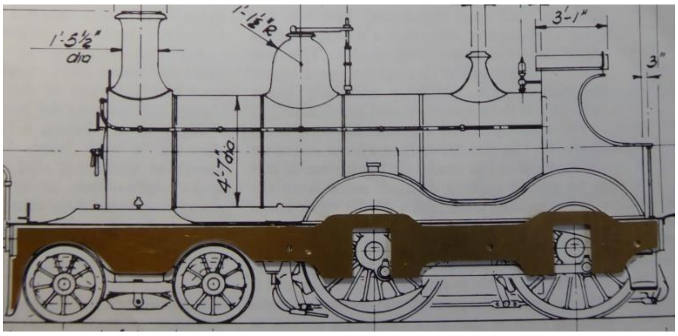
By contrast, on the right, above, is an example of where the photos are correct, and the weight diagram ‘fails’. There are three inspection/access holes to the firebox in the frames, between the driving wheels, clearly evident in photos, but absent from the diagram. Their positions needed to be estimated from broadside views, marked on and drilled/enlarged to size by careful filing.

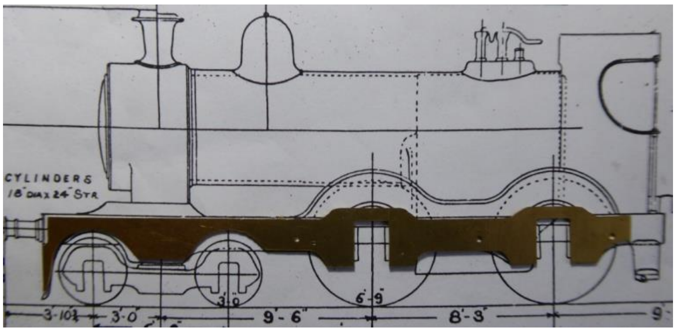


After adding those frame openings, the holes were drilled for the vertical bolt row (far left), marking the front of the frame splice, where the narrower front frames were fixed inside the rear frames. Adjacent bolt holes rearwards were obscured by a sandbox, thus saving me some further tedious drilling work. I will return to the associated prominent frame ‘step’ later on. Next, the CSB fulcrum hole positions were marked (upper pink highlights) and initially drilled 0.4mm. I cannot remember why I had also removed the top strip of the frame profile drawing, there was certainly no practical purpose for this? Finally, two lower holes were marked and drilled, for the brake hangers.

At last, the twinned frames are ready for separating, fettling of edges and slight countersinking of drilled holes. The more worn of my two No.10-bladed scalpels was used to ease the frames apart gently, while applying heat from the soldering iron.

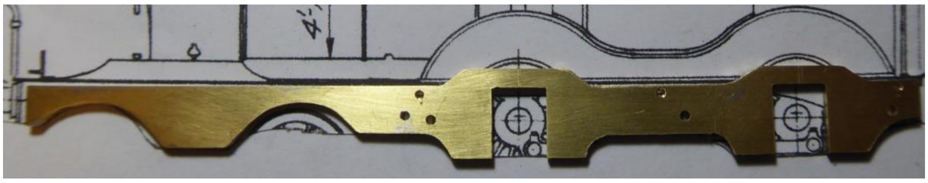
No. 16 - a modification project



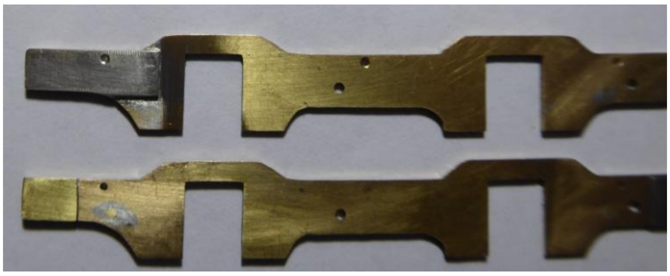
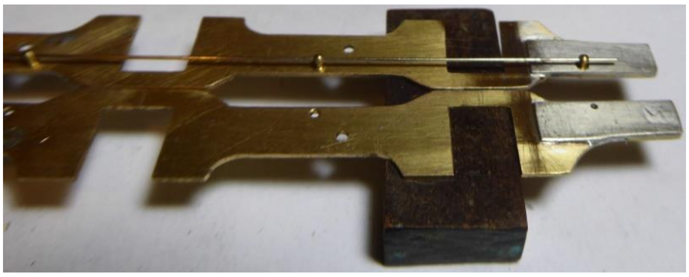


The Gibson milled brass frames for the 1891 designed 4-4-0s were a real boon, and a key factor in my decision to build both types of loco in parallel. Note that the second and fourth holes from the left were intended for sprung plunger pickups, so they would get infilled. The thicker frames (21 thou vs 15 thou for No.77) did require that I filed down the P4 spacers to maintain an appropriate over-frame width - especially since I would need to add thin front frame overlays, having discovered with No.77 that rear bogie wheel cut-outs were superfluous. Interestingly, this time the official works grey photo of No.17 and Bill Ibbott's drawing both duly depicted the frames to be continuous behind the rear bogie wheels!

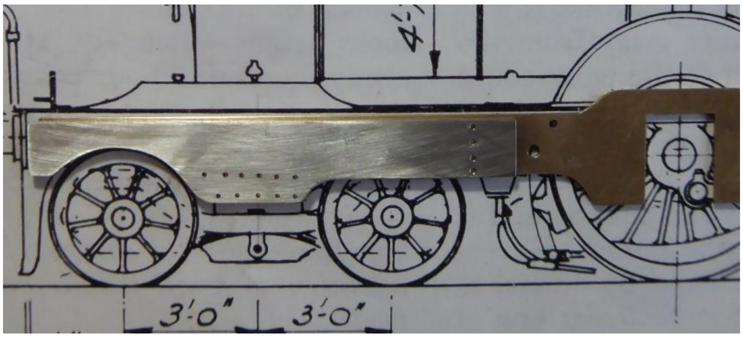
Comparison of the milled frames with the Ibbott drawing of the original design and the weight diagram of the H boiler rebuild illustrates the rear frame extension required, above left, which would use a simple splice joint. I did consider a fresh start with new frames, but decided to stick with a 'retro-fit', which may also be of more value to readers for similar conversion projects?




The model of No.16 has a coupled wheelbase 1mm shorter than No.77, but otherwise the CSB layout was identical, again using the B row of holes in the fulcrum jig, and the central one of the three holes in the bearing tags. I marked out, drilled and fettled the CSB holes immediately, left. On the right a frame has been attached to a sheet of 7thou nickel silver for the front frame overlay….. I then had to remove it (twit!), and replace the frame with a copy of the front profile drawing, before scoring through the drawing to transfer it onto the metal for cutting out.

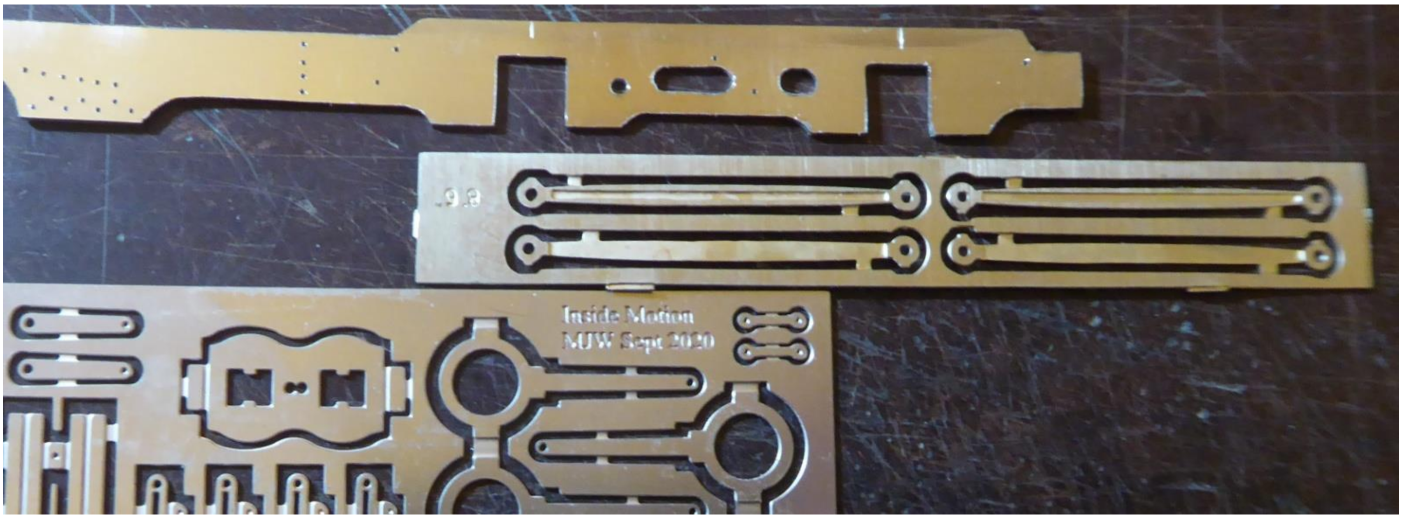
On the left are the rear frame extensions, from front and rear, showing the generous nickel silver splice plate, which I used to deter any tendency for the extension to un-solder during subsequent fitting of hornguides and spacers. The CSB fulcrum hole has been re-drilled using the already established hole in the original frame. On the right, this hole has been drilled wider, within the NS splice only, so that the handrail knob fulcrum seats correctly on the brass frame itself.



Here is the front frame overlay, with a scaled photo extract, aligned in the pre-drilled row of bogie platform rivet holes, to get the inclined cylinder block rivet holes aligned for marking and drilling. Yes, I did stop and reverse the frame's orientation before starting to drill! On the right, the finished frame overlay with rivet holes, and a vertical row for *bolts* at the frame joint, further right. Later, a second overlay will be added to represent the frame 'step' here, as already described for No.77.

To finish this section, an image demonstrating the revised front frame profile for No.16, and a comparison of the frames for Nos. 16 and 77. No.16's overlays also correct a slight error in the front bogie wheel arch outline, as seen in the view from the rear.

CSB Fulcrum fitting, Coupling Rod preparation



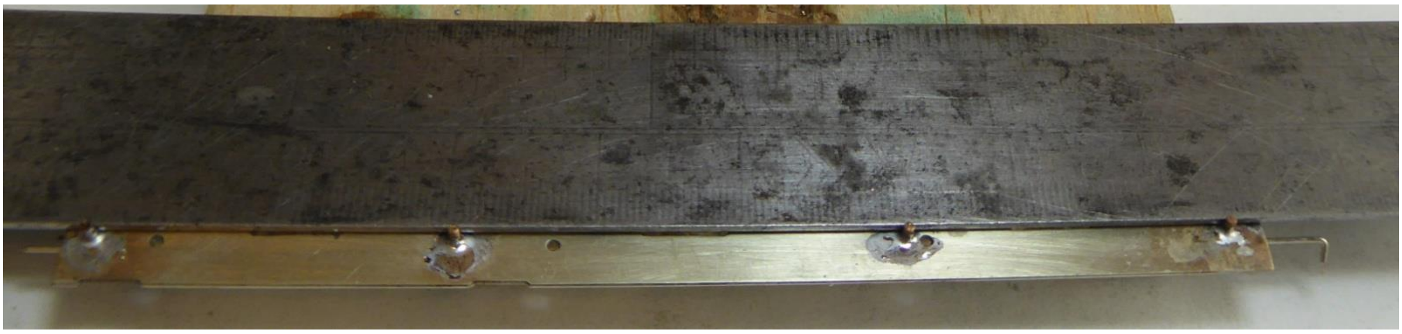
With the pairs of frames completed, attention turned to the coupling rods and frame spacers. Suitable coupling rod etches for both engines were available from Alan Gibson Model Railway Products; above are seen the fluted version for No.77; No.16 carried flush rods. I was fortunate in learning of Mike Waldron's recent etched nickel silver 'generic' inside motion frets and obtained a pair of these. Intended for LBSCR locos, my impression was that these are highly convertible, and certainly for my builds. Of immediate interest are the slide bars and that motion plate; an enormous amount of scratch-build, twice, saved!

However, the immediate next step was to fit the short brass handrail knobs which serve as CSB fulcra; I am fairly certain my stock was Alan Gibson short knobs, but cannot now be certain. Other types are available, notably from Dave Franks at Lanarkshire Models and Supplies, who markets an adjustable-depth version.

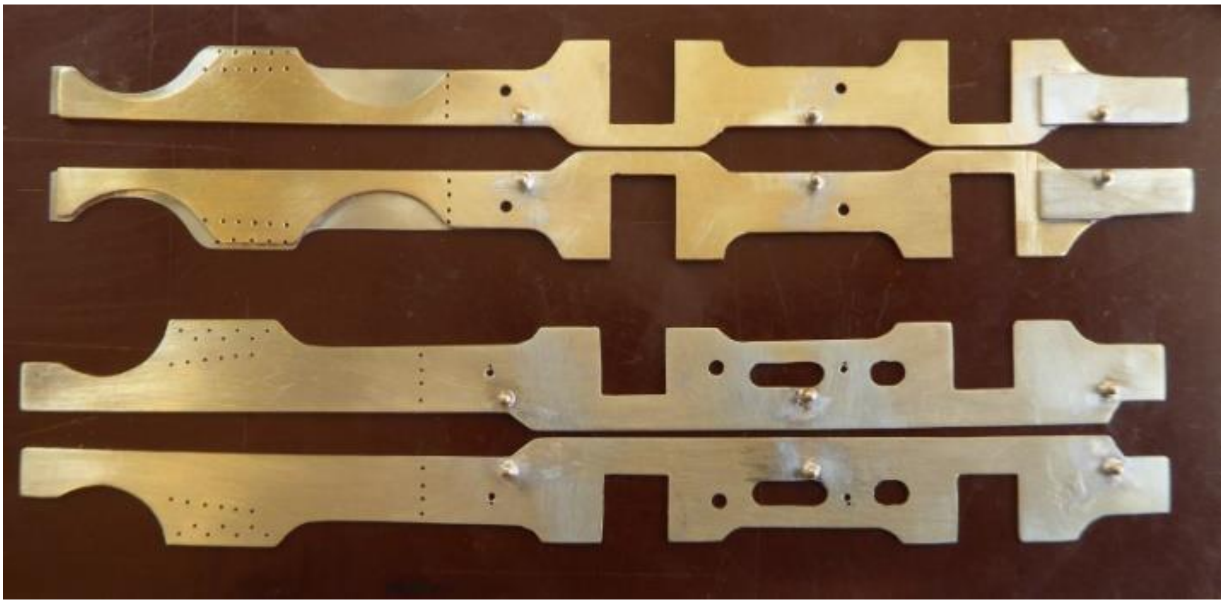
The 0.4mm CSB fulcrum pilot holes now need opening out to take the shank of the handrail knobs. I aim for a close fit, to prevent mis-alignment, so I measured the shanks of each batch before re-drilling and then opening up the holes with a fine broach.

My procedure is to fit the *outermost* fulcrum knobs first, to act as a datum pair, establishing a line upon which the inner pair *must* be centred. The resultant straight line may not be exactly horizontal; errors can be adjusted with packing shim strips under the bodywork – but the line of knobs must be as straight as possible to avoid uneven springing of the suspended axles.

Using a tender chassis to demonstrate, above, hence with four knobs/three axles, the outer knobs have been soldered in place and two steel rules are used to check the alignment of the inner knobs. Once the inner knobs are aligned so that neither steel rule 'rocks' against them, I know the alignment is acceptable. If not, the offending holes are 'eased' appropriately using a broach. Before tacking, I also check the rear face, to see that the knob shanks are projecting vertically, and not at an angle.



Having tacked all the knobs, I finally check the rear (which will actually be the outer) face for alignment/verticality, before running a full solder joint.



Here are the two sets of frames with their complements of CSB fulcrum knobs, after trimming of the excess shanks and fettling of the soldering.

These are the different frames, No.16 above 77, with their matching rod pairs. The rod laminates have been soldered together with 222deg solder and fully fettled. Other rods may have separate boss layers, but these use just two half-etch components, nice and simple.

It is vital to open the rod coupling rod holes out for the crankpins in such a way that they remain *identical* pairs – it is rather too easy with a drill or broach to 'dig' into one side of a smaller hole, and enlarge it slightly off-centre. With four holes to enlarge, the potential for a significant cumulative error between pairs of rods becomes worthy of avoidance. So I create a 'Master Coupling Rod' for each pair, which will be used to set the chassis assembly jig for each chassis, shortly. This is the upper rod in each pair, above.

Both holes in this Master Rod are gently broached up to be a sliding fit, *specifically* on the top-hat bearings permanently carried on the ends of the chassis jig axles. The other rod only has one hole opened up at this stage – so there is no chance of using it by mistake on the jig (lower rod, above). Thus the jig axle spacing will be set and subsequently re-defined in use by a *single* rod, with no chance of mixing the two rods and introducing inconsistency. I learnt this by experience over a decade of chassis builds which seemed to go awry, until I realised why …. Only after the chassis is assembled does the second rod have its second hole opened up, carefully, while the other end of both rods share a common long crankpin bush. The smaller hole is then carefully broached up against the Master Rod's hole to match.

To aid smooth running, all crankpin holes are lightly countersunk at their faces after any drilling/broaching operations, and the bores/rubbing faces are polished with a dilute Brasso/oil mixture on cocktail sticks/cotton buds/lap pads.

Fitting the bearing hornguides using the Avonside 'Chassis Squared Pro' jig.

No.77

There are other chassis jigs and aids on the market, of which I have no experience, but I reckon my basic version of the Avonside 'Chassis Squared Pro' jig, from Eileen's Emporium, has been key to easing my chassis building over the last decade or so.

The principal of the jig is to lock two moveable 1/8th inch axles at the coupling rod spacing, and hold them there while the frames are erected around them. As supplied, the jig offers shorter axles which are intended to hold the frames while the bearing hornguides are soldered in place, thus producing two accurately mirrored frame sides. After attaching alternate spacers to these frames, the jig is then re-configured with two longer axles, enabling the pair of frames plus spacers to be accommodated for tack soldering, checking, and final soldering up.

I have modified that procedure, in that I now prefer to install the longer axles straight away, bypassing the short ones and the resultant axle change-over operation. However, in the early stage I now need to raise the frames up closer to the tops of the axles, so that the Master Rod's axle spacing still transfers on to frames which lie closely adjacent. By using thick machined Tufnol blocks, as seen above, this is achieved, and by substituting thinner Tufnol I can subsequently accommodate the full chassis assembly, all without needing to touch the set axle spacing.

I fit the first hornguide into its frame slot away from the jig, which allows me to turn the frame over to check that a) the hornguide is central and b) it is vertical within the slot. With some older, pre CAD, kits in the past, I have found that the coupling rod and frame cut-out spacings do not match exactly, and so a decision has to be made as to where the initial axle centre should be placed? This will obviously vary from engine to engine.

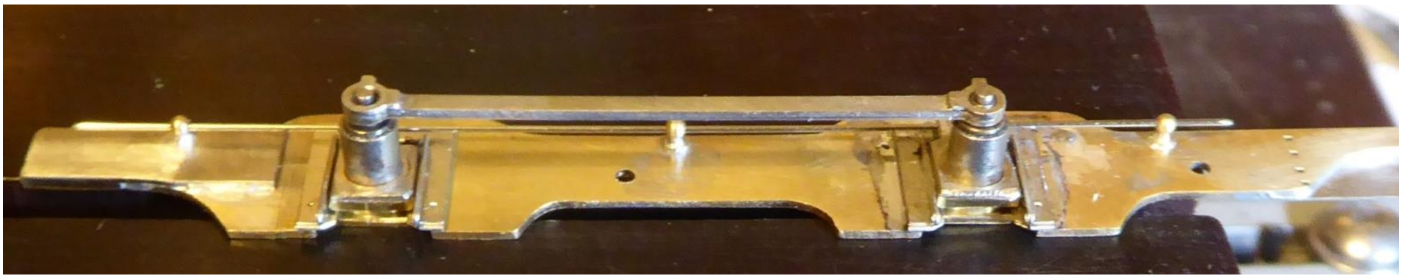
Here, above left, a leading hornguide is being centrally located in its frame slot using Dinky grips, then checked to be vertical, before tacking, re-checking and running the seams. The leading hornguide on the other frame was then similarly centralised, with both frames adjacent and linked by an axle through both leading bearings; thus the frames shared a common leading axle datum.

Unfortunately, I failed to record the next stage for No.77, so No.16's frame is deputising, left. Here, the leading, right-hand, hornguide has been soldered in place, the second one with bearing has been installed in its slot and the Master Rod replaced on the jig axle ends. Next, the rear hornguide having been aligned correctly, and while being pressed down against the frame, its top right corner has been tacked in place. The frame will now be removed and the rear hornguide's alignment re-checked. It will then be replaced on the jig, alignment tweaked if necessary, and eventually the solder seams will be completed.

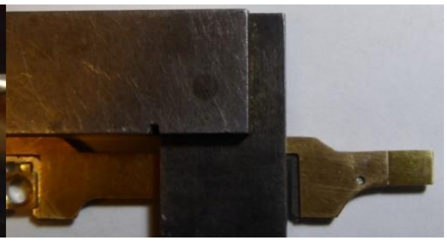
On the right, here is No.77's frame pair after full installation of hornguides and bearings, fettled and ready for the fitting of spacers.

No.16

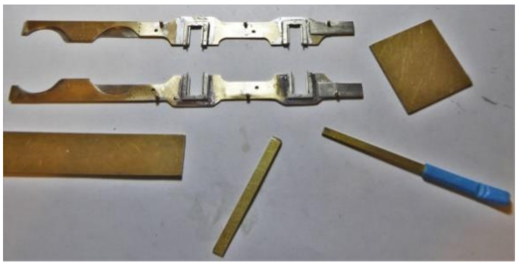
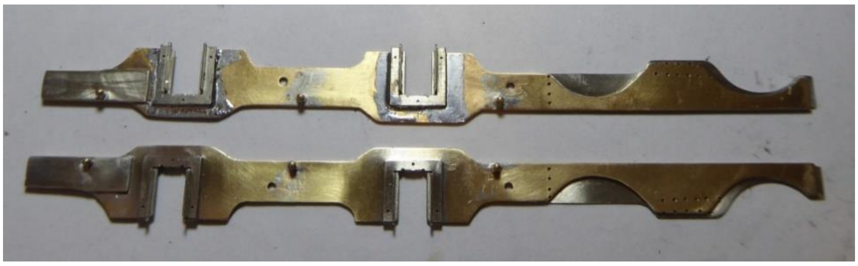
The frames for No.16 followed the same basic procedure, although the presence of the front frame overlays meant that these needed to be kept clear of the chassis jig, or else they would have created potentially critical distortion. Here, the leading hornguide has been positioned centrally in its frame cut-out prior to using the chassis jig and 'Master' coupling rod to set the rear hornguide.



Here is the other frame with its leading hornguide similarly centralised, now placed on the Tufnol block atop the chassis jig, with the front overlay section projecting well clear. The Master coupling rod is in place to ensure its spacing is transferred to the second, rear, hornguide via the left-hand jig axle. The rear hornguide looks reasonably vertical and central in its frame cut-out, but will be checked before one corner is tack soldered……. *(But note that the coupling rod is not fully seated down on the rear axle's top-hat bush; check why and correct, before proceeding!)*

…and here it is, tacked at the top right corner. The frame is then removed from the jig and an engineer's square used to check for verticality, which in this case appears fine, right. The rear hornguide's seams can now be run fully, after removing the CSB wires and bearings. I ensure the frame is lying fully flat on Tufnol, and press the hornguide down firmly, *vertically*, on each side of the horns while running these seams.

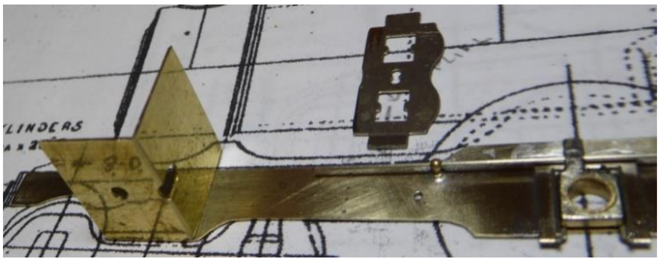



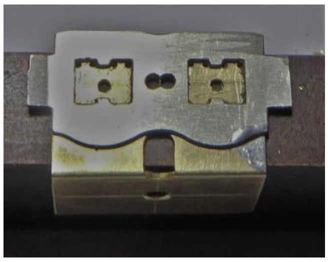
Having used a restrained amount of solder, I still find I use a variety of solder scrapers to clean up afterwards; here are a couple of brass 'chisels' and sheet brass offcuts, which remove the thicker blebs, before finishing with Garriflex abrasive block and glass fibre pencil. 'Before' and 'after' frames on the right.

Spacer selection and fitting, including Motion Plate

My principal here is to use four spacers, which allows two per frame and tends to even up the alternate heating cycles of a frame assembly and reduce the risk of producing a ‘banana’. Neatly, it also corresponds to front and rear spacers incorporating body fixing screws/lugs, with a motion plate and an ashpan spacer; the motor and gearbox fitting behind and above the latter pair, respectively.

No.77

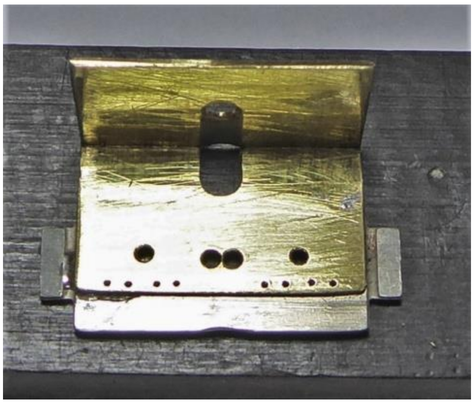
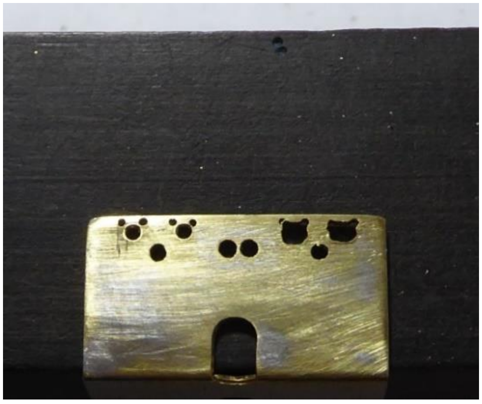




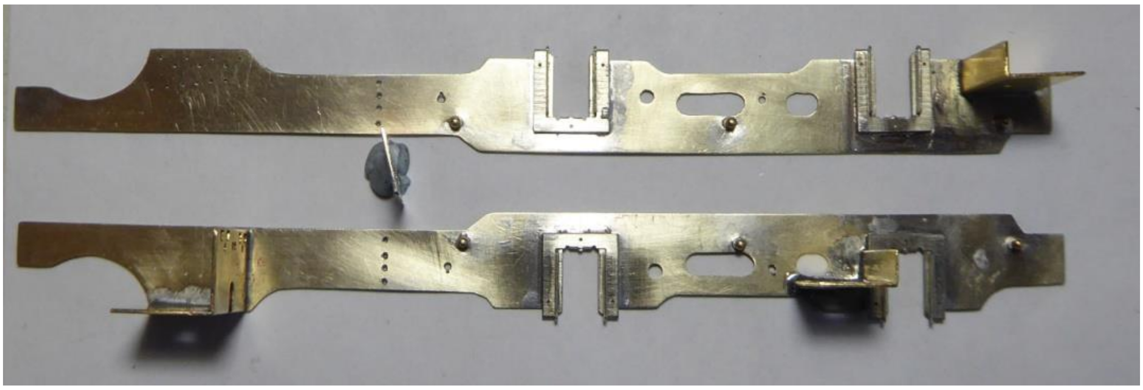
With a bogie engine, the obvious place for the leading spacer is at the bogie pivot location, which will hopefully coincide with the rear of the cylinder block under the smokebox, thus killing two birds with one stone if an ‘L’ shaped spacer is employed - see left image. The motion plate from Mike Waldron’s generic etch is also shown, central above its location, having been re-profiled at the top edge for No.77. Its fixing tabs have yet to be removed.

I had a suitable L-shaped thick brass P4 spacer in the stock box, which had a central hole for a bogie pivot pin and could be trimmed down in height. Having done this, I spent some time transferring the dimensions of the motion plate onto the rear face of this spacer, having allowed for cylinder inclination. This would let me copy key locating slots as apertures in the front spacer, which would later provide positive locations for the front ends of the slidebars, piston rods and valve rods of the dummy inside motion.

The centre image, above, shows the motion plate tacked to the reduced front spacer; the right hand view shows the piston rod and valve rod holes drilled, also pairs of holes in the corners of the upper slide bar rebates. I did not bother with the lower slide bar locations; if eventually I do decide to fit these, hidden mostly from sight, I can fix them to the dummy crosshead and the motion plate.

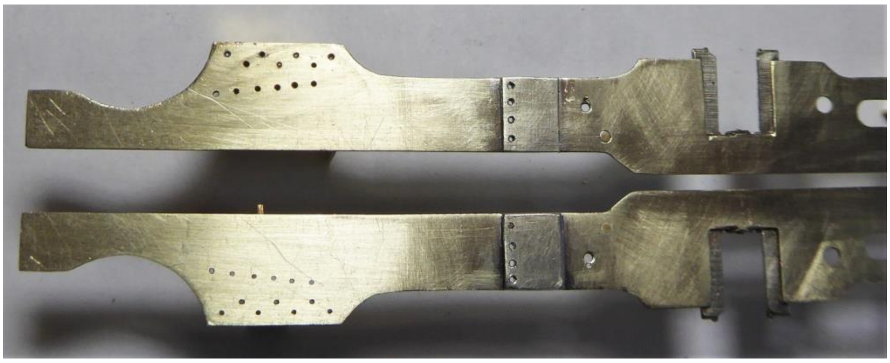

This sequence demonstrates the opening-out of the initial pilot holes for the upper slide bars, by a combination of drilling further holes and using a triangular file to create rectangular slots. The motion plate was then de-soldered and the components fettled clean.

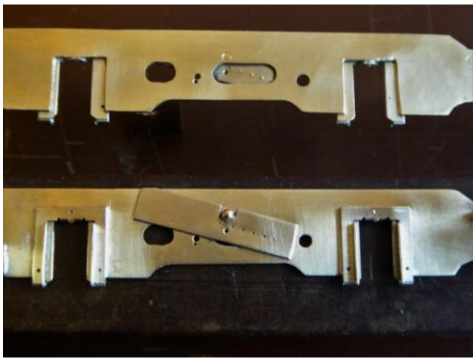


The remaining two spacers, ashpan and rear, utilised standard Scalefour Society etched P4 fold-up ‘L’ spacers, which could be easily arranged to avoid the CSB wire run and thus avoid having to create clearance slots – all useful time-savings! The ‘00’ spacer, seen on left, was selected as it was narrow enough to fit between the CSB wires and - minus one ‘arm’ – create an ‘L’ bracket to attach to the rear frame spacer, when fitting a rear bearing bracket to constrain the drive train.

The arrangement of the four chosen spacers is shown above, right, after soldering three in place. The two rear ones are clear of the CSB wire run. The motion plate eventually will be angled relative to the *inverted* upper frame, but not by such a great angle as seen here. I decided to omit it at the assembly stage, and later use the lowest bolt-hole just ahead of its location to thread a NS wire across as a ‘register’ to help locate it square/angled, once the other three spacers had been soldered in place.

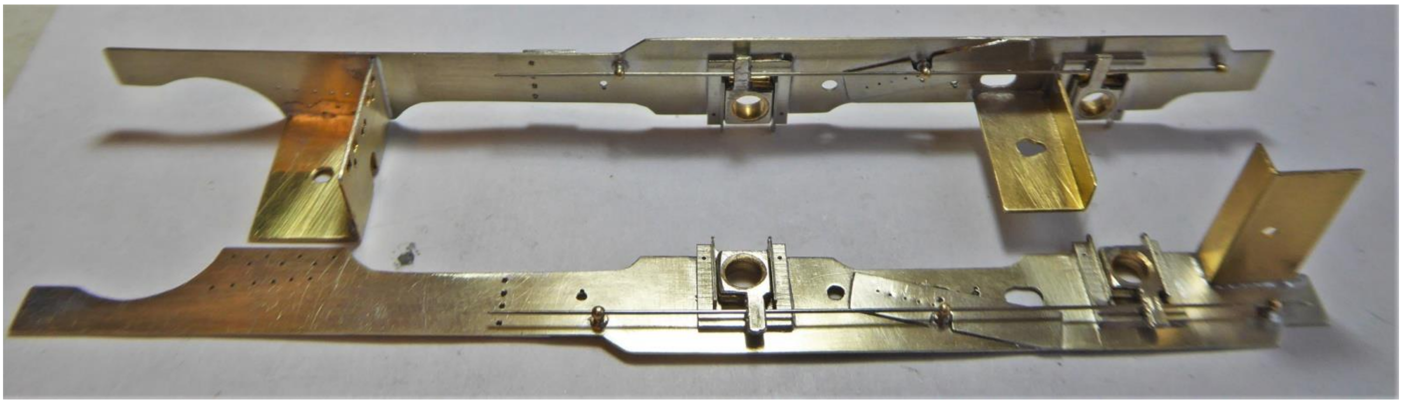
Note, the relatively large gap between the ‘ashpan spacer’ and the motion plate will eventually be occupied by the ashpan itself, fitted between the frames and below them, adding further rigidity to this part of the frames.





Two cosmetic details are shown here; the step in No.77’s frame plates (left) and a representation of the lower firebox edge, as seen through the frame openings (right). The former is a prominent visual feature of Nos.16 and 77, along with the rows of rivets delineating the bogie rubbing plate and the bottom of the inclined cylinder block. My interpretation of this feature involves some ‘visual trickery’, since I did not want the added complexity of genuinely spliced frames. Hence I have only represented the step that is visible ahead of the leading sandbox. When the latter feature is fitted, it will hide the fact that the rearward extension of this frame plate actually ‘steps in’ again on my model; this *false* step will be hidden by the sandbox, and the fact that the leading brake hanger (note the hole for this) sits hard up against the sandbox, while further back, the leading driving wheels mask the frames having been ‘set back’.

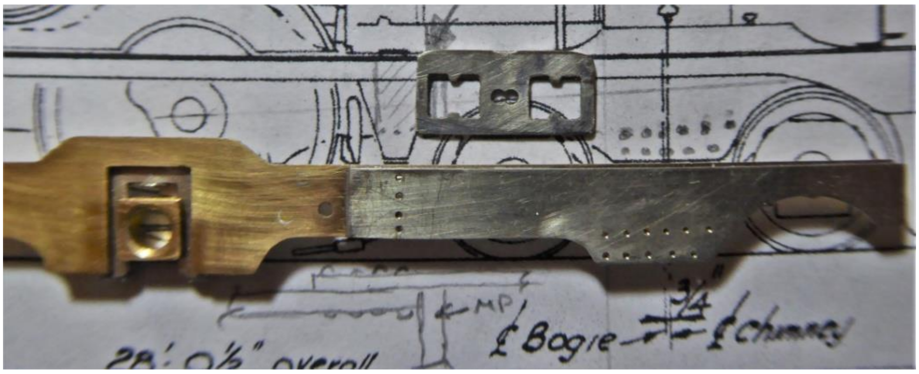
The lower firebox detail needed adding before assembling the frames, in the interests of it needing to fit neatly around a CSB fulcrum above it, and to get it angled correctly. A row of firebox stays and an inspection plug were represented on thin NS sheet, before carefully positioning and soldering in place. The ashpan will eventually be added, sitting within the firebox overlays, thus giving a prototypical gap between the frames and the ashpan itself.



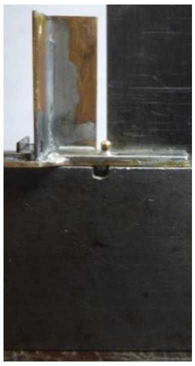
Here is a final look at the two prepared frames for No.77, ready to be aligned on the chassis jig for initial tack-soldering together for alignment checking, before final seam completion.

No.16

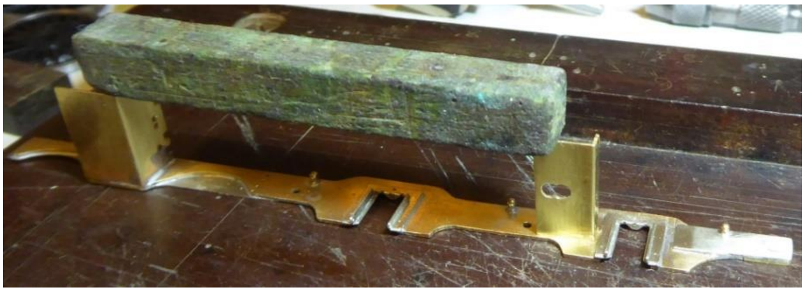
Apart from its frames being comprised of brass and of a thicker gauge than No.77's nickel silver examples, the major difference lay in their shallower depth. The 1891 engines' frames, unlike the 1908 pair, did not project above the running plate, which was also set at just under 3inches (=1mm) below that of No.77. This feature posed some additional problems in terms of spacers, as described below:

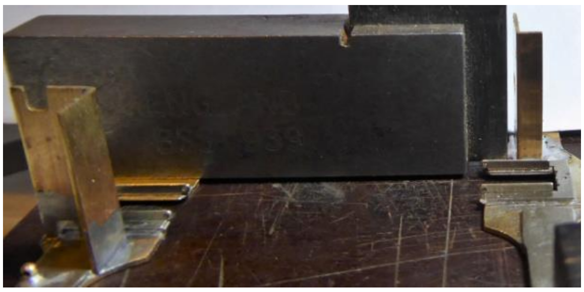


Notably, the etched motion plate from Mike Waldron (left) needed material removed from the base for No.16, although it stood higher in the frames and indeed projected above them (in No.77 the top of the motion plate lay well below the top of its, deeper, frames). This projection is demonstrated in the amended drawing of the original 1891 engines, above right.



As with No.77, I used a brass 'L' spacer above the bogie, similarly modified by the insertion of slots and holes for key elements of the motion. The rear frame splice dictated an upward 'L' spacer this time, which needed slots to clear the CSB wires - centre. Two ashpan spacers are shown, as I had not yet decided which to use - I chose the shallower one, being so close to the tall rear one. As before, the motion plate would be fitted after frame assembly. Right – checking the spacer sits square on the frame.





Having attached the leading spacer 'all square', here it is, assisting in setting the ashpan spacer for tacking in place. Note that frame spacers should *not* be fitted hard up against a hornguide; that is not a good idea, since latitude must be allowed for bearing holes not being *exactly* central in their matched hornguides. The chassis jig ensures that *axles* are aligned correctly, even if *hornguides* may deviate slightly from 'mirror positions'. Offsetting the spacers and hornguides allows this process to occur without skewing the frames.

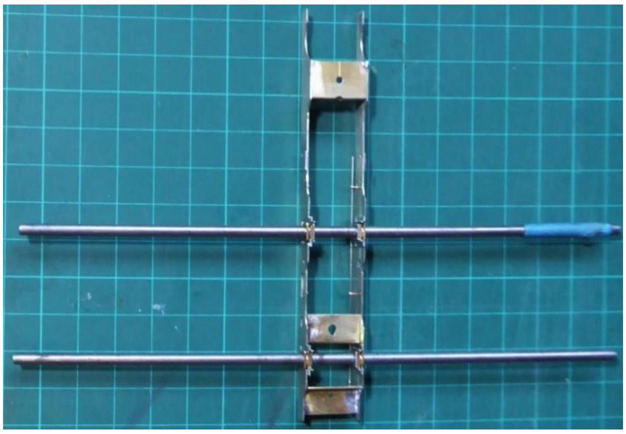
On the right, an engineer's square is being used to check that the ashpan spacer of the opposite frame is sitting square.

Chassis assembly

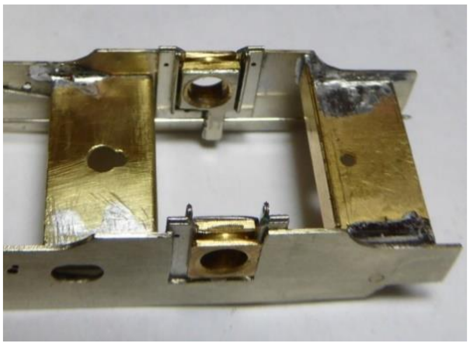
No.77

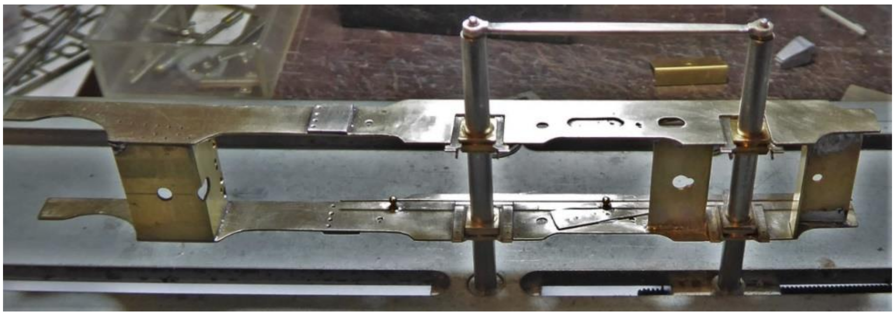
Now we are ready to assemble the pairs of frames together. Their bearings have been set at the correct spacing on the jig, defined by the Master coupling rod for each engine. As explained earlier, my preference has been to use the longer set of jig axles from the start, which we can then leave in place, rather than swapping between short axles (for setting individual frames) and longer axles for frame assembly. We now simply set aside the thicker Tufnol blocks and substitute shallower blocks, which allow both frame elements to fit onto the jig axles, while keeping the whole unit close to the 'datum' defined by the Master coupling rod at the top of the axles.

The left-hand view is purely to demonstrate that the jig axles are undisturbed, and at the spacing defined by that coupling rod, while the shallower Tufnol blocks now allow the spaced frames to fit in below, but close to, that 'datum' axle spacing. The right hand view shows the pre-assembly set-up, with the Master coupling rod in place to re-define the jig axle spacing during soldering-up. You will note that there are *two* Tufnol blocks to the rear, with a gap between. This way, the lower frame is fully supported *except* where the frame 'step' overlay would foul a continuous lower block – note the corresponding 'step' on the upper frame.

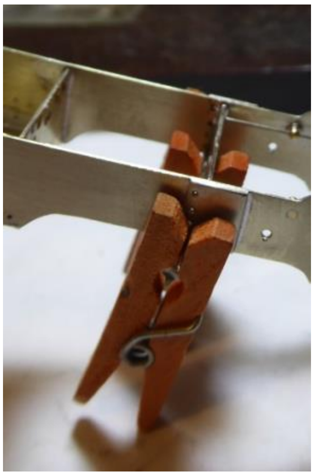
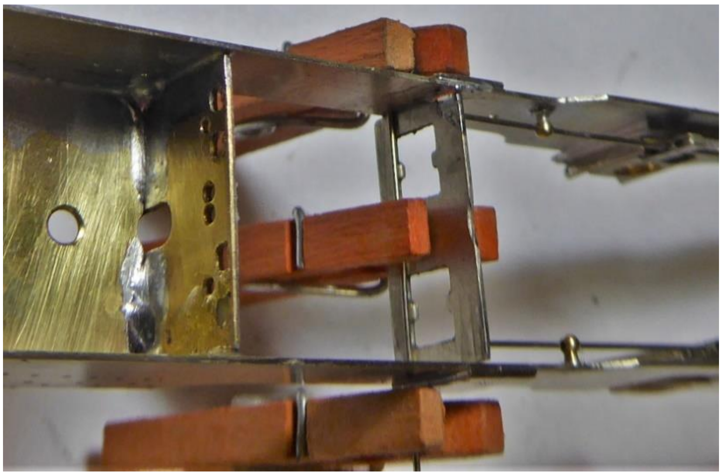
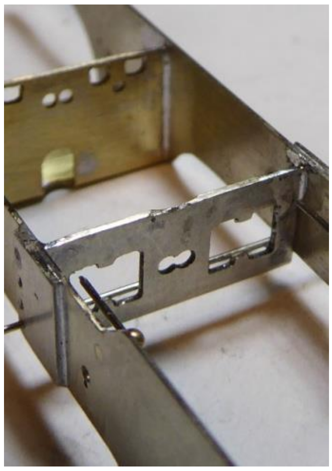


Finally, another Tufnol block is used to align the frame top edges, to complete the set-up operation. Having checked all was square and aligned, front and rear, I initially tacked a top corner of the front spacer, and a lower corner of the rear spacer, ignoring the ashpan spacer. Carefully sliding this assembled frame off the jig, it was then placed on a cutting mat grid; I was happy with the alignment of frames and steel axle rod; my compact camera lens has distorted the rods and the grid.





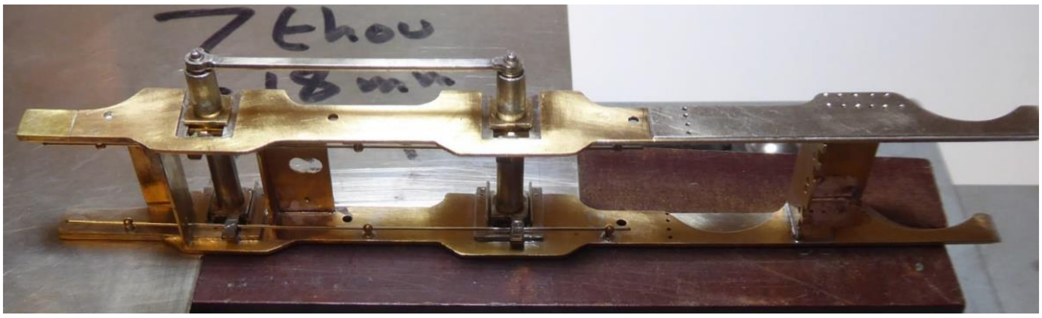
After replacing the tacked chassis on the jig, I ran the full rear spacer seam and tacked the ashpan spacer, above left, adding a further tack inside the front spacer. With this additional stiffening, I tried removing the supporting blocks, and was very pleased to see that the assembled chassis slid freely towards the base of the jig axles. By now, the lower frame and its bearings were two-frame widths away from the reference datum defined by the Master rod, so a ‘snag’ was not unreasonable between dry axle and bearing. All remaining spacer seams were now fully soldered 145deg, alternately working at front, rear and ashpan.

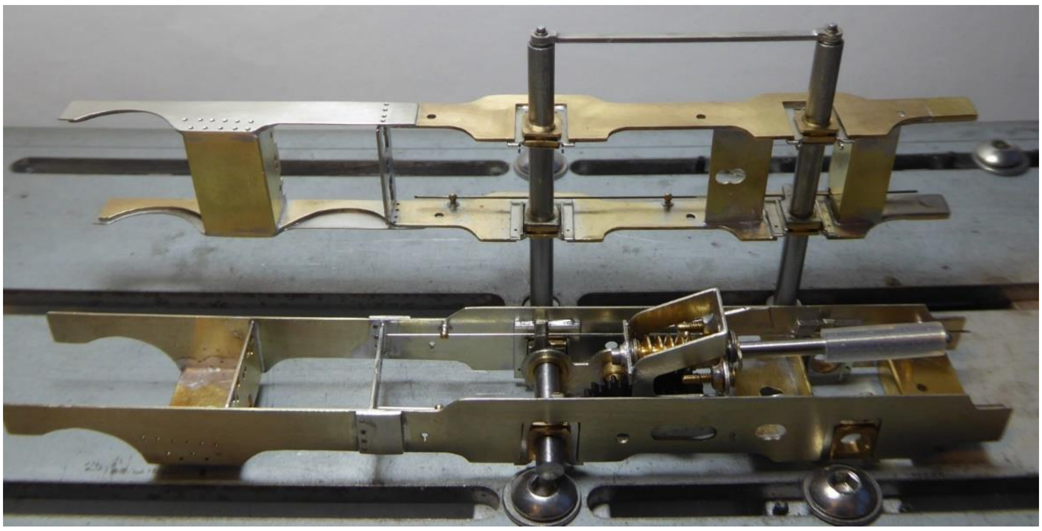
The remaining spacer, the motion plate, could now be fitted, after aligning it and angling it slightly back at the top edge to reflect the cylinder inclination. Mini-pegs were invaluable to hold this in place while it was tacked, checked for inclination and finally soldered in place.

No.16

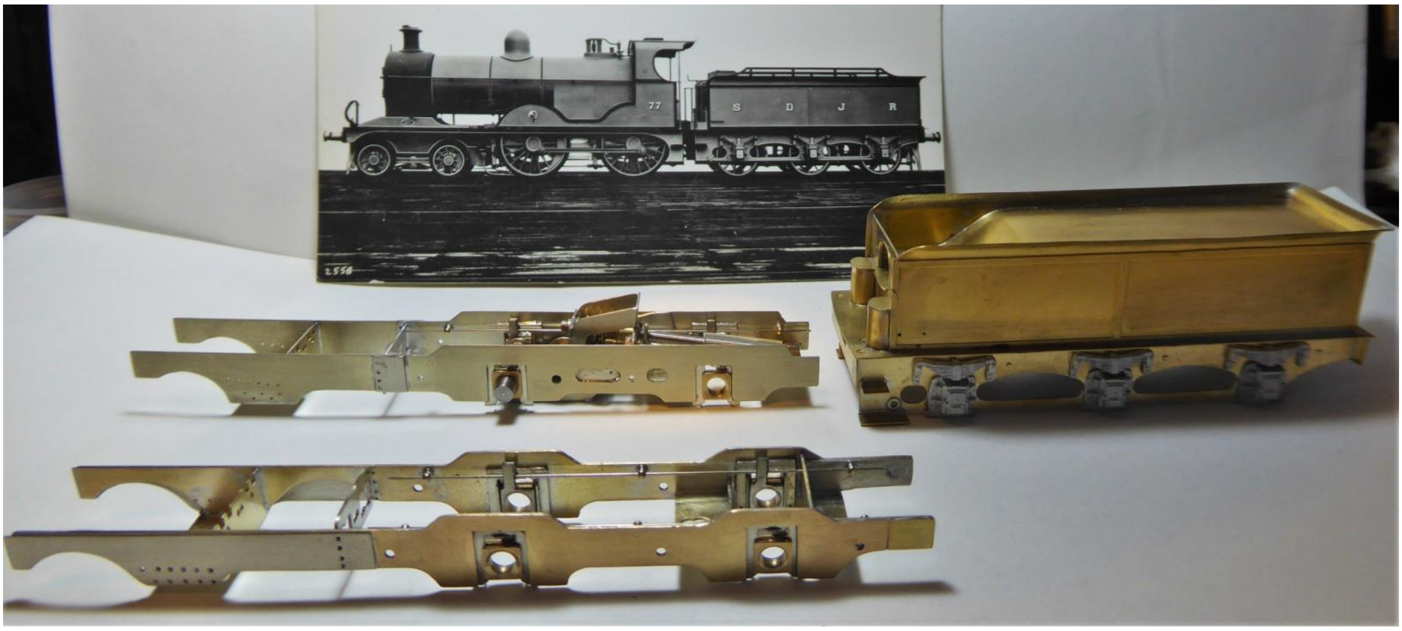
A similar assembly procedure was followed for No.16, initially tacking the front and rear spacers and checking for squareness before running those seams and tackling the intermediate spacers once the chassis had cooled fully. Because of the front frame overlays, it was necessary to insert a sheet of the 7thou nickel silver used to make the overlays, to support the rear end of the lower frame to keep it level over its whole length.



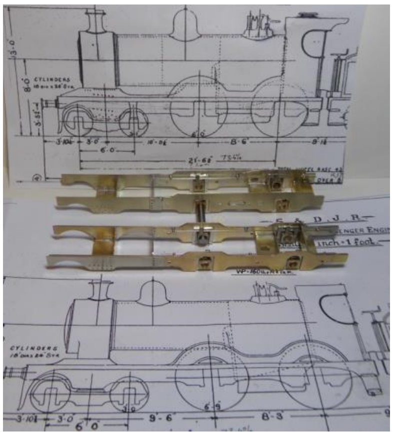
When initially tacked together on the chassis jig, this assembled frame again slid on the jig axles, but not as freely as No.77, see below, so I had to tweak the set-up and spacer tack joints to get a freer movement. The motion plate is here seen posed, below, awaiting final fixing.



The basic loco chassis pair completed; a review of the 'state of play'.



Here are the two completed sets of frames for comparison, with the drive train for No.77 and its tender body assembled earlier from the George Norton kit. It's all beginning to come together at last…….



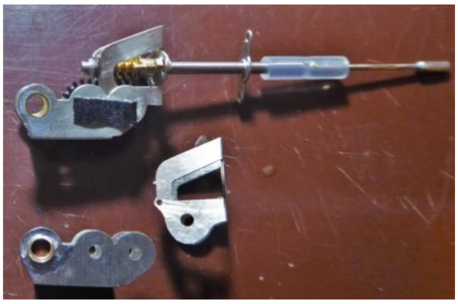
With their frames aligned on the leading driving wheel axle, it is evident how closely related these two classes were, even though twenty years apart in their origins. The 1908 engines were basically of similar dimensions apart from a considerably bigger boiler, whose size could still be fitted to the 1891 engine's frames, with a simple rearwards extension to carry a larger cab than before. A more subtle difference concerns the motion plates; fitted *ahead* of the leading frame splice bolt row on the 1891 engines - but *behind* it on the 1908 version, ie. within the same frames unit as the driven axle.

Having completed the frames, the gearbox and drive trains were tackled next.

Drive train - locomotive

This self-contained element receives the rotation from the motor shaft in the tender, via a cardan shaft with two flexible joints, and carries it forwards via the worm and reduction gear, thence through an idler to the driven, forward, axle. The rear end of the worm-shaft is provided with torque restraint by a brass bearing with sufficient clearance for limited radial movement, mounted in a removable bracket.

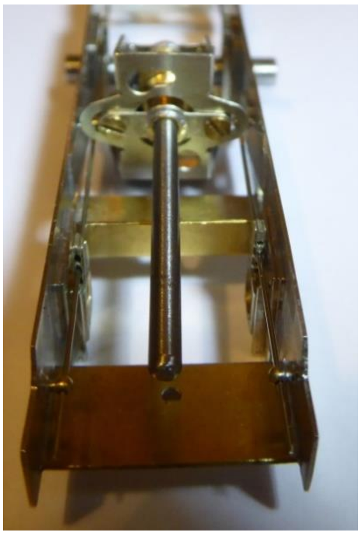
No.77



On the left, a part-assembled drive train using High Level Kits' components; a D2 Drivestretcher articulated to a Compact+ ('Compact Plus') reduction gearbox. Separated components are in the foreground. The gearbox carries front and rear bracket options with brass bearings, for remote-motor operation. A further bracketed bearing ahead of the first flexible joint will be fixed to a rear spacer bracket under the loco cab. The cardan shaft linking loco and tender features 1mm NS wire with 2mm end bosses of brass tubing.

On the right, the articulated gearbox is adjusted to sit low, hidden in the loco ashpan, and is then soldered rigid. Here, a section of styrene sheet has been slid between frame and CSB wire, angled to match the ashpan depicted in the drawing beneath. Note that the driven axle will sit ca 0.5mm higher in the frames, when the loco is weighted and stood on the track, and that the driving wheel and its dummy springs will help to obscure the forward part of the Drivestretcher.

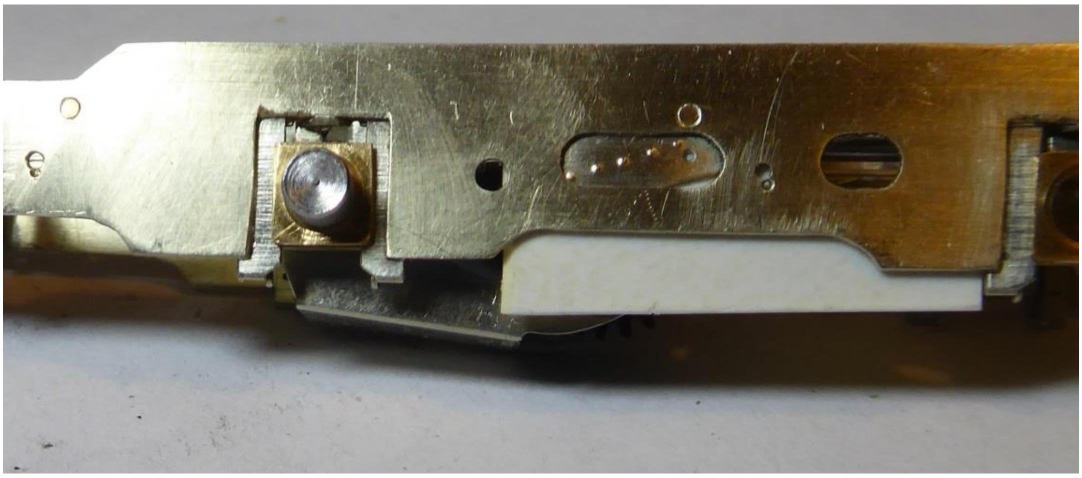
That gearbox projection above the frames will be removed after adding a bracing strip, to further increase space for lead in the firebox above; see below:-



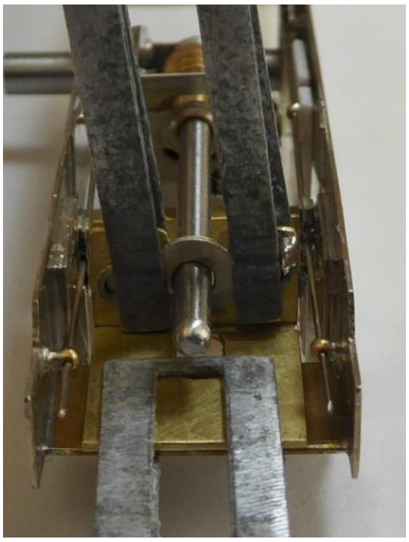
On the left, the drive train can be seen to fit well within the spacing of the CSB suspension wires, apart from the two 'ears' of the Compact+, which carried the holes for direct motor attachment. Now that the 12BA nuts for the screw-on remote-motor bracket have been fitted at the back of these 'ears', the excess width can be cut away; the replacement bracket fits well within the CSB wires.

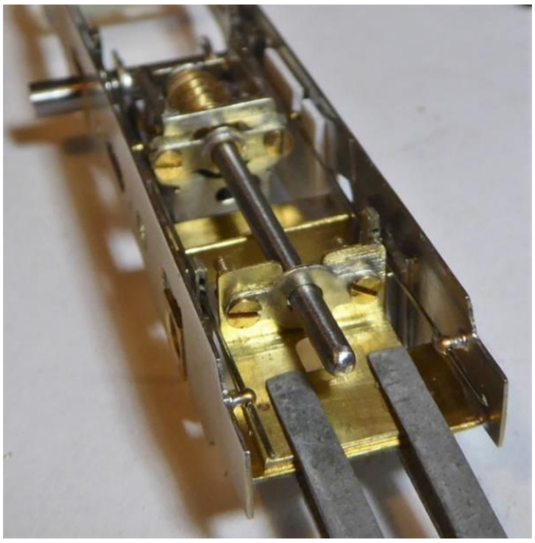
The centre images show the creation of a strengthening brace around the Compact+, clear of the new bracket. This allows the redundant uppermost section of the Compact+ to be cut away. Note here how the over-wide 'ears' have already been truncated. *(NB: For No.16, I simplified this stage by bending up a single-piece brace, rather than three separate bits needing trimming. Still learning on the job…)*

On the right is a view from the front of the assembled Compact+/Drivestretcher 2 unit. The driven axle and final gear have been omitted at the front, and the reduction gear at the rear, to demonstrate how the offset idler gear on the centre axle comes close to fouling the front worm-shaft bracket, when the articulation is set so as to put the gearbox low in the ashpan. The fouling risk can be reduced by grinding away the outer part of the bracket to increase the clearance here, if necessary.



The left image shows how the ‘visibility’ of the completed gearbox assembly can be slightly reduced; I have scored a line showing how much of the rear of the Drivestretcher *base* can be cut away – compare with the image on right, to see where this will be a benefit. Note though, that this image shows a still-untrimmed Drivestretcher. Once assembled to the Compact+, the Drivestretcher will not ‘miss’ the removed material.





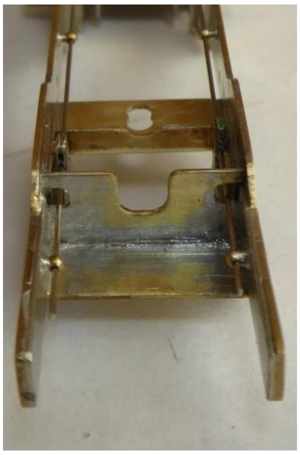
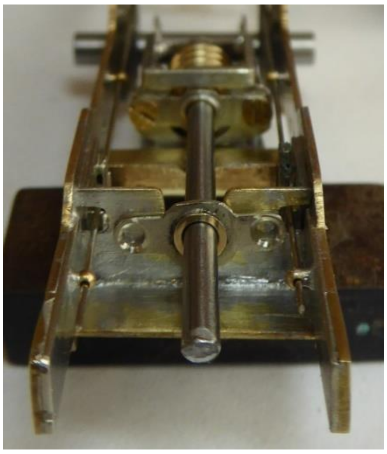
Finally, this sequence demonstrates the fitting of the rear bracket which carries the removable torque reaction bearing. The actual brass 2mm bearing has not yet been fitted to the bracket, which was a spare item from an earlier High Level (HL) gearbox that had been fitted to a motor. *(But see No.16 arrangement, below, which has the brass bearing fitted.)*

Coveniently, an ‘00’ brass fold-up spacer fitted neatly between the CSB wires. A slot was ground in the up-stand section, wide enough to clear not only the 2mm wormshaft, but also the outer diameter of the brass bearing to be fitted, which would project to the rear of the removable HL bracket.

On the left, Dinky grips hold the ‘00’ spacer central on the rear frame spacer, and the HL bracket central on the up-stand section. The HL bracket’s position was adjusted while checking the ‘lie’ of the worm-shaft, to get the latter *running horizontal* when the driven axle was pushed up on its CSB suspension, to attain the approximate ‘running height’ for when the completed model was on the rails. When this height was achieved, the HL bracket was temporarily tack-soldered to the ‘00’ spacer - just visible to the right of the upper Dinky grip.

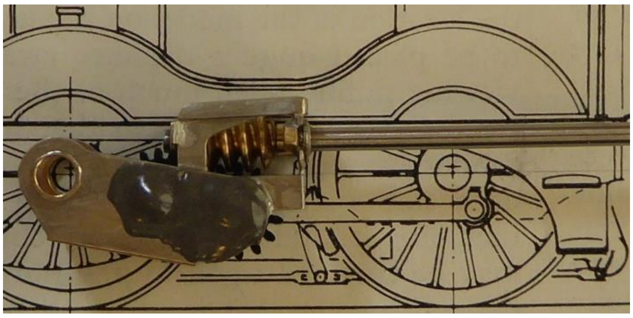
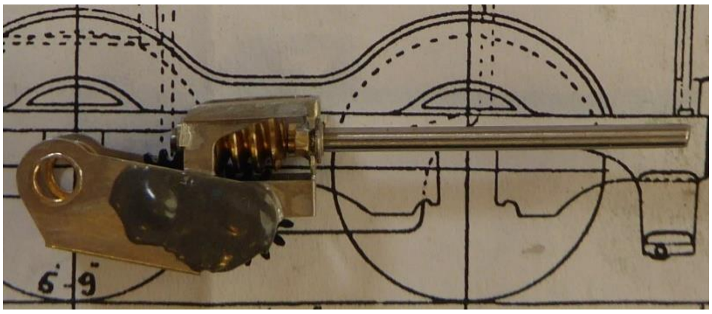
Next, the hole positions were marked through onto the ‘00’ spacer, drilled and opened to give a 12BA screw clearance; two 12BA nuts were then soldered on the forward side of the spacer. The centre image shows the screw-assembled spacer and HL bracket held in position, while the right-hand image shows the ‘00’ spacer marked and drilled for an interim central fixing hole to the rear loco spacer, until the loco is running and I can confidently solder the ‘00’ spacer to the rear stretcher. (Note how the scribed lines demonstrate how this 1970s-era etched spacer carries an off-centre elongated fixing hole, presumably the result of its artwork being hand-drawn and not CAD? *‘Caveat emptor’…*)

No.16

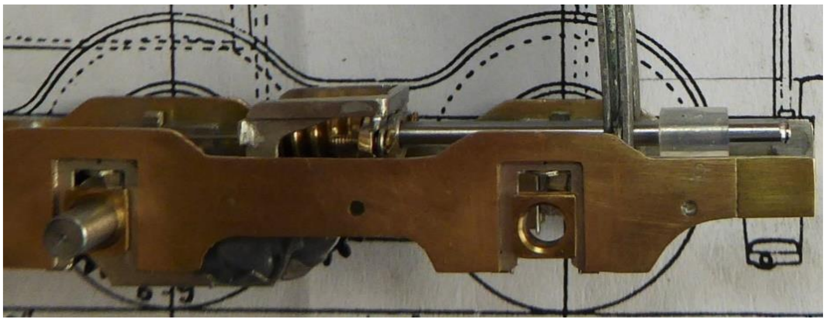
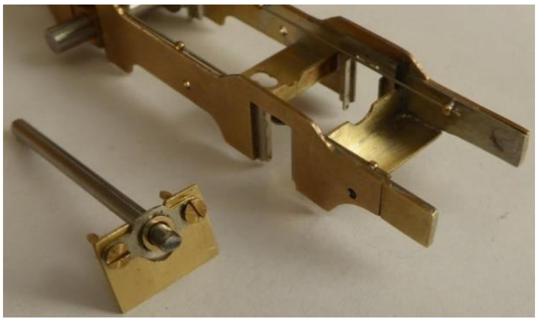
The smaller 4-4-0 uses the same principal as No.77, but varies in detail because of a different rear frame geometry, and the limitation imposed by the lower footplate of No.16 (4ft 0.5in = 16.15mm), compared to No.77 (4ft 3in = 17mm). I confess that I overlooked the latter, more critical, factor, and confidently ‘hoisted sail’ – and eventually sailed straight into trouble.

Initially however, a second Compact+/Drivestretcher 2 assembly was created, featuring the simpler single-piece brace for the truncated Compact+; see left-hand image above. Beneficially, No.16’s rear frame spacer sat further forward than that of No.77, owing to the rear frame extension of the rebuilt prototype. This feature potentially allowed me to omit the separate rear spacer addition used in No.77, and simply fix the HL bearing bracket *directly* to the rear spacer of No.16; see centre image, where I have already created a slot to accommodate the drive shaft and its bearing. On the right, I have installed the drive train to mark the correct height for the fixing holes/nuts for the removable rear bracket. So far, so good……

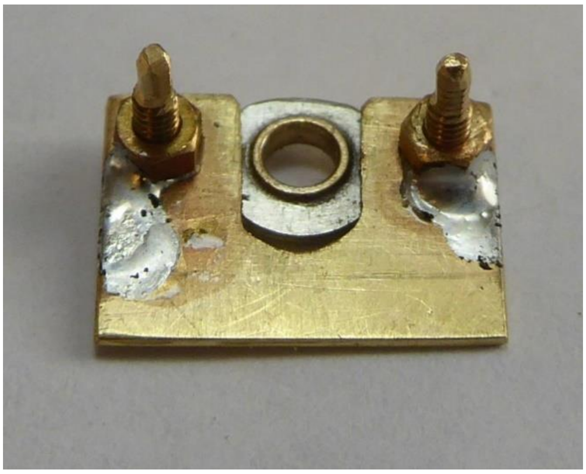
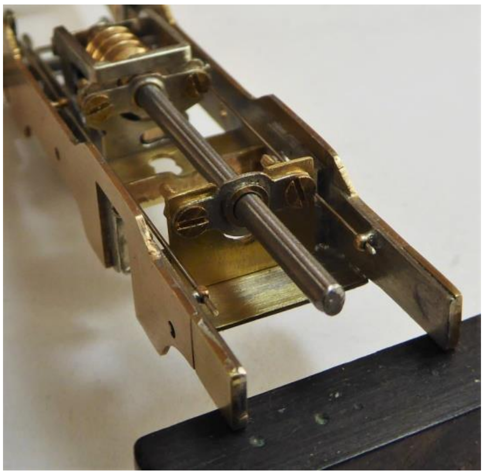
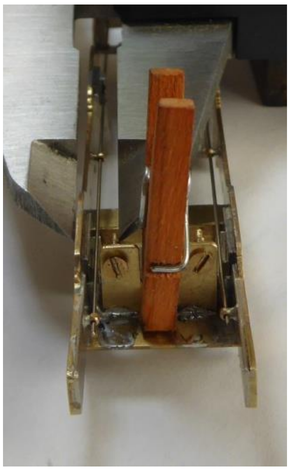
Then I hit the rocks. When I had articulated the Compact+/Drivestretcher 2 combination for No.16, I aligned it against the better-detailed Railway Modeller drawing, showing the original version of these engines, carrying the smaller, lower boiler. Hence the ‘low-slung’ drive arrangement seen in the left-hand image. *(Incidentally, that’s epoxy ‘Steel Araldite’ securing the idler axles in place; rather untidy but no chance of it invading the gearbox interior - and relatively easy to peel away if modification is needed.)*

I had automatically thought that ‘below-footplate’ geometry had stayed the same after rebuild….. However, of course, the fitting of the H boiler, at a higher centre line, included the fitting of a new ashpan, which also sat higher - as duly depicted in photographs and the weight diagram for the rebuilt version; see right-hand image above. So, that low-slung gearbox was now highly visible after all. Although annoyed with myself for such an elementary error *(‘check the photographs!’)*, I was also pleased to find confirmation that the weight diagrams did include such basic accuracy, although being rather sparse on detail.

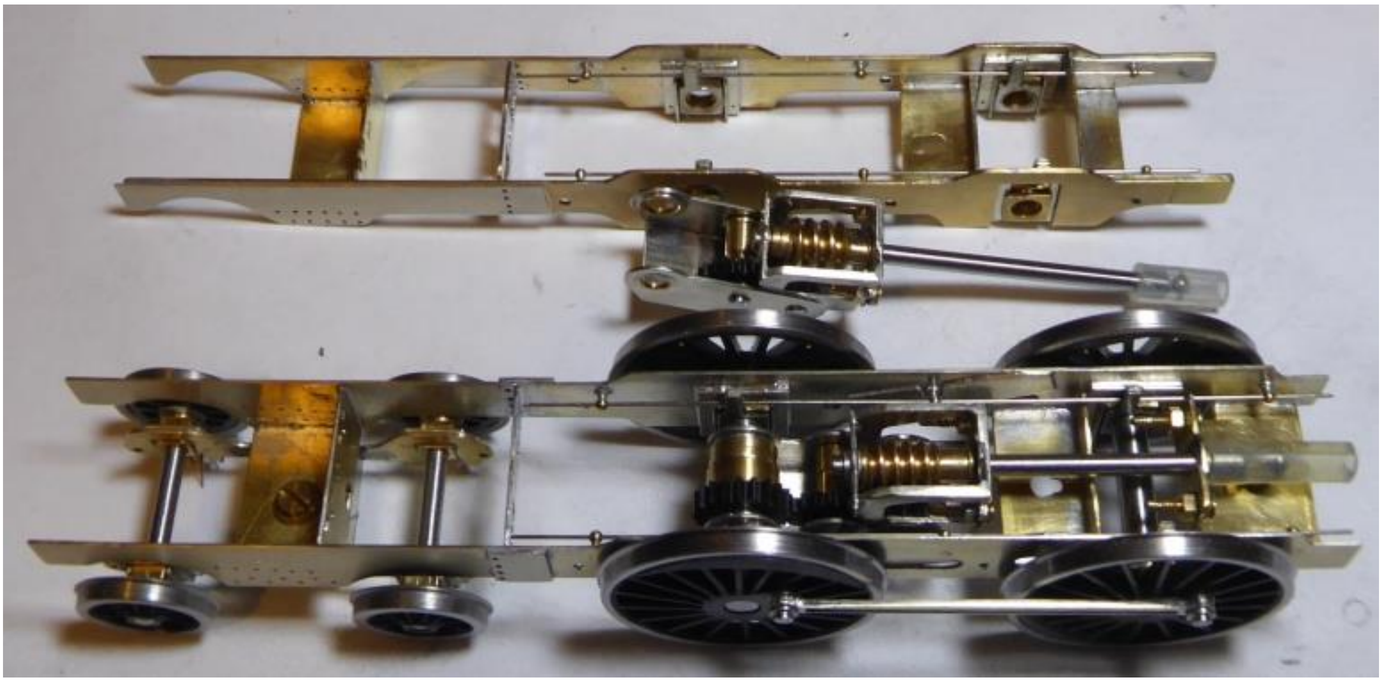
 

Anyway, off came the Steel Araldite, out came the idlers and the worm-shaft, and the gearbox articulation was gradually relaxed to a less acute angle, under the influence of the soldering station. The result is seen on the left, above, with the Drivestretcher carriage now sitting nearly horizontal. The top of the gearbox has lifted about 1mm higher as a result, with the drive train running about level with the frame tops – but still allowing clearance between the flexible joint test piece and the underside of the raised floor which the H boiler rebuilds gained. See the pencilled addition to the drawing, extending forwards from the fall plate.

The revised alignment of the drive shaft rendered the earlier arrangement for its torque reaction bracket to be redundant, and the rear spacer was truncated accordingly, see above right. A separate vertical mount was created for this bracket, shown above right with its brass bearing fitted.

On the left is the forward face of the new mount, showing the initial tack soldering of the 12BA nuts and the slot wide enough to clear the 2mm brass bearing bush. In the centre, the new mount is tested in place, before being pegged to the rear frame spacer, centralised and tacked in position. After a final alignment check, the mount was fully soldered to the rear spacer.



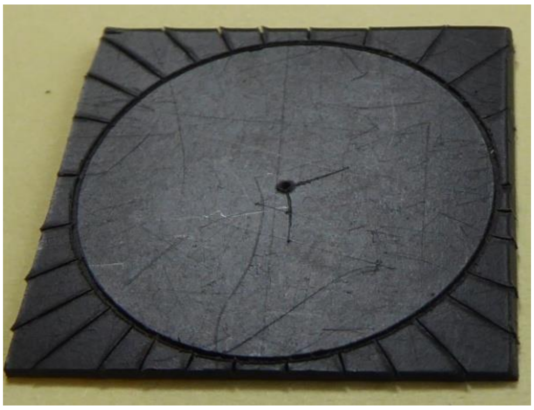
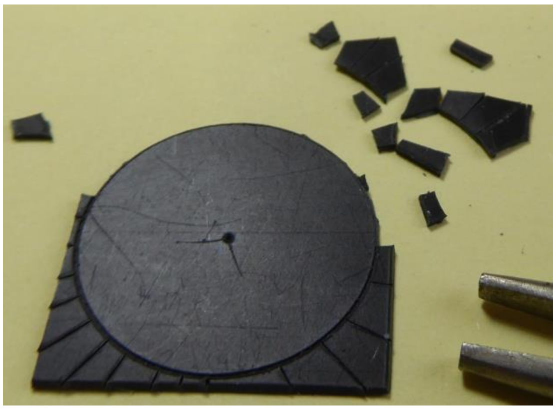
Finally, above is a comparative view of the drive trains for both engines, taken before the amendment to No.16's rear spacer, but after the wheeling-up of No.77 and the addition of its bogie. This leads us neatly into the sections on wheels and then the bogie.

Wheelsets and Balance Weights

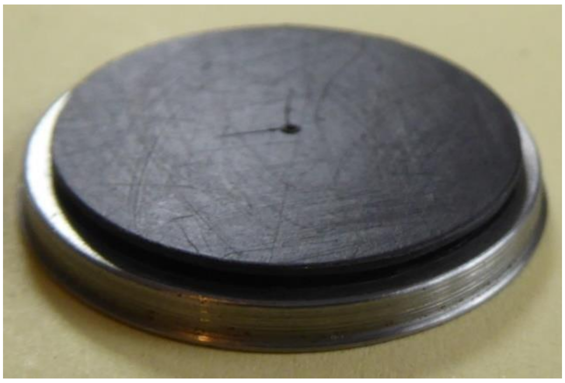
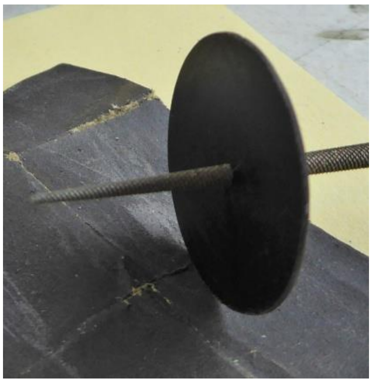
The closest wheelsets in the Alan Gibson range were both correct for diameter and having 18 spokes, but they both differed in having the crankpin *between* the spokes (PB), rather than *in line* with a spoke (IL). I chose to accept this error, although it would cause problems with setting the balance weights – see below:

In the past I have often added balance weights as something of an afterthought, to a wheeled-up chassis. It is much easier to deal with them 'on the flat', and get this task done before fitting the wheels to the axles.

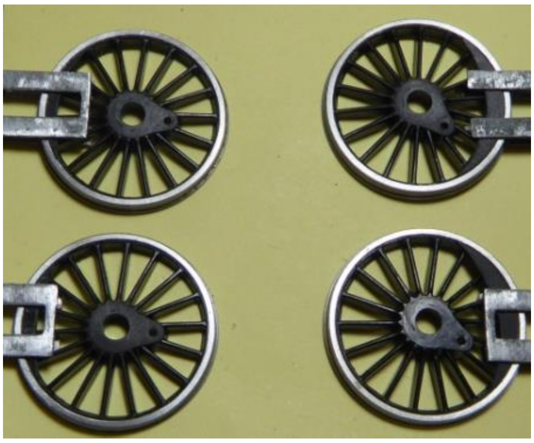
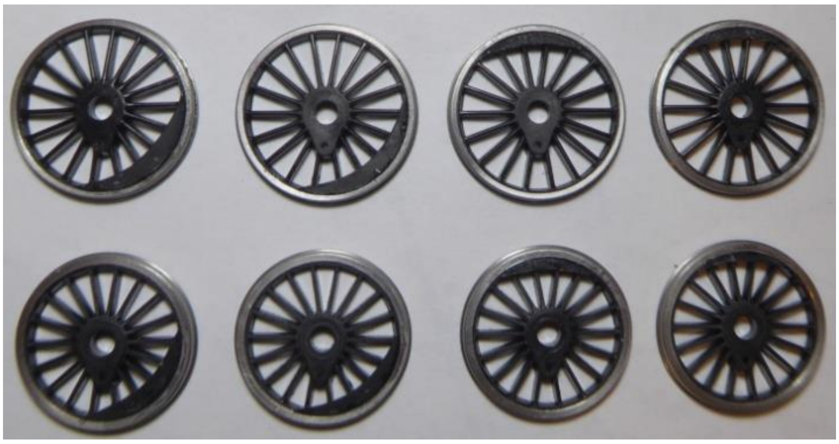
No.77

.  

The balance weights were cut from 20 thou black styrene sheet, which is easy to form and has the minor advantage that if paintwork wears in service or handling, there is no bare metal revealed beneath. I used a Vernier to measure the diameter between the insides of the steel rims, and scribed a circle in the styrene using a pair of dividers, set slightly over this diameter, to allow for trimming back. I continued the scribing until a pale 'witness' circle appeared underneath the styrene sheet. A square containing this circle was then separated, and the excess material scored as above. This enabled me to nibble away the excess with fine pliers, without distorting the scribed circle.

The parted styrene disc was checked against a wheel, and the scribing centre opened out, to allow a round file to be inserted as a crude mandrel. This allowed the disc to be carefully reduced on fine emery, to a close fit against the wheel rim. The large driving axle balance weight and the smaller rear weight were then marked off, using the drawing and photos as reference, scribed slightly oversize by eye, then scored until they could be separated from the disc. I managed to get two small and one large weight from the disc; I used the large one to mark out its twin from the remaining centre of the disc. The cut weights were carefully smoothed and fettled to a close fit against the wheel rim. I chamfered the rear face to sit tight against the rim, and also pared away the inner underside, to allow for the flare of the spokes.

Once fettled, the balance weights were correctly positioned relative to the crankpins, held in place by ‘Dinky’ grips, and fixed with Loctite. I roughen the rear surface with fine abrasive to give a ‘key’ for the Loctite. This is one of those tedious repetitive tasks which I was glad to complete for both locos in a single session, as seen here with weights affixed but awaiting further attention.

The rear weights, merely balancing the crankpin and its boss, were easy to set - theoretically - ie. directly opposite the crankpin. However, this is where the crankpin position, PB rather than IL, comes back to ‘bite’. The model wheels now have a space, rather than a spoke, opposite the crankpin. Being centred on this space, rather than a spoke, correctly-sized model weights must end in a space, rather than at a spoke! I tried the alternative of off-setting the rear weights slightly to fit between spokes, but the eye readily detects this asymmetry. Interestingly, the symmetrical position seems to be less obviously incorrect.

I found the driving wheel weights were actually easier to ‘fudge’ with respect to the crankpin alignment error; since they are anyway asymmetric relative to the crankpin. It seemed easier to adjust their position, since they also overlapped the spokes as well. Photos show which way each side’s weight is offset.


The solid ‘weight’ is then built up behind the styrene profile using black Miliput, and allowed to harden overnight before fettling any excess Miliput or Loctite, to leave a flush rear surface and a neat interface with the spokes and wheel rim. As on the SDJR prototypes, these weights stand slightly proud of the wheel rim; this feature will vary across other types of loco, and may require thinner, or even thicker, material.

I was very pleased that these Gibson wheels already had the crankpin hole drilled through, saving me all the extra hassle of drilling out dimple-marked hole locations. I merely had to countersink the rear of the holes, de-burr the top-hat bushes and faces of the nuts, and Loctite the screws in place.

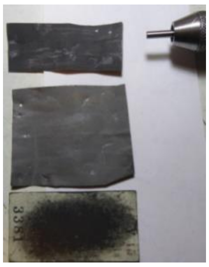
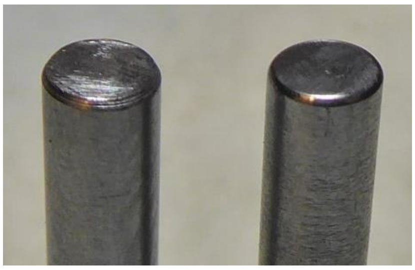
No.16

One advantage of simultaneous model builds is the discovery of hitherto unobserved differences between similar classes of engine. In this case, I had barely registered that the wheels of the 1891 engines had wrought iron spokes, whereas the 1908 pair ran on cast steel wheels. The wrought iron examples often display a markedly ‘square’ front face, as opposed to the taper of the steel wheels, which is reflected in the Gibson wheels as used un-altered on No.77.


Accordingly, after a promising experiment on a set of ‘scrap’ wheels, I spent some time with a No.10 scalpel blade and gently pared back the face of the spokes on the driving wheels for No.16. This produced a pleasingly ‘wrought’ effect, to my eyes at least. It will be interesting to see how this is affected by painting, in the final effect.

Fitting axles, polishing washers and bearings

Before attempting to fit the axles into the wheels, I spent some time smoothing and polishing the axle ends, to ease the process. Although the Gibson axles are supplied with *chamfered* ends, I have sometimes found it difficult to start the insertion into the wheel centres - it may be that different batches of nylon, or even different wheel types, show significant variation in this matter. It is not a major problem, but one I would like to avoid if possible, hence this preparation:


Each axle was mounted in the craft drill, and given a short ‘wipe’ of the end angle on 500 and then 1000 grade emery, before rinsing any grit away with 50/50 meths/water, and finally buffing on a pad impregnated with oil and ‘Brasso’. This soon produced the contrast seen in the centre and right-hand photos; hopefully it is clear that the right/lower axle ends are smoother than the left/upper ones. The polished axle ends certainly entered the wheel centres more readily.


While polishing axle ends, I also took the opportunity for my routine fettling and polishing of all bearings and coupling rods (bores and rubbing faces in both cases), crankpin bushes and nut faces, sideplay washers, anything that rubs against another surface. It only takes an eyeglass to discover how ‘rough’ these apparently smooth machined surfaces are. In particular, washers have turning and boring ‘burrs’ at both the hole and the outer edge – a form of model disc-brake if left unattended.

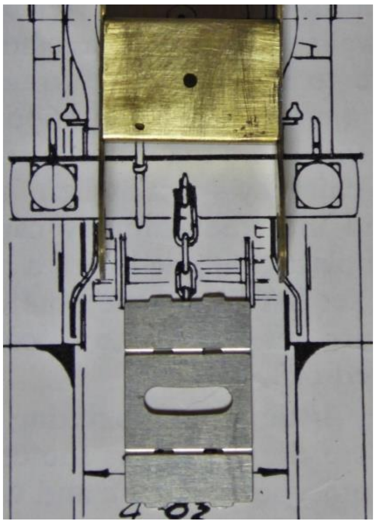
Bores - de-burred and countersunk – were polished with a dilute Brasso/oil mix, carried on a half-cotton wool bud, partly thinned, or a half-cocktail stick. Flat surfaces were de-burred using 1000 grade emery, rinsed clean then polished with the same mix on a lap plate, utilising a card ticket from a Heritage Railway. Untreated washers in foreground, polished examples to rear - a big difference.

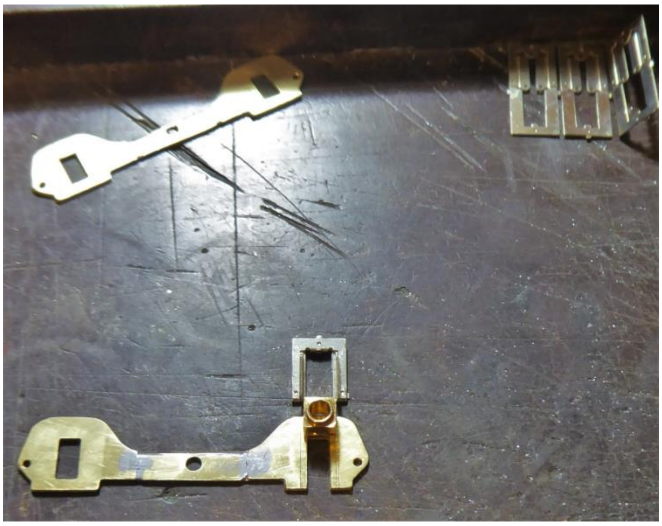
Bogies

I planned to use simple springing on the engine's bogie, and weight the engine so that its centre of gravity lay one third of the way between the centre of the coupled wheelbase and the bogie pin; this would make the bogie carry one third of the engine's weight and leave two thirds of the weight over the driving wheels.

I was initially keen to check that the bogie could negotiate my ruling 3ft 6ins test curve (for a proposed layout with 4ft minimum radius) without the rear wheels fouling the frames, in the absence of a frame cut-out here. So this was my first task, based on the bogie frame from an old Maygib kit of late 1970s vintage, for a MR '378' Class 4-4-0. I had obtained this kit as a 'donor' for my SDJR version back in 1981!

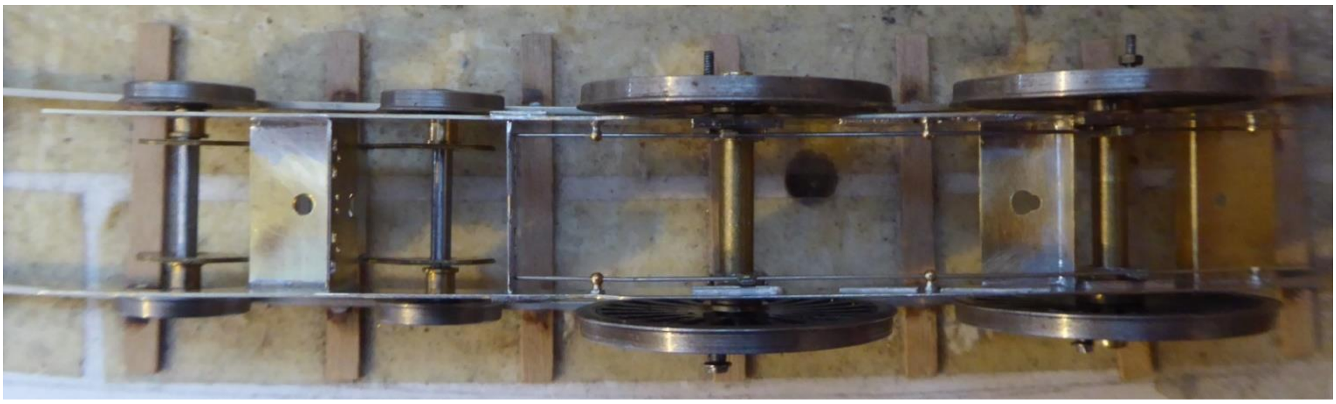
No.77





I had previously assembled the Maygib bogie frame, many years ago. On revisiting it now, it was clear that it was over-width and would not allow the fitting of external details such as dummy springs and the equalizing beam. Comparing the frame against the Bill Ibbott front-end drawing, I found that the spare 00 version of the Rumney bogie etch was virtually dead-on for the correct width, needing only a light filing-back of the etch cusp. I realised that by reversing the HL hornguides to sit *outside* the bogie frames, I could replicate the prototype's external bogie axlebox arrangement as well.

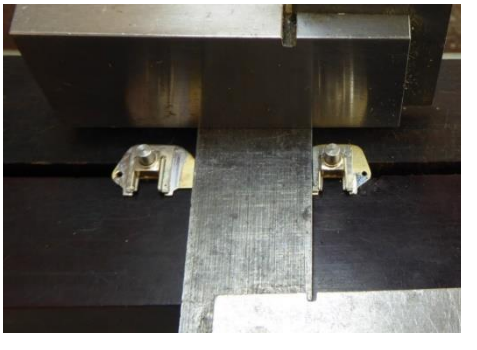
So the next step was to dismantle the Maygib bogie and clean up the parts. On the right, the High Level 'Miniblox' 2mm bearings and hornguides are being trialled against the frames, to determine how much widening of the existing closed slots was required. The visible solder on the frame shows where I had to flood 296deg solder into the half-etch slots, which the kit provided to locate the now redundant stretcher.



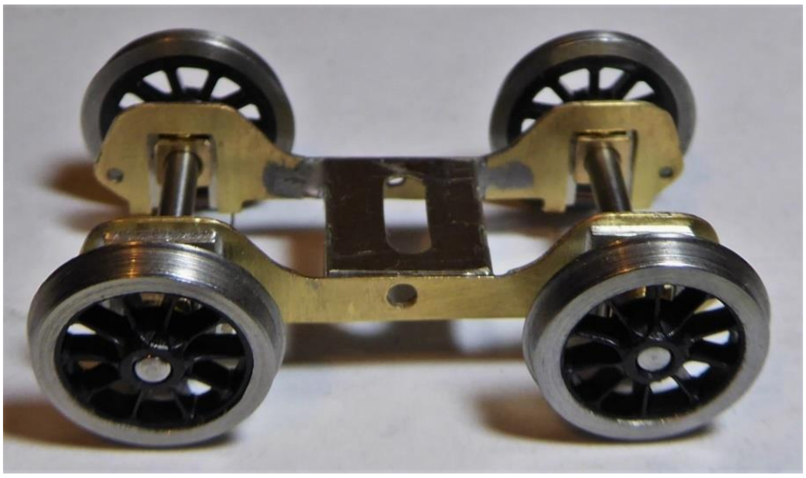
At this stage, I did a quick test of the revised bogie arrangement, mounting the wheels and axles in the loose frames, with 2mm top-hat spacers providing appropriate spacing from the frames. With ‘scrap’ 7ft wheelsets fitted to the driving axleboxes and appropriately washered-up, the chassis was posed on the 3ft 6ins test curve, as seen above. Although crude, this visual test gave me confidence that my proposed bogie would swing clear between the frames, and that the *rear* bogie wheels could be kept away from the frames, by use of judicious washering-up of the driving axles and limitation of the bogie’s side-play.

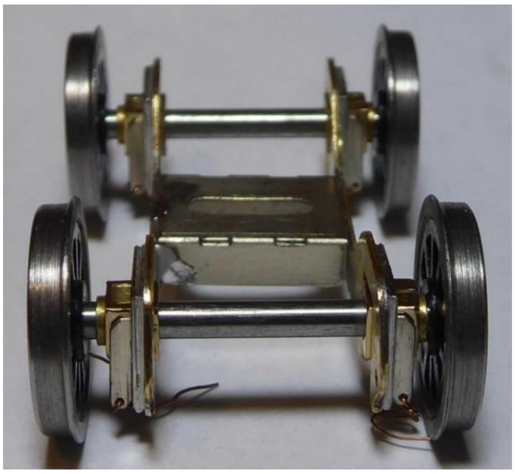

On the left, the frame slots have been opened out and widened to receive the HL hornguides. The central etched hole was intended for some form of Maygib compensation, and will be hidden by the overlay detail eventually. The four tiny HL Miniblox bearings were threaded onto a cocktail stick to facilitate the task of filing off milling burr, chamfering edges and polishing the rubbing surfaces.


On the left, a mini-peg holds a hornguide in place while its alignment is checked (note, this image shows a frame from *No.16’s* bogie). Once the first hornguide was soldered in place, the frame was placed on the chassis jig, re-set at 6ft = 24mm axle spacing, so that I could check for sufficient clearance between slots and bearings (back to No.77’s bogie for this one....).

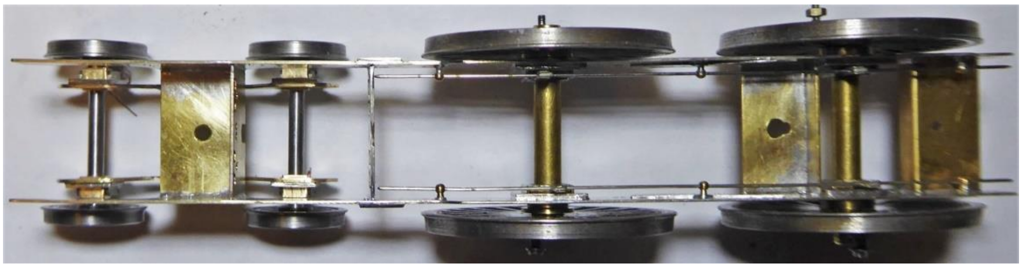



The frame is now inverted to lie flush on the Tufnol surface, and the right-hand hornguide has been tack soldered in place. On the right, an engineer’s square is used to check that the second hornguide has been tacked ‘all square’, before running the seam. This will now be the *outside* of the frame.



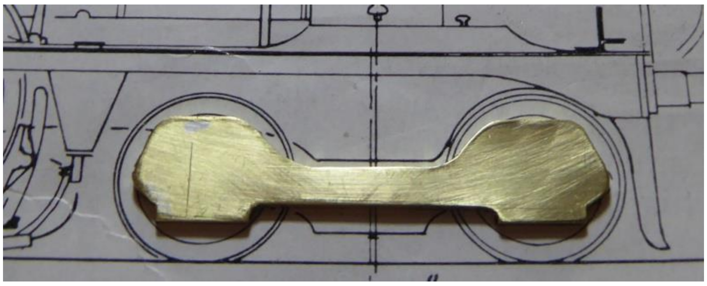


Here is the re-vamped bogie, tack-soldered to enable testing. Some washers will be needed to reduce the sideplay evident here. I have yet to decide exactly how to spring the bogie, preferably by spring wires bearing directly on top of the bearings. Cosmetic spring and compensation beam detail will also be needed.



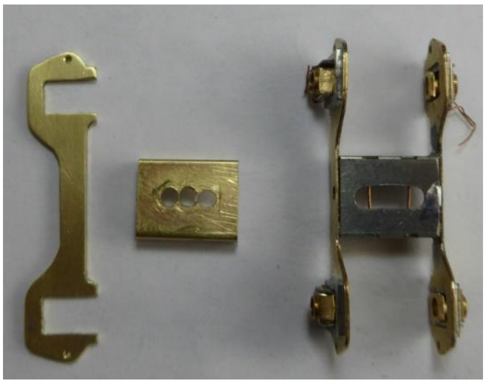
Here is a final view of No.77's chassis on its trial driving wheels, showing how the revised bogie frame sits well within the frame spacing, allowing space to swing without fouling the frames.This viewpoint also emphasises the advisability of springing via the top of the *bearings*, rather than onto the *axles* between the frames. On the right, I took the opportunity of having the bogie dis-assembled to copy its profile onto some laminated brass sheet, to make a start on creating a second bogie, for No.16. The earlier engine used the same basic bogie dimensions, although differing in suspension details, which would be reflected in its eventual detailing.

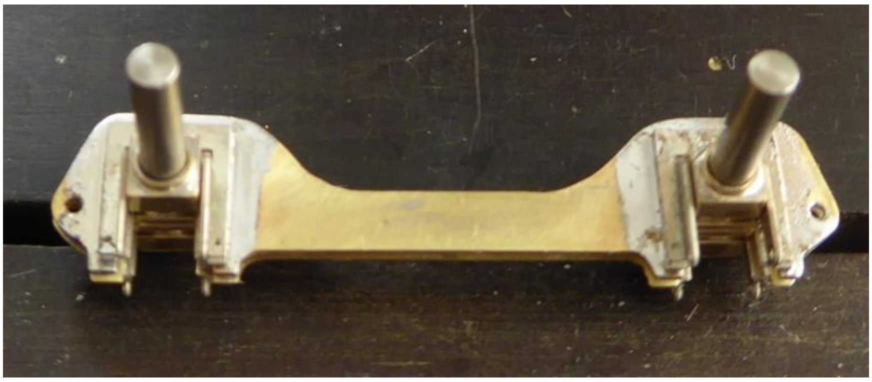
No.16



The laminated bogie frame 'blanks' for No.16 which I had prepared while working on No.77 were soon filed to shape and checked against the Bill Ibbott drawing.

Slots were cut with a disc for the HL 'miniblox' 2mm bearings, a couple of holes at the top enabling the waste brass to be broken out and the slot shape refined. On the right is a finished frame with the holes drilled for fitting the end stretcher rods.

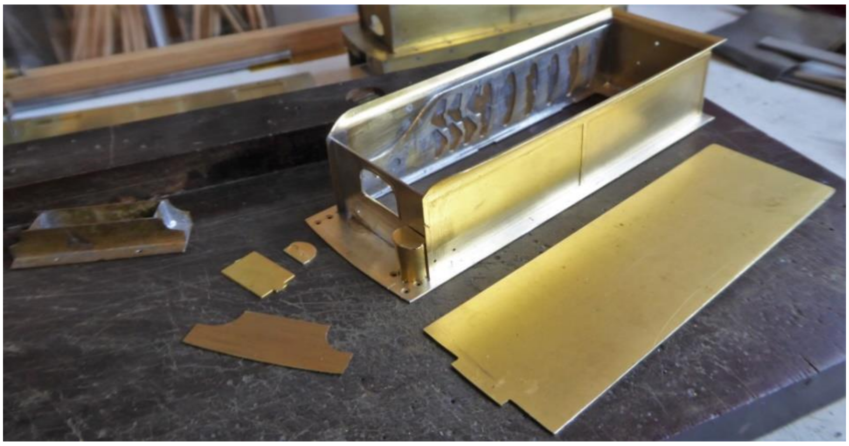


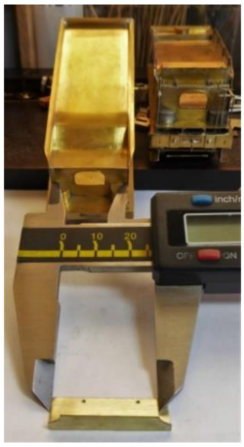


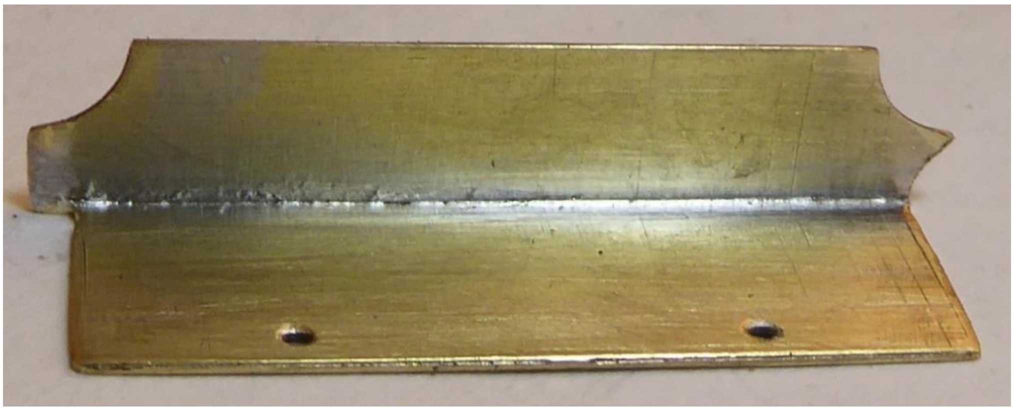
A spare brass EM spacer was modified to create a copy of the Rumney Models etched version used on No.77. The latter provided the template for scribing the curved bogie slot on the new stretcher, and three adjacent holes were then enlarged and filed smooth to recreate the slot. On the right, the pair of hornguide-fitted frames are jointly tested, to ensure they slide freely on the 2mm jig axles. In the absence of coupling rods on these axles, the absolute alignment is less critical than for driving axles, but it is still worth aiming for the best possible alignment.

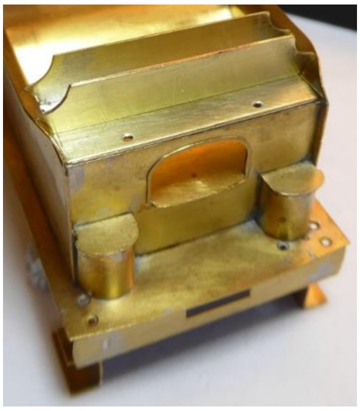
Tender chassis

I had made a head start on the overall 77/16 project by an early assembly of the basic body shell from the George Norton 2,900 gallon tender kit for No.77's tender. This included a modification of an existing front tender toolbox which I had to hand for this type of tender, albeit the wider 3,2500 gallon version. I will describe the full tender body build in more detail later, in part 2 of this project account but for now, here are a few pictures to illustrate why I was keen to move onto the build of the chassis to fit under it!

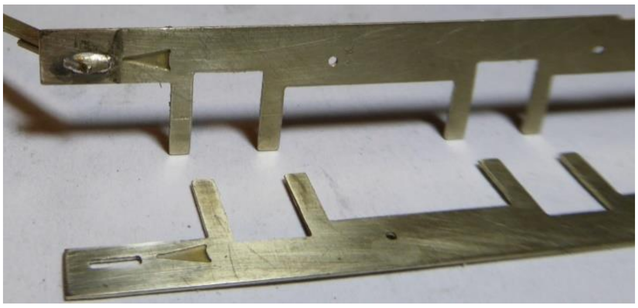
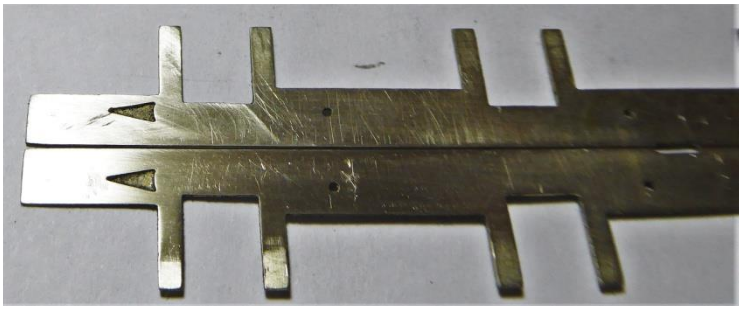




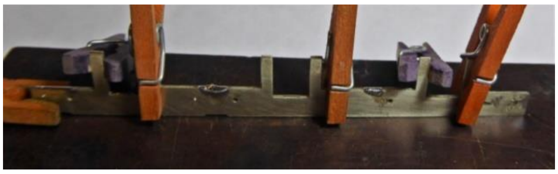




No.77

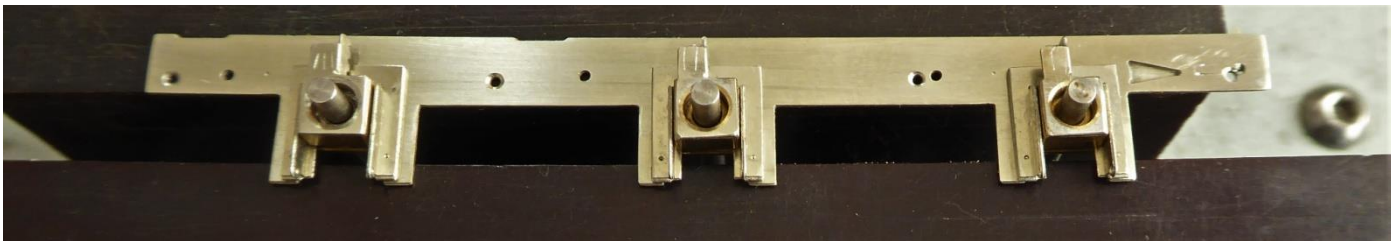



While assessing the Norton chassis for CSB fitting, where the CLAG website again gave examples of fulcrum layout specifically for this symmetrical 6ft 6in + 6ft 6ins wheelbase, I found that the front fulcrum position would be close to an etched spacer slot. This slot was redundant anyway, as I would be using P4 ‘L’ spacers, so I soldered a strip of nickel silver etch strip into the slots and ground them back flush, before marking and drilling for the CSB fulcrum knobs. On the right, the second of four CSB knob positions can just be discerned, immediately behind the etched hole for the front brake hanger - and on the same level, by chance. Immediately above this is a ‘mis-fire’ during marking out, which has been crossed out.

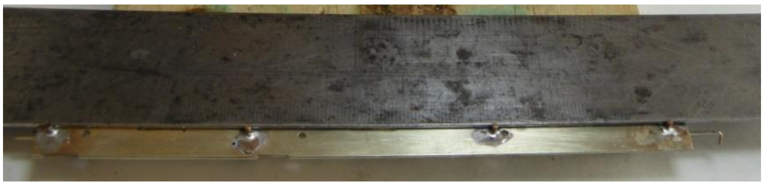
The four CSB positions are marked here by indentations; note how close the rear one is to the end of the frame. This will mean that the ‘L’ bend formed at one end of the CSB wire (to ease handling and limit excess movement) will need to be at the front end, and the CSB wire’s length must be cut accurately enough that it cannot slide forward far enough to slip out of the rear fulcrum knob.

On the right, the two frames are pegged together and checked for alignment before being tack-soldered to allow the CSB fulcrum holes to be drilled through both frames.

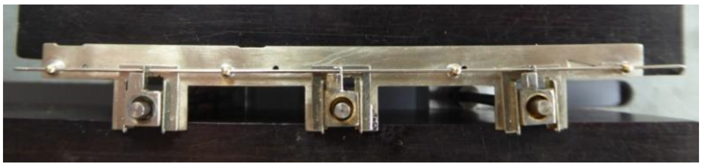


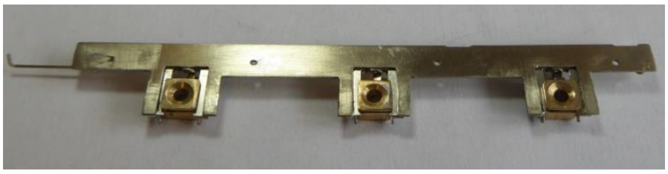
Here is a CSB-drilled frame, the holes already opened out and countersunk, mounted on the axle jig set at the appropriate 26mm + 26mm axle spacing, while the hornguides are all checked for clearance against the 6mm wide slots of the kit. At the left-hand end, the rear slot comes rather close up against the hornguide. It was not enough to require remedial widening, but it demonstrates again, how a (presumed?) pre-CAD kit, even of Norton quality, may contain discrepancies from scale dimensions. Note the Roman numeral bearing identification marks for a left-side frame; I,II,III front to rear, the right side being IV,V,VI.

(That is a soldering blemish, not a second hole, just above the front (right) CSB hole. The brake hanger holes are 2nd, 4th and 6th from the left.)

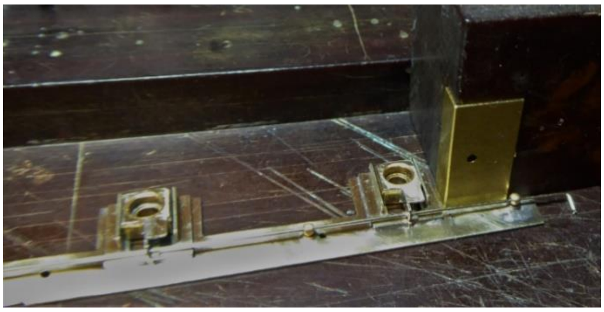
Returning to the CSB fulcrum set-up, here in its proper place is a photo pair that you have seen already; I borrowed it earlier to illustrate loco CSB set-up. So just a brief reminder to fix the outermost knob pair first, then use the steel rules to ensure the intermediates lie in a straight line - with all the shanks projecting vertically from the far side.



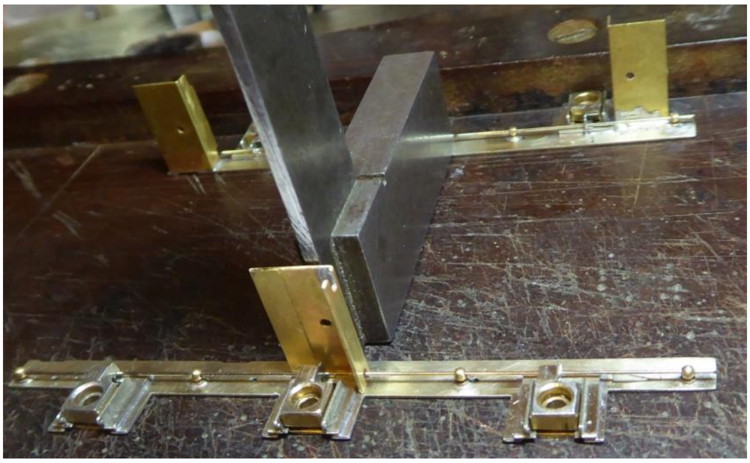


The CSB knobs are next trimmed and the frames fully fettled. On the left, the left-hand frame is mounted on the axle jig and the centre hornguide has been tack-soldered in place. When the other hornguides have been similarly tacked, the frame is removed to check alignment and clearances. The three tacked hornguides are shown right, before re-mounting on the jig and running the seams.

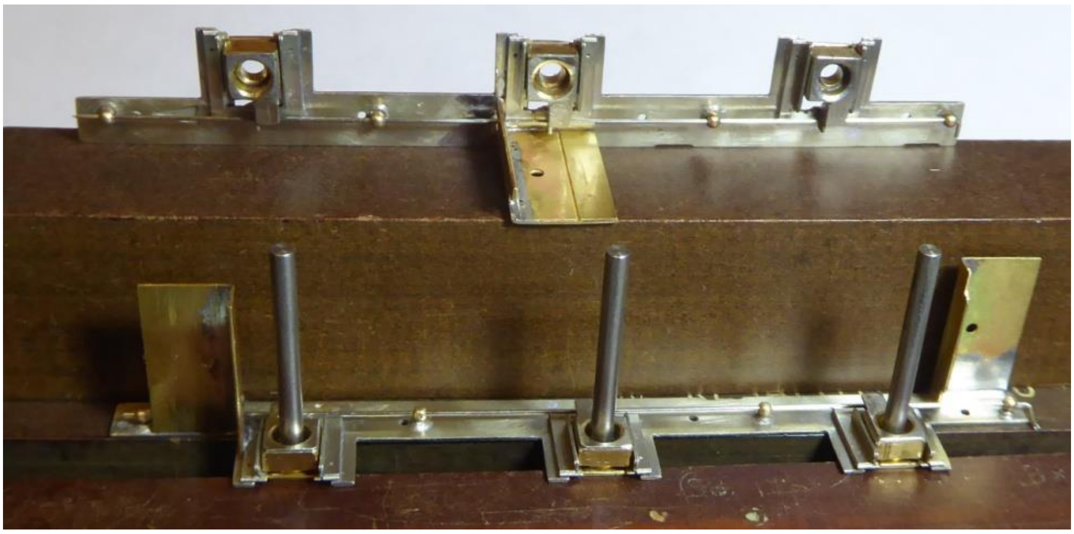
The next job is to fit the frame spacers, which are all Scalefour Society P4 etched ‘L’ variants.



The rear spacer has been fitted, to give a flush fit under the tender body, with a fixing screw location. Experience has taught me to leave a gap to the rear of the spacer, otherwise if the frames are found to need any filing to fit the assembled body, the spacer will need filing too, which slows things down a bit! The spacer is a shallow ‘L’ type, but still needed the outer edges reducing in height a little bit, to clear the CSB wires –this is shown more clearly in a later photo. On the right, the front spacer is being positioned against a Tufnol block, sitting just clear of the front hornguide. It is mounted this way - downwards - so that it does not foul the flexible joint of the drive train, which is going to be sited overhead.



Here, the centre spacer is aligned on the other frame, and sits above the centre bearing. It has been slotted to clear the CSB wires. It is set low enough to allow a motor cradle with a rubber base pad (bicycle inner tube) to be fitted above it, but must be high enough to allow adequate upward clearance for the CSB tag on the bearing underneath. Extra clearance can be gained by ensuring that the etching ‘tab’ above the CSB tag has been fully filed away - and even a slight amount of material removed from the tag itself; but be careful…. A clearance of 1mm should be plenty; 0.5mm to allow for the weight of the tender when sitting on the rails, and a further leeway of 0.5mm will accommodate anything likely to be encountered on P4 tracks.

I find it helpful to conduct an ‘eyeball test’, against the sky, on the tender frame which carries two spacers, even after using an engineer’s square during set-up; the human eye seems very sensitive to even small departures from the parallel in such circumstances. All looks OK here. So here are the prepared frames being mounted in the axle jig for tacked assembly, checking and final soldering up. Another slab of Tufnol is used, edge-on, to press the upper frame level along its full length, while being pressed against the rear flat reference surface. I tack and then complete the seams on the outer spacers first, and ensure that the resultant assembly does not ‘rock’ on a flat surface; check and re-tack if so, until satisfied.

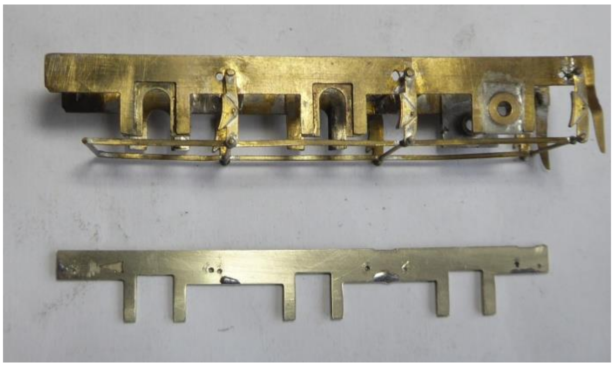


Before wheeling-up the completed chassis, do check the wheels for any blemishes like this moulding ‘pip’ at the edge of the wheel centre. At worst (very rare indeed) this can affect the sit of the wheel rim on the centre and cause wobble. But if left in-situ, it can also prevent the correct setting of the wheelset back-to back when using a BB gauge.

Centre; with the chassis wheeled, a Mashima 1426 motor and attached High Level ‘Tenderiser’ 1:1 offset gearbox are loosely posed in approximate position, and it can be seen how the Tenderiser sits comfortably between the CSB wires in P4, right. This arrangement will also fit under the top of the tender tank seen in the background, although a clearance opening may be needed to accommodate a motor cradle.

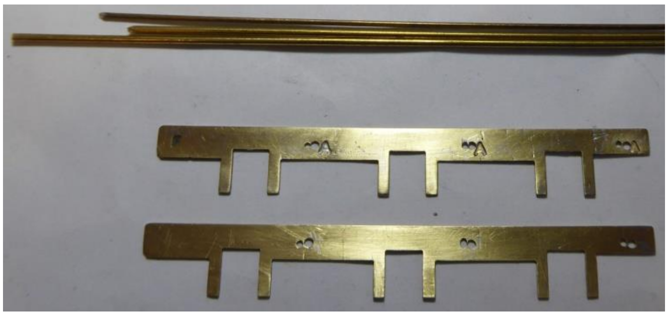
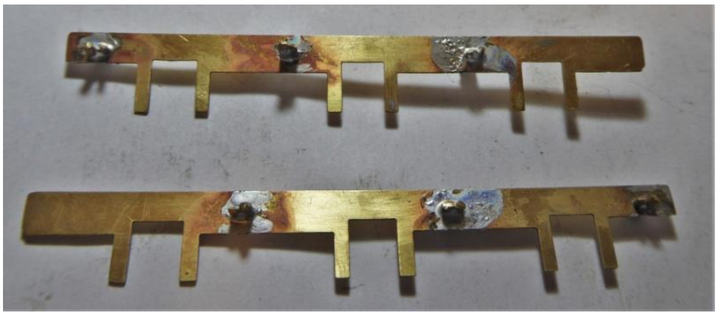
I will be returning later to the tender end of the drive train, and the motor installation, in Part 2!

No.16




While assembling No.77’s tender frames, I considered how to tackle the frames for No.16. This had a narrower tender, although with a slightly higher tank in its rebuilt form. The chassis would be dimensionally the same as that for No.77 however, so I chose a short cut and press-ganged an assembled old Maygib chassis from a MR 0-6-0 project that is a low priority. This chassis is seen on the left with 77’s frame sides, demonstrating the family resemblance, albeit designed as a 1980s fixed rear axle/floating front axles job.

It only took five minutes to dis-assemble this to obtain the basic sideframes; the intact brakegear and guard irons were set aside for re-use, the Perseverance bearing guides went in the salvage box, the simple flat spacers into brass stock. Oddly enough, the brake hangers proved to be the correct length for the tender of No.77, and in turn the hangers in the new kit being assembled for No.77 proved better suited to No. 16’s tender!! A serendipitous swap…..

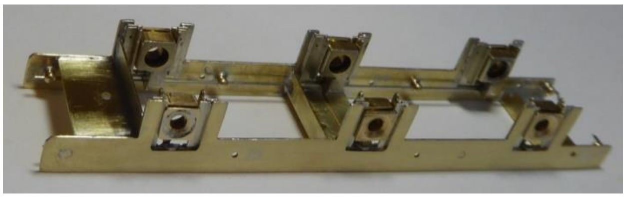
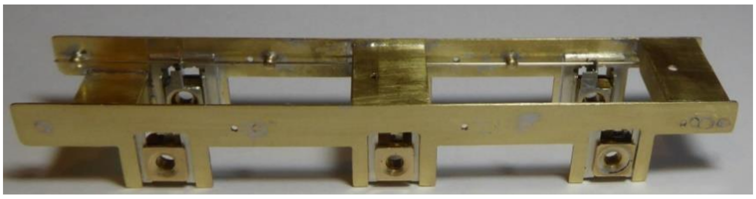
When cleaned up, above, the ’new’ frames for No.16 did display certain disadvantages, which required some serious infilling before I could mark out and drill CSB, and even brake hanger, holes. The Maygib etches included rather deeply-etched letters: ‘F’ to denote the front end, ‘A’ to identify the three brake hanger holes…? Anyway, on top of this, the brake hanger holes had been in the wrong place and I had previously drilled new ones nearby; so much for short cuts! New brake hanger holes and the CSB holes need a firmer foundation, so I soldered thick brass wire into the (broached-up) holes, 222deg solder, as seen on right, and then trimmed and ground back the frames flush.


Here, left, are the salvaged frame sides tacked together, now looking more presentable, with the CSB centreline scribed on and the four fulcrum holes pilot-drilled. Above them, the selected short fulcrum knobs and the prepared HL bearings and hornguides await installation.

On the right, the frames have been separated after marking and drilling the brake hanger holes, and the CSB fulcrum knobs have been soldered in place (ignore lens distortion, again) and checked for alignment.

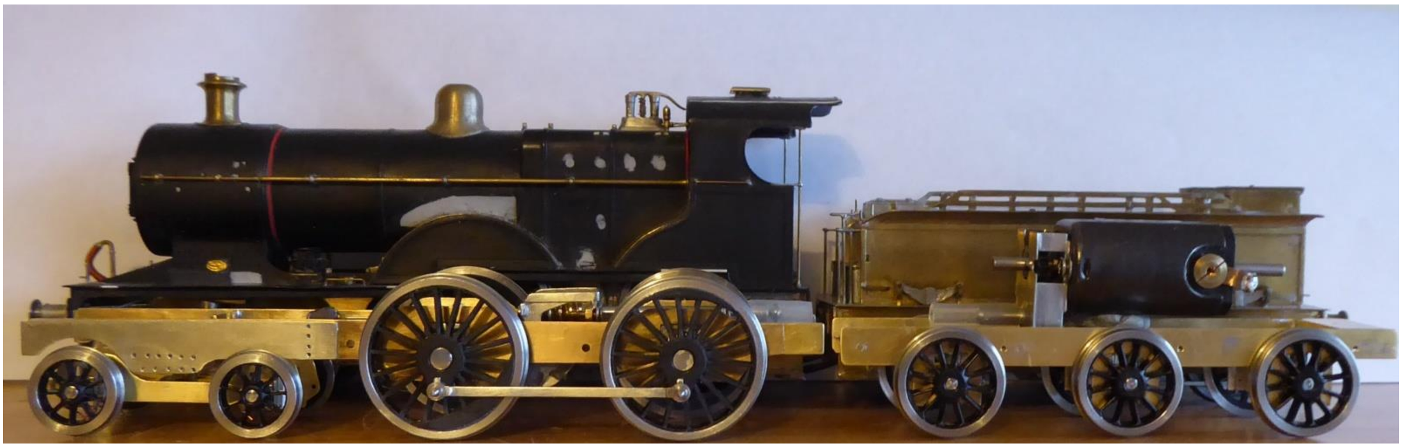
After fettling of CSB fulcrum soldering, left, the hornguides were positioned and soldered up next, using the chassis jig as already set for No. 77's tender. On the right, one frame side is having its rear spacer (to the right) fitted, clear of the frame end and the nearby hornguide. The other spacers help to align everything for tack-soldering, aided by a steel rule and Tufnol block.

Here is the second completed tender underframe, for No.16, awaiting wheeling-up and installation of the motor and TendeRiser step-down gearbox as with No.77.

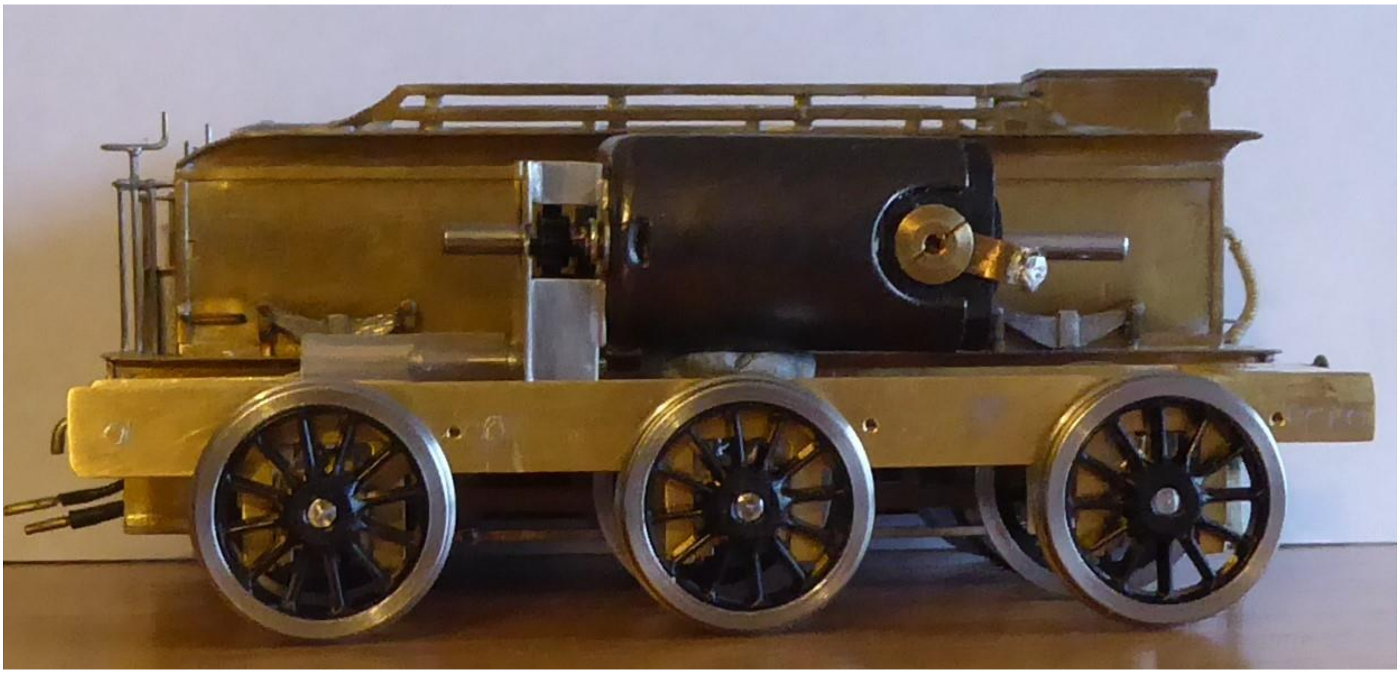
And that is as far as the two builds have progressed, at the time of writing this in early February 2021. I hope to have installed the tender drive trains, sprung the bogies and been able to test the mechanisms by the date of Spring Virtual Missenden 2021 in early March, and hope to 'report back' in due course…… meanwhile, I will end with a few images showing 'where we have got to', between the end of November and the 4th of February.

SDJR 4-4-0s Nos. 16 and 77, Part 1: The Chassis Builds – Progress so far

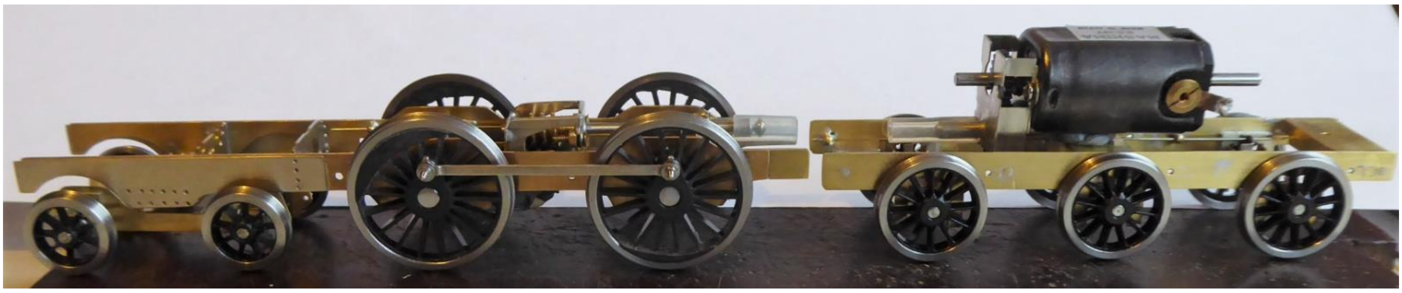


Here is No.16's chassis, wheeled-up at last – well, sort of. Posed here, for comparison with 7ft 4-4-0 No.68, the driving wheels on the far side are barely engaged on the axles, as I have yet to complete the washering of the drivers; this chassis is about 0.5mm narrower than No.77's. The Master coupling rod is seen here, but the second rod has yet to have its second crankpin hole enlarged to fit the pin. The new bogie carries the correct 9-spoke wheels for No.16 (77's bogie has 10 spokes), but awaits springing and pivot completion, like No.77. The motor/Tenderiser 1:1 gearbox is perched on Blu-tack at roughly the correct height. Behind it, the 2,200 gallon tender (not 68's) is similar to the 2,600 gallon version which 16 will tow. This will have raised sides, up to about the top of the flare on the one seen here, so the motor in No.16's tender should have reasonable clearance without cutting out the coal space floor.

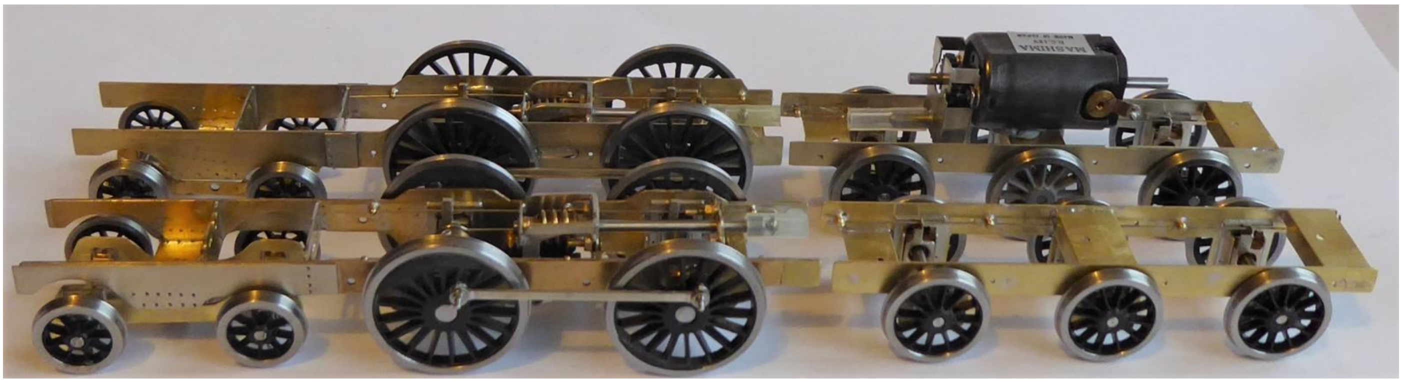
This image emphasises how small the 1891 5ft 9ins engines were, originally, in comparison to this 1921 (1914 design) 'monster'!



Here is a closer broadside look at the motor and gearbox, awaiting installation, along with brakes, pickups, weight and much small detail. The gearbox output shaft will not be this length, I have borrowed the combination from another project. Assuming the motor will it roughly where it is, I will need to fit a gearbox forward frame extension, with the front bearing moved towards the leading axle, as I want the shaft to project as far beyond that axle, as does the loco's shaft beyond its rear axle, to keep the flexible joint angles comparable. See the next photo, and compare.



No.16 in its current entirety; rather down at the bows, as the bogie pivot and suspension are incomplete/missing.



The SDJR Sisters; No.16 at the front, No.77 at the rear – the latter with its bogie temporarily dismantled, the separate frames simply resting on the axles! Yes, the camera sure can lie.

Thank you for following this project, I do hope there are some useful tips and techniques in there somewhere, for your own projects? Meanwhile, enjoy the rest of Virtual Missenden Spring 2021 and *'watch this space'……*

Steve Duckworth, February 2021