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SCRATCHBUILDING MODEL WAGONS

CHRIS CROFTS concludes his series on making 4mm PO wagons with the trickiest bits – solebars and below.

Having dealt with bodywork at length in the last article, we can now move on to the frame and all that hangs from it. Although you will be familiar with my approach to wagon modelling by now, I do point out once more that these techniques represent the way I choose to go about things, not a set of 'rules'.

THE FRAME

The headstocks are cut from 0.060 in plastic and the solebars from 0.040 in. Both are 4mm deep for most wagons. I find it best to detail and fit the headstocks first, then make the solebars an exact fit between them, and square off the ends of the headstocks. Many wagons had the corners of the headstocks chamfered, and this can be reproduced quickly by filing. There was also commonly a clip or a band which was supposed to stop the wooden headstock splitting, the headstock was narrowed slightly to allow the iron band to be fitted while keeping the same overall dimensions. I have tried to reproduce this in plastic but it is hardly worthwhile; if you wish to simulate the band it can be done more easily with paint.

Find the exact centre of the headstock, vertically and horizontally, and mark the point. From it, mark the buffer centres – each will be 11 1/3 mm from the centre mark (yes, I do know that one is not supposed to use fractions with the metric system, but I didn't invent the 4mm:1 ft scale! You can judge 1/3 mm using a millimetre rule and a lens, but if I had written 11.3333 mm someone would ask 'Do you really work to 0.0001 mm?'). When you have marked both buffer centres, check that they are 22 2/3 mm (= 5 ft 8 in) apart and drill holes to suit the buffers of your choice.

Cut out the drawbar faceplates from 0.010 in styrene; dimensions are given in part 1 of this article (*MRJ* No. 12). Notice that at the door end of the wagon, the plate is extended upwards to stop the end floor plank (or sill) from coming out. At the fast end, this is, of course, impossible, because of the end pillars. At present I cut the corners of the drawbar faceplates judging only by eye, but I am not totally satisfied with this method. Fix the plates in position with solvent.

When the solvent is dry (next day) mark out the centres for the holes that will take pieces of plastic rod to represent the four nuts on the faceplate. On the full size wagon, two of these nuts are on the ends of rods running the full length of the wagon, through both faceplates. These nuts are massive – 1.8 in across the flats. It is almost worthwhile – but not quite, in 4mm – trying to make them hexagonal. As it is, I use 0.023 in plastic rod. The other nuts are smaller, being carried on the ends of bolts passing through the headstock and faceplate, and are represented by 0.017 in rod. Note that, even on a wagon without end doors, the drawbar faceplates are 'handed', because they take through-rods. This must be reproduced; although you cannot look at both faceplates at the same time (once they are fitted) it is just as easy to get it right as it is to get it wrong.

Near the ends of the headstock the strapbolt nuts are to be seen. Sometimes the two nuts at each end had individual washers, while on other wagons a single washer plate was used. It is for this, and many other similar reasons that it is impossible to build a 100% accurate model from a sketch, though obviously you have to rely on sketches if nothing else is available. If the strapbolts take a washer plate, cut it from 0.005 in plastic strip, with rounded ends, in the same way that you made the body ironwork. Fix the washer plates to the headstocks with a spot of solvent and, when dry, drill for 0.020 in plastic rod to represent the nuts. If the nuts have individual washers, you will need to punch out plastic discs 0.005 thick and about 0.030 in diameter to represent the washers. You will probably not have a 0.030 in punch and you will not be able to buy one either, but there is an easy solution: obtain a No. 68 (or 1/32 in) drill, put it in the vice with about ½ inch of the shank sticking out, snap off the projecting piece – and there is your punch. The break may not be clean, but it doesn't matter; the other end, which is usually finished off square, will be used for punching. Next, place a piece of plastic sheet on a piece of lead sheet (available from a builders' merchant), hold your punch in suitable tweezers, tap gently with a hammer, and behold! – washers. Many of the washers will drop out when you bend the lead sheet, others can be eased out with a needle or a sharp blade. You will need lots of these washers. I find it convenient to bash out fifty or a hundred at a time, storing them in a matchbox conspicuously labelled TOP so that you don't open it upside down and empty your washers all over the carpet! Fix two washers to each end of each headstock. The side that was next to the lead and away from the punch will be slightly convex. You will get a sharper finish if this side goes towards the headstock. When the solvent is dry, drill 0.020 in and insert plastic rod to represent the nuts.

The buffers can now be fixed to the headstocks. I like to use turned buffer rams (heads), so if a white metal head is present I cut it off and drill the body to take the shank. Since I began building wagons in 1973, the position with regard to both buffer bases and rams has improved considerably, but there is still quite a long way to go. It is now possible to obtain reasonably accurate 1923 RCH buffer bases in 4mm scale from Kean Maygib, Mike Trice, and ABS, though in the case of the latter the webs need attention with a half-round needle file to make them curved instead of straight. The 1923 buffer base comes in two varieties; the one with the lip at the top goes at the door end to help to keep the sill in (although I have recently discovered a photograph of a wagon with no end doors – LMS Diagram 1666 – and lipped buffers!). On some buffers the web on the lip was straight, on others it was curved (check with photographs) and in the latter case your buffers will need further attention with the file. Even where the buffer has no lip, there is a 'correct' top and bottom; on the top, the rib stops short of the end, leaving a gap in which a shunter's pole can be rested, while on the bottom, the rib goes right to the end. I mention this because some modellers have been surprised when I have pointed out that one of their buffers is upside down! In addition to the sources mentioned above, a good selection of pre-group buffer bases can be obtained from D & S and Model Wagon Co. A source of Lancashire and Yorkshire Railway buffers was advertised in a fairly recent HMRS newsletter, but I have yet to try these. Studiolith used to produce a very nice buffer for earlier Midland wagons, and it is hoped that this may be reintroduced under the Exactoscale label before too long. Among the many buffer bases which cannot yet be bought is the round-based, four-ribbed buffer, very common on PO wagons during the last 15 years or so before grouping (again shown in Part 1).

The position with regard to buffer heads is not too good at the moment. The table shows the main dimensions of all those I know of, together with the 1923 and 1887 buffer rams for comparison.

	Head diameter (in.)		*Shank diameter (in.)*	
	Model	*Full-size requirement*	*Model*	*Full-size requirement*
Slater's 4mm	0.156	11.92	0.034	2.60
Slater's 7mm	0.297	12.92	0.069	3.00
ERG	0.176	13.45	0.049	3.74
Kean-Maygib	0.156	11.88	0.036	2.74
RCH 1923		13.00		3.00
RCH 1887		12.00		2.50

It will be seen that the Slater's 4mm buffer head is very close to the pre-1923 type, and their 7mm version is almost spot-on for the 1923 RCH standard. At the time of writing, Slater's are proposing to market their new 1923 RCH wagon kit in 4mm as well as the 7mm version already available. If this comes to fruition, their dead-scale 13 in. buffers would be most welcome. The Kean-Maygib buffer rams are not too bad for 1887-1923 wagons, despite the too thick shank, and they have the great advantage of being sprung, unlike Slater's 4mm version. Mike Trice uses these heads cast into his own bases, but for 1923 standard buffers, they are not strictly accurate. The ERG buffers (still available – see 'Miscellanea') have heads that are too domed (as well as being slightly oversize) and shanks that are much too thick. This can lead to difficulties in drilling the buffer base.

Getting back to construction, it might be a good idea to paint the headstocks at this stage. This is because on many wagons the ironwork was picked out in black; it is obviously far easier to do this with the headstocks flat on the workbench than perched up on the end of a wagon. Fix the headstocks to the floor of the

wagon with Uhu. Where the end pillars cross one headstock, use solvent. Apply the solvent sparingly to the inside of the end pillars and you will not have much touching-up of paint to do.

SOLEBARS

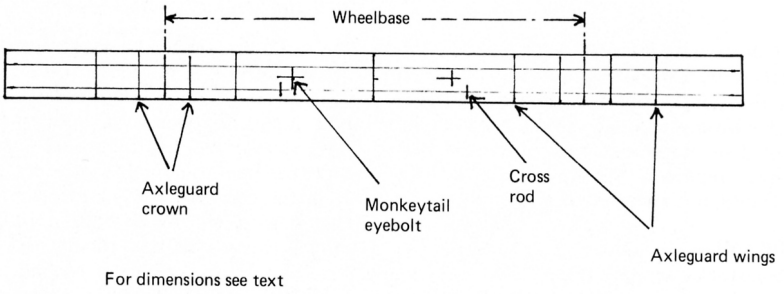
We can now turn our attention to the solebars. For pre-1923 wagons I make these out of 0.040 in polystyrene. Cut two strips 4mm wide and of such a length as to be an exact fit between the headstocks. (If the wagon is to be a 1923 RCH standard type, make the solebars from 0.030 in. This is to allow for the 1 in joggling of the V-irons – more about this later). Find and mark, with a sharp pencil, the exact mid-point along the length of each solebar. Place the solebars with the marked edges together, push the solebar ends against a square or a rule, and check that the centre marks coincide exactly. From the centre mark on each solebar, measure outwards half the wheelbase (18mm usually) and mark. Again, place the solebars together and check that you have marked accurately. Extreme care at this stage is essential. [Again if the wagon is to be 1923 RCH type with brakes both sides (as opposed to Morton brakes) the V-irons have to be fitted at an early stage. This having been done (as described later) marking out of the solebars can proceed.]

Still using a very sharp pencil, draw a fine line along the length of the solebar a scale 2½ in above the bottom edge. A slightly generous 1/32 in will be about right. Draw a second line parallel to it and 2mm above it. Now, working outwards from the wheelbase marks, mark the positions of the axleguard nuts on the two longitudinal lines; I often carry out this marking using one of the axleguards that I shall use for the wagon. On the lower longitudinal line, mark the positions of the cross rods 8mm out from the centre. Mark the positions of the monkey-tail eyebolts (if the wagon is to have bottom doors) – their centres are 6 in (2mm) above the bottom of the solebar and 3 ft 5 in apart (13 2/3 mm). Repeat all this on the other solebar. Each solebar should now look like *Fig. 6.*

Next, mark and cut four washer plates to the correct size (see *Fig. 2* in Part 1, *MRJ* No. 12) and fix them with solvent to the solebars, taking care that the axleguard wing bolt centres coincide with those marked on the solebar. Take a supply of plastic discs and fix them to the solebars at the remaining axleguard bolt positions, and also at the places marked out for crossrods and monkey-tail eyebolts. In some wagons, the inner, lower axleguard wing bolt took a bracket that secured the side rail to the solebar. If this is the case with the wagon you are building, cut strips of 0.010 in plastic, using your ironwork cutting jig. Cut squares of this material, and stick a square centrally over each relevant bolt position. The rest of the bracket will be added from the same strip after the solebars have been fixed to the body. (The coal salt wagon shown in the last issue has these brackets.)

From a strip of 0.005 in ironwork material, cut eight strapbolts each a scale 10 in (9 1/3 mm) long and round one end of each. Fix them to the solebars with solvent. The lower ones are centred 2¾ in above the bottom edge of the solebar – i.e. ¼ in (0.003 in) above your pencil line. There is no need to measure again; if you set the strapbolts so that you can *just* tell that there is more above the line than below, you will not be far out. The upper strapbolt is 3 in (1 mm) below the top of the solebar. I suppose I should have told you to mark out for this, but I don't think I usually bother, and it is so much easier to do than to describe! Leave a gap of 0.010 in or a little less between the outer end of each strapbolt and the end of the solebar. If you are really keen you can insert tiny slices of 0.010 in plastic rod here to represent the inner end of the 'bolt' part of each strapbolt. On the same centrelines as the strapbolts, and centred 2 in (2/3 mm) out from the edge of the axleguard wing/buffer trimmer knee/solebar washer plates, attach two more washers at each end of each solebar. Again, it is hardly necessary to mark out for these. Make sure that all washers and washer plates are securely attached, then set the solebars aside until next day.

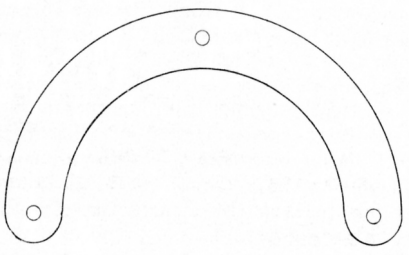
Fig. 6. Solebar marked out



For dimensions see text

All this assumes, of course, that you are making solebars with separate washers. For pre-1923, and for some standard wagons, you will need crownplates and wing washer plates. For the crownplates you will need a punch, turned and filed to the dimensions in *Fig. 7.* When I made my punch, I drilled three small depressions so that it would also punch out the 'rivets' (the *what*!!!?). As you all now know, the 'pimples' are really nuts and are best applied separately. I really ought to have another punch for wing washer plates, but so far I have not got round to making one, so I still have to make these plates from ironwork strip.

Fig. 7. End view of crown plate punch

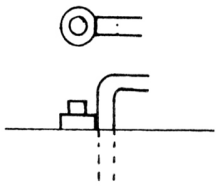


Outer dia. 5.08 mm
Inner dia. 3.58 mm

Readers who have followed my account thus far may have realised that I appear to have ignored a serious snag – 0.005 in plastic is no longer available. When I became aware of its impending disappearance, I took care to lay in a fair stock – enough, I hope, for many years – but this does not help the newcomer. One solution might be to sand down 0.010 in sheet, in strips, a fairly small quantity at a time, as you don't need much for a wagon. I have also investigated another material . . . Being unmarried, and having to cook for myself, I occasionally resort to kit-built meals, though, as with wagons, I find the scratch-built item much more satisfactory. In the 'Vesta' range of products (curry, paella, etc.), part of the kit is contained in a composite material, paper on the outside, metal on the inside. The thickness is 0.003 in – actually nearer to scale than 0.0050 in plastic – and the paper side seems to bond quite well to plastic or treated wood. Although in principle I am opposed to the use of scrap in models (I long since learnt to consign empty toothpaste tubes to the dustbin!) this material may have possibilities and I offer it as a suggestion.

But back to the solebars, to which we should return when the solvent is fully dry. Mark and drill for all the nuts. Insert short lengths of plastic rod or wire, according to availability or choice, and secure them with the appropriate solvent or adhesive. When everything is hard, cut off the surplus pieces at the back of the solebar. If the solebar has square nuts, you will need to cut strips of plastic the right width, and then chop off squares, as with the body. The nuts on the solebar were larger and therefore also thicker, so use 0.015 in plastic this time. If you are very keen, or have a few minutes to spare, you can add tiny slivers of 0.010 in plastic rod to the centre of each nut, to represent the ends of the bolts; the Oxcroft wagon has these (what do you mean, you didn't notice?). Add the horse hooks (see *Fig. 8* for fixing), having determined their position from a photograph if possible. Fix the bearing spring stops – these were not used with 9-plate springs. The pressed steel type is often supplied with the spring, and the cast type can be fabricated quite easily from plastic strip and rod. Remember that, although we are using 0.040 in solebars, the spring stops should really be on the longitudinal centre line of a 0.065 in solebar, and a further 0.013 in towards the

Fig. 8. Horse hooks and commode handles



centre of the wagon on a 1923 standard wagon, as each solebar is 0.013 in (1in) further from the centre. Perhaps you would prefer to wait until the solebars are fixed – I often do.

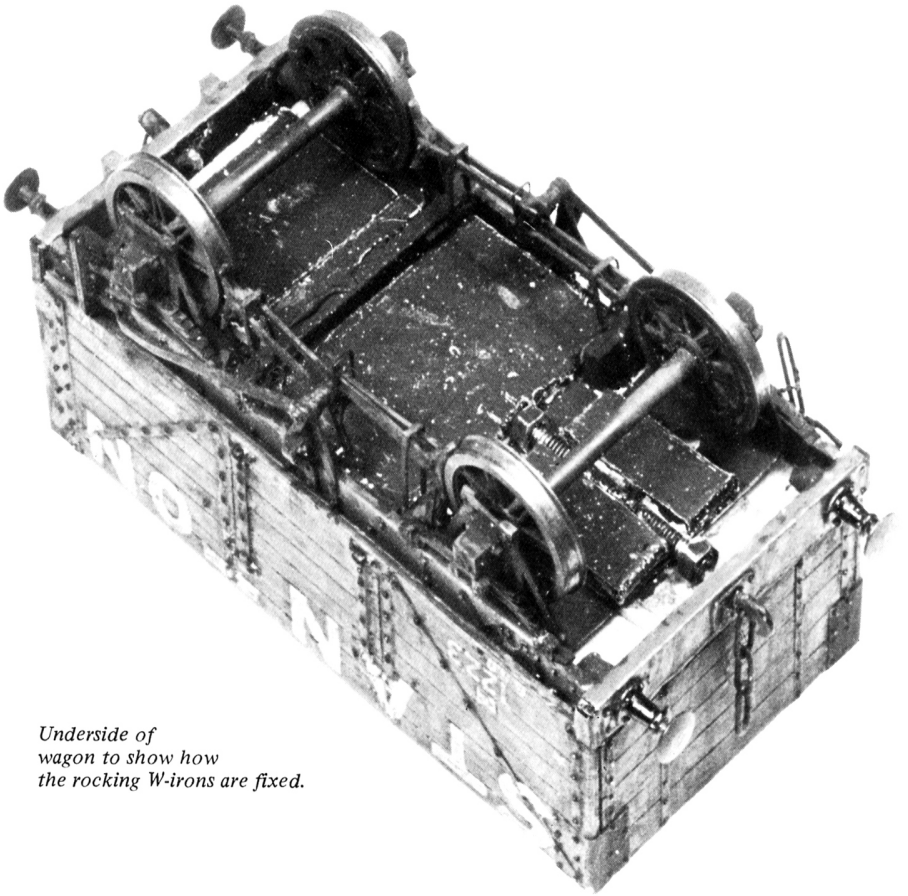
Paint the solebars and pick out the nuts, washers, and washer plates in black, if necessary. Paint the outer ends of the inner faces of the headstocks, which you probably forgot to do earlier, and glue the solebars to the floor with Uhu when the paint is dry, and bond them to the headstocks with solvent applied from the inside. The outside faces of the solebars should be 6 ft 11 in (27 2/3 mm) apart for a pre-1923 wagon, or 7 ft 1 in (28 1/3 mm) for a 1923 standard. If you have planned ahead, you will already have these lines drawn on the underside of the floor, but if you are like me, you will have forgotten and will have to manage without. Now that I have written it all down, I shall probably remember next time!

COMPENSATED SUSPENSION

All my wagons have been built with compensated suspension, right from the very first one. Not only does compensation keep them on the road, it also seems to make them move much better and look much heavier than they really are. Much to the disgust of some of my Scale-four Society friends, the Chairman in particular, I still prefer the old Studiolith axleguards (W-irons); they were strong and cheap, and held the bearings firmly, which not all of the more recent types do. I am glad to say that I still have a good stock – do all modellers hoard things I wonder? For those without such a stock, there are plenty of etched W-irons available, probably better detailed, though more expensive. For the rocking W-iron unit, I still prefer the method devised by Ken Morgan and described in *Model Railways* in October 1973.While allowing each axlebox to move up and down, it gives the very positive location which is essential for my method of axlebox-spring separation. The type of location that depends on twisted lugs is, to my mind, too sloppy. For those who do not have the original article, here's how Ken's system works:

Solder an 18mm length of 10BA studding to the longitudinal centre line of the underside of one of the suspension units. I bought the studding from Whiston's of New Mills but it may not still be available – the old story! – although there should be a metric equivalent. If not, use a long 10BA bolt with the head sawn off, run a 10BA nut on to each projecting end and solder each nut on to a piece of 0.008 in brass or nickel silver. This combination of sizes should add 0.020 in to the spacing between the compensation unit and the wagon floor, but, owing to my ham-fisted soldering, I never take

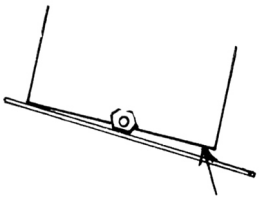
The prototype of the Stanton wagon was built by Eastwoods. 1223 started life with side, bottom and end doors, but the end door was blanked off and the small corner plates fitted, probably in pre-grouping days. The letters EEC (Edward Eastwood, Chesterfield) are reproduced on the scratchbuilt Ellis axleboxes. We now think of Stanton as ironworks, but in pre-nationalisation days they were also colliery owners in quite a big way.



Underside of wagon to show how the rocking W-irons are fixed.

this for granted. A little care is needed to ensure that the unit rocks freely. To check that all is well, hold the nickel silver plate with small pliers and tilt it slightly to one side. Lift the downhill end of the suspension unit and release it. It should drop under its own weight, the studding turning in the nuts. If it is too stiff and fails the test, adjust the nuts with the soldering iron until all is well (*Fig. 9*). The bearings can now be pressed into the axleguards. Check that they are sitting squarely, in all planes, and spring in the wheelsets. Adjust the axleguards so that the ends of the pin-point axles run in the ends of the coned bearings but

Fig. 9. Checking rocking suspension units



Lift here. Unit should fall back under its own weight

are not under any inward pressure. The wheels should then run very freely.

The axleguard units, with their wheels, can now be mounted on the wagon, placing the non-rocking unit first. Doing a dry run, without any adhesive, insert plastic packing pieces between the floor of the wagon and the compensation unit until the distance between the bottom of the solebar and the centre of the bearing is exactly 5½ mm (1 ft 4½ in). If you get this right you will not need to worry about the buffer height, it will be set correctly automatically. (I have never yet had to set the buffer height, as described in many of the older articles.)

Bond the packing pieces together with solvent and fix them to the suspension unit with Uhu. When reasonably dry, offer up the whole assembly to the wagon, do a final height check, and glue the unit to the wagon floor – Uhu again. Make sure the unit is positioned squarely across the wagon. The axleguard legs and wings should line up with the appropriate bolts on the solebars. Make sure, too, that the unit is properly centred on the wagon's longitudinal centreline. Leave the wagon until the next session for the adhesives to harden.

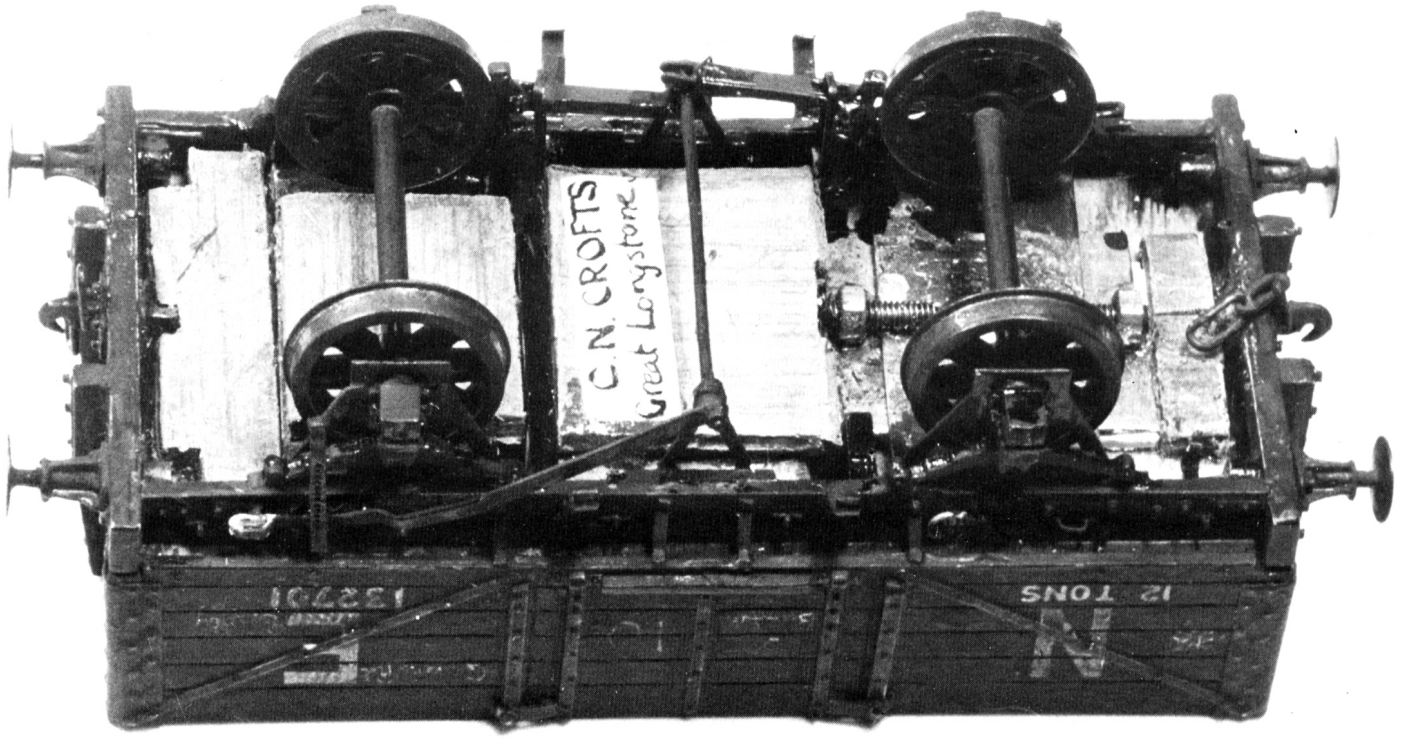
Repeat for the rocking axle. This end should require 0.020 in less packing, but I always check that the bottom of the solebar is level with the wagon standing on its wheels. I usually check by eye, but it would be possible to use a strip of, say, 0.030 in plastic 8 2/3 mm wide as a gauge. With the wagon standing on a flat surface and the plastic strip under a solebar, there should be an even line of daylight equal in width to the flange depth between the strip and the solebar. When satisfied, glue the rocking unit in place. As well as the checks described previously for the fixed end, make sure that the distance between the bearing centres is exactly 36mm (or whatever) both sides. Before the glue sets, stand the wagon on a smooth surface, such as a Formica-topped table, and blow it along. It should roll dead straight; if not, adjust the newly fixed axle. When satisfied, allow the wagon to stand for the glue to set.

We now have a wagon which, if supplied with couplings, could run on the layout. However, it would look rather odd without springs, axleboxes, and brake gear, so we must now turn our attention to the provision of these items which are, of course, only decorative in the model.

SPRINGS

Springs, at least on 10- and 12-ton mineral and merchandise wagons, were usually either five-plate or nine-plate. The latter were not used for new construction after 1923. Prior to this date, cast spring shoes were usually used with both types of spring. After 1923, pressed-steel shoes were used. Wagons with steel frames had spring shoes with an extra piece of bent metal at the top, to space the shoe out from the shallower solebar. These should not, of course, be used with wooden solebars, though I have seen it done on models. I have even done it myself, before I knew better!

Springs and axleboxes may be obtained separately, the Scalefour Society have quite a good selection in their list. Alternatively, the spring may be cast integrally with the axlebox, in which case a break must be made, at least at the end with the moving axleguards. Where should the break be made? Some people leave the spring shoes free from the solebar, thinning the shoes to leave clearance for rocking. Others saw through the ends of the springs, fixing the spring shoes to the solebar and leaving the rest of the axlebox/spring unit attached to the W-iron. Yet others saw straight through the axlebox just below the spring. I do not like any of these approaches; instead, I make an L-shaped cut with a M4/0 piercing saw, starting



downwards in front of the spring buckle and turning inwards below the spring. This leaves the front of the axlebox intact, and the gap is disguised better than in the other methods. The gap can be increased and cleaned up as necessary using files (see *Fig. 10*).

Fig. 10. Separating spring from axlebox

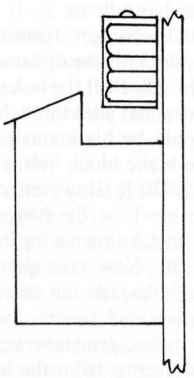
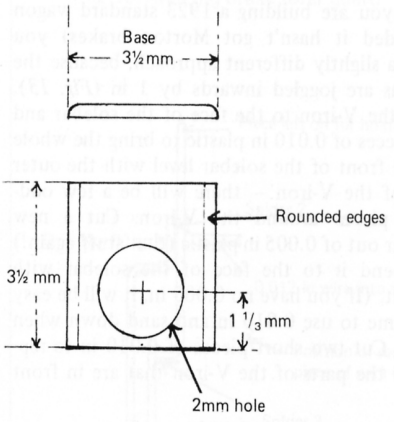


Fig. 11. Axlebox base



AXLEBOXES

As with buffer bases, so with axleboxes. The position has improved somewhat over the last ten years, but there are still types that cannot yet be bought. The best 1923 standard axlebox was the one produced by Studiolith. Bernard Weller tells me that he hopes to be able to market it again in the Exactoscale range. Slater's are due to produce a similar box, which should be very nice, when they release their new 1923 standard wagon in 4mm scale. Being plastic, it should take kindly to such small modifications as the fussy modeller may deem necessary. Slater's also do an Attock's axlebox for 10-ton wagons and a Midland oil box.

When it comes to the provision of axleboxes for the older PO wagons, the position is not so good. One of the snags is that the standard 4mm scale bearing is 2mm (6 in) diameter, and some axleboxes were only 6¾ in across the front face – or only 6¼ in in the case of the Midland 8A box – there simply isn't room to get the model bearing in *and* leave a thickness of material adequate for strength at the sides, so manufacturers have had to compromise by making the axleboxes too wide. But we don't want compromises in finescale modelling, do we? So what's to be done? The answer is – scratchbuild them! No, I'm not joking, it's quite easy really, and here's how:

Fit the bearings to the axleguards. If the axleguard is one that allows the bearings to slop about, secure them with solder or other suitable method. Drill a 2mm hole in a piece of 0.010 in plastic and slip it over the bearing – this protects the axleguard and the bottom 0.010 in of the bearing. File flats on the sides of the bearing. If a box 6¾ in across the face is required, the calculation is as follows:

Required distance across face	= 0.089 in.
Diameter of bearing	= 0.079 in.
Plus 2 sides @ 0.010 in each	= 0.099 in.
Amount to be removed, therefore	= 0.010 in.

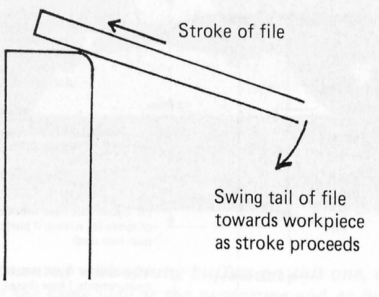
(i.e. 0.005 in from each side of the bearing).

This sounds complicated, but it isn't really. The amount to be filed off is not too critical, as long as you take enough, and there is plenty of 'meat' in the bearing. Try to file square, though, in both planes. (I must apologise again for the mixed metric and imperial units. I use an imperial micrometer, and a calculator where necessary!).

Remove the piece of plastic that protected the axleguard. Drill a 2mm hole in another piece of 0.010 in plastic to the dimensions in *Fig. 11* and radius the sides with a file. This will represent the wider part of the box that slides (in the prototype) in front of the axleguard. Slip it over the bearing, and this time secure it with solvent. Make sides from 0.010 in plastic to the axlebox shapes and dimensions shown in Part 2, *MRJ* No. 13. Secure to the base with solvent, making sure that the sides are square in both planes – the bearing will help. Make fit, and secure pieces for the front, top, and bottom of the spring well. No need to fit a bottom – the real ones have open bottoms. Next day file the front smooth; the joints with the sides will disappear. Add details – lid and its spring from 0.005 in plastic, hinge from 0.010 in rod, lugs from thicker plastic, shaped, until you feel you have gone as far as your patience will allow. You can put letters on the front if you wish – Stanton wagon No. 1223 has E_CE – standing for 'Edward Eastwood, Chesterfield' – made out of slivers of 0.005 in, teased and stuck into place. Smaller lettering can be represented by lengths of the same material, cut and gouged into 'letters' when the solvent is dry. It should be possible to treat the new Slater's box in this way. 'Lettering' done like this can be most effective when painted. I have had Bill Hudson peering at 'cast iron' plates through a x 10 lens and wondering how it was done!

I have not, so far, fabricated a united Ellis box in this way, but this is how I propose to tackle it. Mount a piece of wooden cocktail stick in the electric drill held in the vice, sand the stick down until the diameter is the distance of the box across the face minus 0.020 in (care is needed here; stick wet and dry paper to a piece of wood and *keep your hands away from the chuck*.) Cut 0.010 in plastic for the sides of the box, and bend it through 180° round the stick, using hot water and smooth-jawed pliers, as for end door bands. It might be easier to make the top part of the box sides separately, to allow for adjustment of final height. Shape a piece of 0.010 in for the front of the box (*Fig. 12*). I think in this case it might be better to mount the face in front of the sides, instead of between them. Then proceed as before.

Fig. 12. Filing curves



Before leaving the subject of axleboxes, I ought to mention that some nice white metal castings suitable for various pre-group wagons are available from D & S, Model Wagon Co., and no doubt others.

BRAKES

Before fitting the brake gear, we need to add the middle bearers, made from 0.060 in plastic and set at 18 mm (4 ft 6 in) centres. The one at the end with the rocking axle will have to be in two pieces, as the compensating mechanism gets in the way of a complete middle bearer. The section of solebar between the middle bearers can now be thickened out to the full scale width – 0.065 in.

V-irons: The brake V-irons can now be added. Logically, I suppose this should have been done at a much earlier stage, and now that I have had to think things through properly to write the article, I shall almost certainly fit them before painting the solebars in future. On reflection, I think that my reason for leaving them so late was that they had to be made. This was a job I disliked, so I put it off. Now it is possible to buy some beautiful etched V-irons from D & S Models, although perhaps I shouldn't be too fulsome because Dan Pinnock had them etched from a drawing that I supplied. The little washers in the etch are soldered over the bottom end of the V-iron to form the thicker boss; Dan very thoughtfully added a few spare washers to make up for those you lose – a very good idea. If you don't lose them you can solder them on the ends of brake levers to make the thicker end of those. Drill the bolt holes in the V-irons No. 77. I like to solder at least one piece of 0.017 in wire into at least one hole on each leg; this wire goes right through the solebar into the inner V-iron and helps to ensure that nothing falls off. Leave a short length of the wire projecting at the front of the V-iron to represent the nuts.

Using a mini-drill in a stand (which I haven't yet got) and holding the pieces of wire in a hole in a small block of wood while you solder (to avoid melting the solebars), it should be perfectly straightforward to fit all four pieces of wire if you plan ahead and fix the V-irons

before the solebars go on to the wagon. Fit the V-irons so that the soldered-on washer on the outer iron is on the outside of the wagon, while that on the inner iron faces the centre of the wagon.

If you are building a 1923 standard wagon (provided it hasn't got Morton brakes) you need a slightly different approach, because the V-irons are joggled inwards by 1 in (*Fig. 13*). Glue the V-iron to the face of the solebar and cut pieces of 0.010 in plastic to bring the whole of the front of the solebar level with the outer face of the V-iron – there will be a few odd-sized pieces around the V-iron. Cut a new solebar out of 0.005 in plastic (that stuff again!) and bend it to the face of the solebar with solvent. (If you have no 0.005 in, it will be easy this time to use 0.010 in and sand down when hard.) Cut two short pieces of 0.010 in to represent the parts of the V-iron that are in front

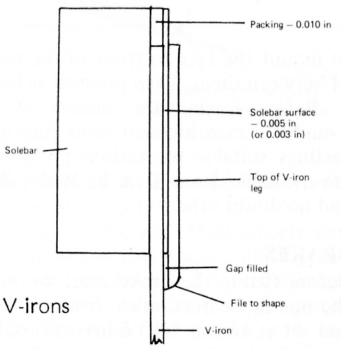


Fig. 13.
Joggled V-irons

of the solebar; these pieces should project a short distance (about ½mm) below the bottom of the solebar. Fill the gap between the pieces you have just fitted and the metal V-irons with tiny slivers of 0.005 and when dry, file a curve on the plastic pieces to represent the joggle. When painted, this deception will be almost impossible to detect. Before painting, though, add the V-iron nuts. It would have been a good idea, too, to blacken the V-irons chemically before starting, now that suitable blackening liquids are more readily available.

The brake shaft between the two V-irons runs in a ferrule 3 in in diameter, and models usually have this much too thin. Insert a short piece of 0.030 in plastic rod in each V-iron hole, and fix with solvent. Leave a short length sticking out on the inside to take the brake tumbler, and another short length sticking out on the outside to take the brake lever. On the surfaces of the V-irons that face each other, the plastic should be flush with the metal. The plastic rod seems to vary in diameter, and it should be possible to find a piece that is a snug fit in the holes. Now cut a short length of 0.040 in rod (it *should* be the same length as your solebar thickness, i.e. 0.065 in) and fix it between the V-irons, cementing it to the ends of the smaller rod in the irons.

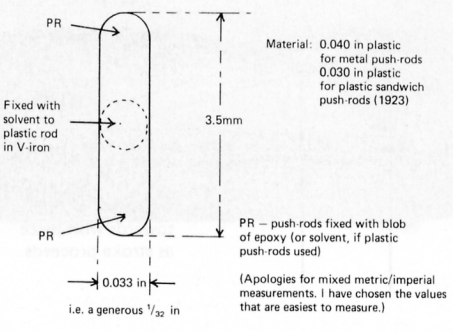
Brake block assembly: We can now tackle the brake block assemblies. I prefer to use separate blocks, and by far the best block ever produced for 4mm scale was the old Studiolith item. Unfortunately . . . However, now that a drawing has been published (see Part 1), it is to be hoped that one of the more enterprising white-metalsmiths will have a go. Having had another look at the brake block drawings, I realise that it would be possible to solder them together from three etched pieces, two 0.015 in etchings flanking one of 0.010 in. I must pursue this idea. Assuming that you have a supply of separate brake blocks (old stock, new product, cut out from kits, or scratch-built – yes, I have tried it!), proceed as follows:

Cut two brake hangers from 0.008 nickel silver for each block to the dimensions given in Part 2, *MRJ* No. 13. Drill the holes at the ends. The piece of wire that goes through the hangers and blocks should be big enough to represent the nut on the brake block bolt, so you really ought to drill 0.020 in. However, you may find that the brake block or the hanger hasn't got enough 'meat' to take such a big hole, in which case drill No. 80. Now take short lengths of wire to fit the holes, file the outer end of the wire for the lower end square, and solder the wire into the holes, remembering to leave a short length projecting from the lower hole to represent the nut. Cut a length of 0.040 in plastic 1mm wide and 4mm long, drill a No. 80 hole through the plastic half-way along its length – this will be the bracket to suspend the brake hangers from the middle bearer. Thread a brake block on to one of the pieces of wire soldered into a brake hanger (make sure you get it the right way round!) and thread the hanger bracket on to the other piece. Thread the inner brake hanger over the ends of the pieces of wire, and secure with two tiny blobs of five-minute epoxy. When the glue has set, snip off the surplus lengths of wire.

The next job is to make the push rods. The dimensions are given in *Fig. 9*, Part 2. For a 1923 standard wagon, I make the push rods out of plastic, 0.010 in for the push rods proper and 0.030 in for the wood packing. This gives an overall width only fractionally over scale. When the solvent has dried, drill through and insert tiny pieces of plastic rod to represent the nuts on the bolts holding the pushrod together. The holes at the brake block end (drilled before assembling the three pieces of the push rod) are No. 80. You may or may not wish to drill the adjusting holes at the other end. They should be 0.011 in, and a sharpened piece of 0.011 steel wire will suffice. Most of these holes tend to disappear when the push rods are fixed in place, but you will need one hole in each plate of the right-hand push rod (facing the wagon) for the inner safety loop. If I am building a pre-1923 wagon I prefer to make the push rods out of 0.008 in nickel silver for greater strength.

Make a brake tumbler from 0.030 in plastic (0.040 in if you have made metal push rods) to the dimensions given in *Fig. 14*. Slide the

Fig. 14. Brake tumbler



tumbler over the brake shaft projecting from the V-irons and fix it with solvent – it should lie roughly along the line of the left-hand leg of the V-iron as viewed from outside the wagon. Leave enough room for the upper push rod between the tumbler and the V-iron.

Make an inner safety loop to the dimensions given in Part 2 – I make mine out of 0.008 in brass wire. A note on my copy of the drawing reminds me to anneal the wire by heating to red heat very briefly and allowing to cool. If you don't do this you are liable to break the wire when forming the sharp bends – something else I found out the hard way! Assemble the safety loop to the upper push rod; there is no need to fix it – it simply sits in the holes just like the full-size item. If you feel so inclined, you can blacken the loop chemically (and any other metal parts, for that matter) before assembly.

Arrange the upper push rod, its brake block and hangers in approximately the right position relative to each other and offer the assembly up to the frame and tumbler. Secure the hanger bracket to the middle bearer with solvent and the push rod to the tumbler with a blob of five-minute epoxy (or solvent, if push rod is plastic). Adjust the components so as to get the brake block as near as possible to the wheel. At the end with the fixed axle you should be able to get really close, but at the end with the swinging axle you will always have to leave a little daylight to allow for movement. When the adhesives are dry, repeat for the lower push rod, threading it through the safety loop. When the adhesives are set, paint any parts not already blackened – it will be more difficult if left until later.

Safety loops: Cut safety loops from 0.004 in nickel silver, bend and twist to shape. Try to get the bends at the bottom two right angles and not a continuous curve. Always be on the lookout for safety loops that differ from the usual standard – I mentioned the Midland type in Part 1. Paint or blacken the loops. (I am still using paint, holding two loops at a time by their open ends in a pin vice) and when dry, fix them to the middle bearers with solvent. Then bond a short piece of 0.010 in plastic across the legs of the loop to secure it properly.

Lever guards: You now have to tackle one of the trickiest jobs on the whole wagon – the brake lever guards. Their construction is shown in *Figs. 5, 15, 16 & 17* in Part 2, *MRJ* No. 13. It will be seen that the 1923 standard lever guard is made from three pieces of metal, while the earlier type uses only two. I start by sawing off a long strip of 0.006 in brass, 2/3 mm wide. The sawn edge is cleaned up by filing so that the strip is the correct width throughout its length. You now have to think about the holes. If you use the smallest readily available drill – No. 80 – you will find that the holes will be considerably oversize and that you cannot get the correct number (15 for a 1923 standard wagon) into the available length. Ideally, the holes should be 0.007 in diameter. I did once have some drills of this size, but then all got broken or lost. I am not usually in favour of making things oversize 'so that they will show up better' (have you ever heard of anyone applying this argument to an unrebuilt Royal Scot chimney?) but in this case I have found

0.009 in to be an acceptable compromise. Very small drills are now available (at a price!) – see *MRJ* No. 9 page 205 – or you can use a piece of 0.009 in entomological pin sharpened to a chisel-shaped end. In the latter case, start the hole with a No. 80 drill, but stop before the hole has been opened out to the full diameter and finish with the pin; the use of two pin chucks, one for the No. 80 drill and the other for the pin, is recommended. Incidentally, for any readers who have never drilled tiny holes by hand, the method is extremely simple: put a drawing pin in the 'non-business' end of the pin chuck; this rests in the palm of the hand, while the chuck is turned with the first finger and thumb. However, the use of this improvised drill always seems to leave a 'pimple' on the back of the metal; these can be removed with a sharp scalpel blade.

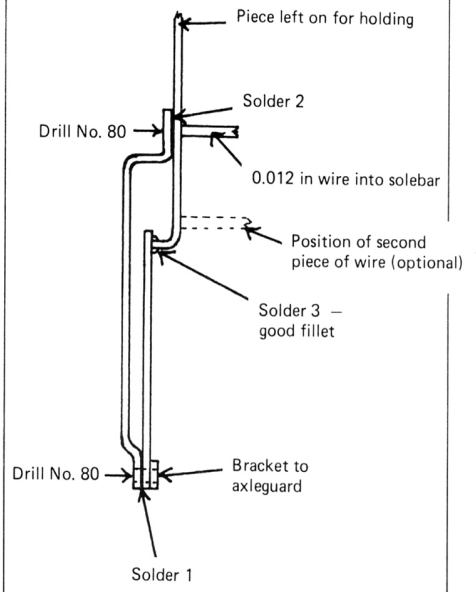
Whatever size drill you decide on, mark the position for the first (bottom) hole 2½mm from one end of the strip. Drill as many holes as you require – or as many as you can get into the available length. Now bend the bottom of the brake guard to shape, taking care that the inward bend is in the correct place and is not centred on the bottom hole – again, I learnt this the hard way! Bend the top of the guard to the shape shown in my drawings in *MRJ* No. 13. Cut a piece of your 0.006 in strip a fraction under 8mm long – actual length was 23½ in – to be the back plate of the brake guard. You can drill holes in this too if you are feeling keen, but I must admit that I don't usually bother (cries of 'shame!'). Solder the back plate to the front plate at the bottom, making sure that the plates are parallel in both planes.

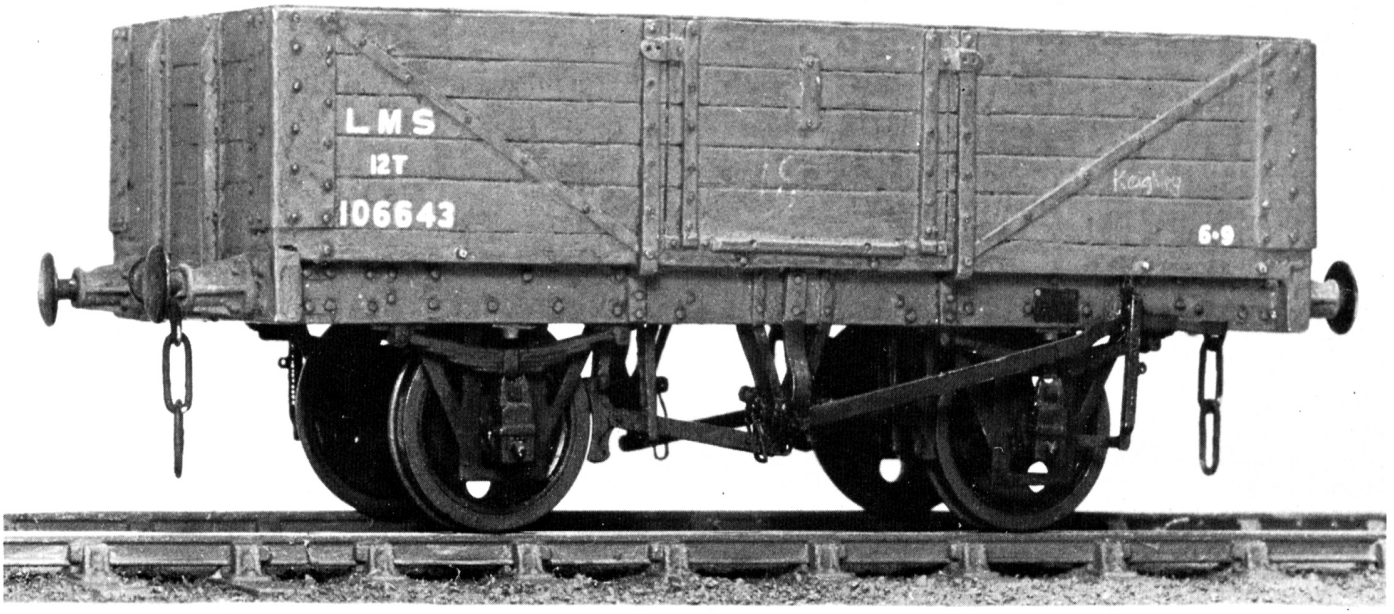
Take the remainder of your strip and file one end square. You are now making the part of the brake guard that goes against the solebar, again as shown in the drawings. Bend the terminal 2/3 mm forward and offer it up to the top of the front plate; the end of the bent forward portion should just touch the back plate. Adjust by filing the end of the bent piece if too long (best to make it thus, really) or judicious bending if too short. There is no need to cut this small piece from the rest of the strip at this stage; leaving the waste gives you something to hold. Solder the final piece to the front piece, making sure that they are parallel in both planes, and solder the bent-forward end to the back plate, using a good fillet of solder to make a strong joint (*Fig. 15*).

Now back to the drill: mark for the holes at the extreme top and bottom of the brake guard and drill No. 80. Insert short pieces of 0.012 in or 0.013 in wire and solder them in, leaving short lengths projecting at the front to represent the nuts. The piece of wire at the top will help to secure the guard to the solebar, while that at the bottom secures the bracket-brake guard to axle guard.

At this stage, you need to consider whether to make and fit the lug for the pin and chain. Although fiddly, this job is not particularly difficult. Drill a 0.009 in hole near the end of a piece of brake guard strip. Using a flat needle file, round off the end of the strip around the hole. Holding the part that will become the lug in a pin vice or smooth-jawed pliers, saw off the surplus strip and square up the lug with the needle file. Put the lug where you will be able to find it – e.g. on a white saucer. Prepare a piece of wood to fit between the front and back plates of the brake guard – I do this by filing a strip of 1/32 in ply. Drill a 0.009 in hole in the wood, and insert a short length of ento-

Fig. 15. Making brake lever guard





This LMS Diagram 1666 wagon is scratchbuilt. I experimented with sprung buffers on this one, and the right-hand buffer appears to be pushed in. Amazingly, the model has sagged at the ends in exactly the same way as the prototype and to just the right degree! Check by placing a ruler along the lower edge of the solebar. Note also properly joggled V-irons. The LMS had 70 of these wagons for each 4F!

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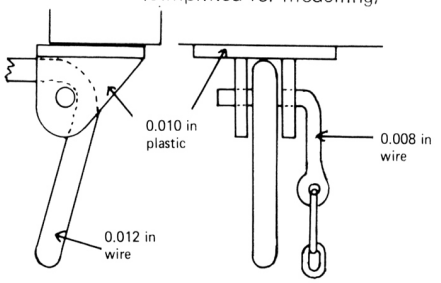
the hook, carefully adjusted to make sure they are not twisted (not always successful, this, as some of the photographs show!) and then soldered. Photographs show that most railway companies and private owners did not use brightly polished metal for wagon coupling links, so the couplings are now painted, first matt black. You cannot do it all at once; you have to keep coming back to the job to do the bits you have missed. Again, chemical blackening might be the answer, but with brass hooks, two nickel silver links and one iron link, it might not be easy. Finally, Humbrol track colour is applied with an almost dry brush to simulate rust. I must have achieved some measure of success with this, as Bob Barrott once took me to task for having rusty coupling links, saying that I ought to paint them! He just would not believe that the effect was deliberate!

FINAL DETAILS

Door bang springs: I usually leave these until a late stage, though there is no real reason why they shouldn't be fitted much earlier. 1923 standard springs were made from two ½ in plates, 4 in wide (and the tendency on models is to make them too narrow). I use 0.006 in brass cut to 1 ⅓ mm width. The outer plate is

Fig. 16. Bottom door fastening (Simplified for modelling)



formed first, the radii being checked against rod of the appropriate diameter – see *Figs. 3 & 4* in Part 1, *MRJ* No. 12. The inner plate is then bent to fit and the two soldered together at the top. Holes are drilled No. 77 and pieces of wire inserted with the ends of the pieces representing the nuts, as in previous applications. The wires go right through the solebar and make sure that the springs don't come adrift.

Bottom door fastenings: The monkey tail bracket is fabricated from tiny pieces of 0.010 in plastic (*Fig. 16*). The bottom door handle is bent up from a piece of suitable wire and the pin is made from 0.008 in wire. One end is flattened in the pliers and a hole (as small as you like, 0.009 in max) drilled through. 0.004 in copper wire is wrapped round a suitable drill shank (it should be 0.026 in) to make the first link of the chain. This is cut off, made into a flat ring and threaded through the hole in the pin. The wire is now wrapped round the shank of a No. 80 drill to form a 'spring'. A fine scalpel blade is inserted in one end of the 'spring' and circles cut off. These are worked into links using very fine forceps and the whole assembled into a chain. You need nine short links, as well as the ring on the pin. A final loop of the wire will secure the chain to the solebar. Future chains will be blackened chemically. I do not pretend that this work is easy and you will need whatever aids to vision you have available!

Sheet rings: These are easy, and not all wagons had them anyway. Make the rings in the same way as the rings on the monkey-tail pins. Secure them to the solebars with a loop of 0.004 in wire passed through a No. 80 hole and fixed at the back. Tease out a strand of dark brown cotton and tie it through one of the rings to represent the end of a sheet line left where a lazy goods porter cut the line rather than undo the knot.

This was my second attempt at a brake van; the first had to be scrapped. This one was meant to be a quickie, made from two Slater's Midland brake van kits. In the end I used the inner ends and scratchbuilt the rest! Buffers are MPD (now Slater's) Midland loco buffers – almost correct. They are sprung, but as the model pre-dates Hubert Carr's metal black they are gunged-up with paint. This van has special significance for me because in building it I learnt how to paint plastic and metal to look like weathered wood – needed for the platforms and steps. The van appears as it might *have been repainted in LMS smudge – dark grey – and with letter racks removed.*

Handles: Many wagons, especially vans, had various handles on the body. These handles are basically similar in construction to horse hooks (see *Fig. 8*). They are represented by a wire of a suitable diameter (0.011-0.013 in is about right) bent in the form of a staple and secured with tiny blobs of epoxy into No. 80 holes drilled through the sheeting. The full-size handles were, of course, fixed in an entirely different way. The ends were bent up and flattened, a hole drilled through the flattened part, and the handle bolted to the wagon. This fastening is easily represented by tiny discs or strips of plastic secured adjacent to the ends of the handle. A small piece of 0.010 in rod can be fixed to each disc to represent the securing nuts.

Plates: Wagons had numerous cast iron plates, mostly on the solebars, but occasionally on the fast end between the end pillars. These should really be etched. However, until I can get round to preparing the necessary artwork, reasonable substitutes are made from 0.005 in plastic painted black. The lettering and raised edging of the larger plates are applied with process white and the fine mapping pen. A good thick application of the process white will actually give raised letters and edging. For smaller lettering, strips of plastic are stuck on to represent words. When dry, the strips can be teased into 'letters' with a scalpel blade and a needle. Such plates can look quite effective when painted. For all these operations the plates are held to a piece of hardboard with double-sided tape. Finally the plates are secured to the wagon with a tiny blob of Uhu.

WEATHERING

At first I could not bring myself to dirty my newly built wagons. I suspect this attitude applies to many modellers, and it seems to be more prevalent in 0-gauge than in 4mm. At exhibitions, one sees pristine locomotives pulling ex-works coaches and wagons past freshly painted stations, signal boxes and signals. Workers in 4mm seem happier to make their models resemble the real, scruffy thing, and eventually I talked myself round to this attitude. All my wagons are now weathered. I use very simple techniques, applying track colour and dark grey with an almost dry brush until the desired degree of filth is reached.

I begin below the solebar. Track colour is applied thinly and unevenly to axleguards, axleboxes, springs, and brakework. With a little experimenting and care, it is possible to create the effect of rust bubbling through old paint. The track colour gives a good impression of old rust mixed with dirt.

The body is dealt with next. The brilliant new paint can be toned down with a thin layer of grey – LNER wagon grey seems about right. The lettering seemed to disappear first where it crossed the ironwork, and this is attended to.

For wagons in a more advanced state of weathering, it would be necessary to begin much earlier, adding white to the red body colour to give a pink wagon and using much thinner paint for the lettering so that the base colour showed through. Sometimes the white letters all but disappeared, leaving the black shading, which seemed more durable. Some railway-owned wagons had the lettering, or parts of it, renewed without receiving a full repaint.

CONCLUSION

I hope that readers will have found this account interesting, and that some will have been stimulated into having a go. Obviously, my methods are not suitable for those who require a layout tomorrow or sooner. A lot of time is involved, but how long do you expect to live? I hope to have enough time left to build several hundred more. Finally, try to ignore the occasional sneers from those who consider wagons beneath them; remember that for most of the railways' history it was the wagon fleet that provided the real money. If you keep this thought in mind, and when you have spent perhaps 100 hours on a wagon, you will be less inclined to perpetuate the use of the epithet 'humble' as applied to goods stock.

In the first part of this series Chris Crofts used the famous Hull Corporation 'Electricity' vehicle as an illustration of a 1923 standard without *side doors (*MRJ *No. 12) and speculated on its fate after the 1939 pooling arrangements. 'Lacking side doors', he said, 'it would have been quite useless for deliveries to coal merchants'. As ever, one of our readers has been able to shed some light with this 1957 photo of the wagon's battered sister at Southall, Middlesex. Overmarkings show that it was still very much in business at the time. Our thanks to John Johnson of Hayes for the picture. Can anyone be specific about the vehicle's use and ultimate fate?*

J. F. C. JOHNSON