

SCRATCHBUILDING MODEL WAGONS

In the third part of his widely acclaimed series, CHRIS CROFTS, having discussed the anatomy of common private owner wagons at length, gets down to modelling them in 4mm. Here he describes his own perfectionist methods for building and painting bodywork.



One of two wagons built together, and representing a type not often modelled, LNER Diagram 2. Both were built by Charles Roberts. No. 132701 shows the position of the lettering when new. I counted the number of components in one of these models, and although I have mislaid the record, I seem to remember that there were around 670 bits to be cut, shaped, and fixed. Buffer heads are Studiolith, rather oversize on the heads but reasonable shanks.

Model photographs by RICHARD WILLE

I built my first model wagon in 1973, using what seemed to be the best techniques described up to that time. As I gained experience, I found that many of these techniques were not really very good, and, slowly, better methods were evolved.

I like to start a wagon by building the body. Once I have got the body made, painted, and assembled, the sight of it gives me the necessary stimulus to proceed with the frame and running gear. The bodies are usually made from 1/32 in ply, which can be obtained from shops catering for aeromodellers. This material is about the right thickness for wagons with 2½ in sheeting. I have to admit that it is really too thin for wagons with 3 in sheeting, but so far I have not been able to find a supply of true 1mm ply. I chose wood rather than polystyrene because I found the latter unsatisfactory in two important respects: (a) the wagon sides tend to bow inwards in a most unrealistic manner, (b) it is difficult to make plastic look like the unpainted wood on the inside of the wagon. I have found solutions to both these problems (even so, I still continue to use wood). The solutions are: (a) Make two pieces to fit across the inside of the wagon, about on the line of the middle bearers/side knees. These pieces should be up to 0.010 in more than the inside width of the wagon. When the sides and ends are assembled (with solvent) insert the two cross pieces but do not glue them in. The spacing pieces will cause the sides to bow outwards slightly. Leave the body for at least a week to be sure no distortion occurs as the solvent dries out fully. Then proceed as usual. This method could be used with advantage when assembling plastic

kits such as Slater's. I am indebted to Gerry Arundel for this idea. (b) Paint the plastic with a mixture of paint matched up to a piece of clean wood. You will find that the paint is mainly white. I added a small quantity of buff, left over from painting a Midland signal box. When the paint is thoroughly dry (two days, if you have the patience), weather it with LNER grey (Precision Paints) well thinned down. Do not use black. Apply several very thin coats, allowing each to dry, until you are satisfied with the shade. Brush all coats in the direction of the supposed grain, but do not try consciously to achieve a grained effect. If this method is applied properly, it can produce an effect almost indistinguishable from wood, and is far more effective than applying a coat of black or sludge brown.

Before leaving the subject of plastic, I offer two points in its favour. There is no grain, therefore it is easier to scribe plank lines, and it can be obtained in a thickness more suitable for wagons with 3 in sheeting. Try to find a sheet of 0.040 in, that is 0.002-0.003 in under nominal size.

PREPARATION OF THE WOOD

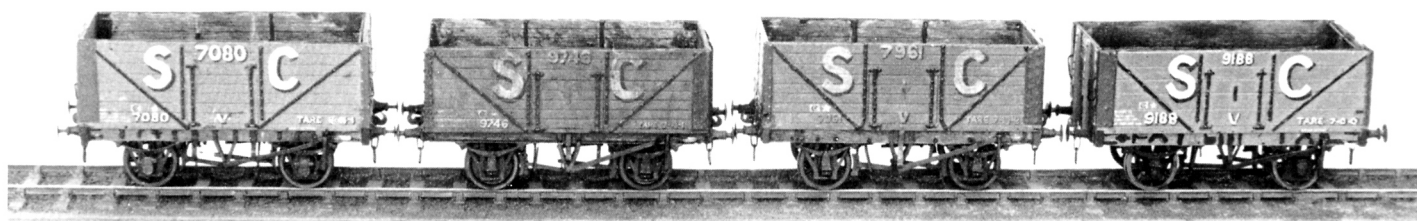
Select your piece of 1/32 in ply. It will probably be curved. The outside of the curve (convex side) will become the outside of the wagon. Apply a coat of Humbrol Sanding Sealer to this surface only – it will dry within minutes. The wood should then be rubbed down with fine wet-and-dry paper to give a glass-like finish. I use the paper dry, and it soon clogs up. It might be possible to avoid this by using it wet, but I just use more paper! Do not

attempt to get any graining effect on the outside of the wagon; prototype wagons had three coats of paint which all but obscured any grain.

Planking

The grooves between the planks can now be scribed on. The plank widths should be marked out very carefully, and then checked. I use a sufficient length of wood to make side-end-side-end all in one strip (assuming the ends have the same planking as the sides). I measure the plank widths at both ends of the strip of wood, although some might prefer to use dividers. When satisfied that all is accurately marked out, scribe the plank lines with the scalpel blade used against a steel rule. A new No. 11 Swann Morton blade should be used for these operations. It will not be easily deflected by the grain and will give a very narrow cut. This cut will become the top of each plank groove. On the prototype, the grooves between the planks were actually half-vees, the bottom of each board being finished square, while the top was chamfered at about 45°. So we now have to open out each scribed line *on the bottom side only* to represent the chamfer on the top of the lower board at a joint. This is done with a scribe held at an angle; it takes a bit of skill, but if you make a mess of it you haven't lost a lot at this stage. Alternatively, practise on a spare bit of wood first. Mark out the edges of the side doors, and scribe the lines, using a square. Clean out the corners, where the edges of the door meet the plank grooves.

Although I have referred to planks, the sides as modelled also include the side rails, which



I had been building wagons for less than a year when my friend Tom Mather, whose father had once been Managing Director of the Derbyshire Carriage and Wagon Company, asked 'Why don't you build a Stephenson Clarke wagon?' Believing that batch building would be quicker (it wasn't!), I laid down a batch of five. This was at the time when you couldn't get P4 wheels. By the time I had completed four bodies, wheels had become available, so the fifth wagon is still just planked sides. The photo shows the four - all different - that did get completed.

were really part of the frame. These were usually 5½ in deep, so this amount must be added below the bottom plank. Do not chamfer the top of the side rail; the chamfer did not go all the way along so it is best left until the ironwork is in place. I hope you will have remembered, too, not to cut the lines at the edges of the side doors through the side rails! If you make this mistake, correct it with plastic wood rather than scrap the side.

You can now turn the piece of wood over and scribe the plank lines on the inside. These scribed lines can be quite shallow; the plank tops were not chamfered on the inside. Finally, from the pieces which will become the ends, remove the bottom 'plank' - the continuation of the side rails.

Ironwork

We are now in a position to make a start on the body ironwork (not 'strapping', remember!). I first make the corner plates out of 0.004 in nickel silver. I cut this material with a scalpel blade, which is thereby ruined! Never mind, they are cheap enough, and I find it is much easier than trying to saw such thin metal. Form the cornerplates to shape, remembering that they had a 1 in radius on the corner. One

way to do this is to file a 1 in (scale) radius (by eye) on the corner of the wagon side. Draw a pencil line 4mm from the corner. Hold the corner plate up to the line and bend it round. When you are satisfied with your cornerplates, fix them in position with five-minute epoxy.

While you are waiting for the epoxy to set, you can be preparing the rest of the ironwork. Washer plates, diagonal braces, door catches, and the parts of the door hinges on the side rails are cut from 0.005 in thick plastic strip cut to the appropriate width on a jig. This idea

Fig. 1. Jig for ironwork

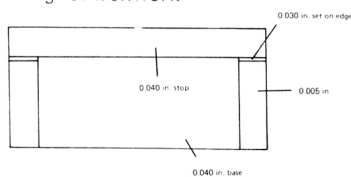
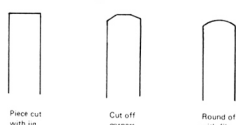


Fig. 2. Rounding ends of ironwork



came from the article by Smokey Bourne in *Model Railways*, October 1973. The end door fastener bar is made from 0.010 in strip, 1mm wide. The side door hinge bands are a bit more difficult, as they are tapered.

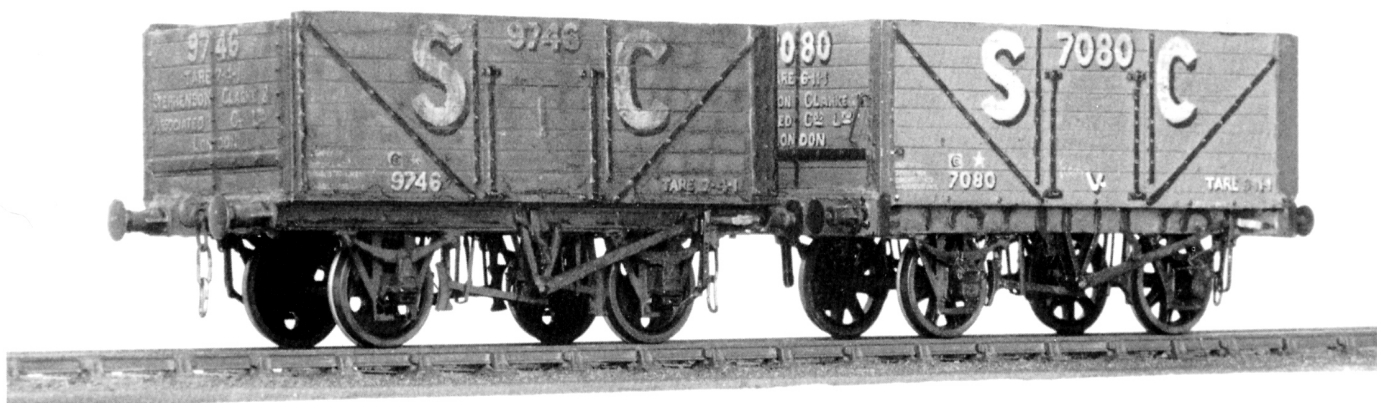
Determine the approximate line of the diagonal brace across the corner plate. Drill two 0.020 in holes where the bolts will be. Insert pieces of 0.020 in plastic rod (Slater's), fix with solvent, and cut off flush both sides when dry. These are to give you something to bond the diagonal brace to, as it does not stick too well to metal. Cut pieces of plastic to length for the end and side knee washer plates, taking a tiny piece off each corner, and rounding off the ends with a fine needle file. Fix the washer plates in position with solvent; you will find that it bonds well to the treated wood. Repeat for the diagonal braces. Check from a photograph, if possible, to find the relationship between the end knee washer plate and the diagonal brace on the particular wagon you are building. Sometimes the washer plate stopped below the diagonal, while on other wagons it went right to the top of the wagon and the diagonal brace was cranked and bolted outside the washer plate. The bottom ends of the diagonal braces are on the side rail, but they must not be directly below the side knee washer plates. This position would, of course, be occupied by a middle bearer. The diagonal brace took the end of a cross rod, which was either inside or outside the middle bearer and also, of course, below the floorboards.

Side knee washer plates bent round

These were very common, and are tricky to make. I have used several methods. (1) Make a number of tiny cuts in one side of your strip of plastic. This will become the outside of the curve. Radius the end, and bond the curved piece to the rest of the washer plate at the point where the nut on the bottom plank will be. The joint will be invisible when the wagon is finished. Bodge up the cuts with Plastic Padding or similar. These, too, will later be invisible. This method has now been superseded by: (2) Bang out a crown plate with your crown plate punch (q.v.). Cut a piece off, and join it to the straight part of the washer plate, or: (3) If the bend in the washer plate is sharper than that in a crown plate, drill a hole of the required radius in a piece of 0.005 in plastic. Cut the piece out roughly, file the outside to a smooth radius, and proceed as before.



This wagon, built in 1976, has always been one of my favourites. It was copied from a model built about 1935 to the scale of 11/16 in to 1 ft. Copying models is usually deplored, but if the builder had published an inaccurate sketch I would, presumably, have been in order in using it. My model has Rigley's axleboxes, which I now feel ought to be United Ellis. I would also make the word 'Main' larger if I were starting again. Very few photographs of Yorkshire Main wagons exist.

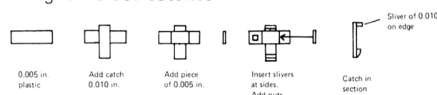


A closer view of two of the Stephenson Clarke wagons. No. 9746 seems to have lost its end door roller bar in service.

Door bands

Cut two pieces of 0.015 in plastic 1/32 in wide, and a little longer than the final length of the door band. File a taper on each so that the narrow end is 0.009 in and the wide end remains 0.015 in. (This is actually fractionally oversize; you can file the wide end down to 0.013 in if you wish). Cut to length and fix to the wagon side. For each side, cut two pieces of 0.005 in plastic strip 3mm long. This is cut from the strip that you used for diagonal braces. Cut each corner off each piece at 45°, trying to get them all the same. These form the fixed part of each hinge and they can now be fixed in place with solvent. Note that these pieces were rarely central on the side rail; they were usually at the bottom, but sometimes at the top, where their bolts would foul the floorboards. Build up the door catches from pieces of strip as shown in the drawing. Add the door protector – plastic strip again.

Fig. 3. Door catches



Final touches

Determine the position of any nuts on the side rail, remembering that their centres must be below the level of the floor. Drill 0.020 in. Insert short lengths of 0.020 in rod and cut off flush. There are also two nuts on the second plank up for the end door fastener. Make discs of 0.005 in plastic, and stick them to the cut ends of the rod to represent washers.

End pillars

These are made out of plastic 0.060 in square. This is actually 0.005 in undersize but I don't worry too much. The end pillars have to project below the bottom plank by a distance equal to the thickness of the floor plus the depth of the headstock, i.e. the thickness of your ply plus 4mm. The end pillars are tapered over the top five planks. Norman Dale has described a suitable jig to do this, but I just file mine. On the full-size wagon, they would not necessarily be the same after repairs. The washer plates at the bottom of the end pillars are made in the

same way as the diagonal braces. The washers for the nuts nearer the top are again made from tiny discs of 0.005 in plastic.

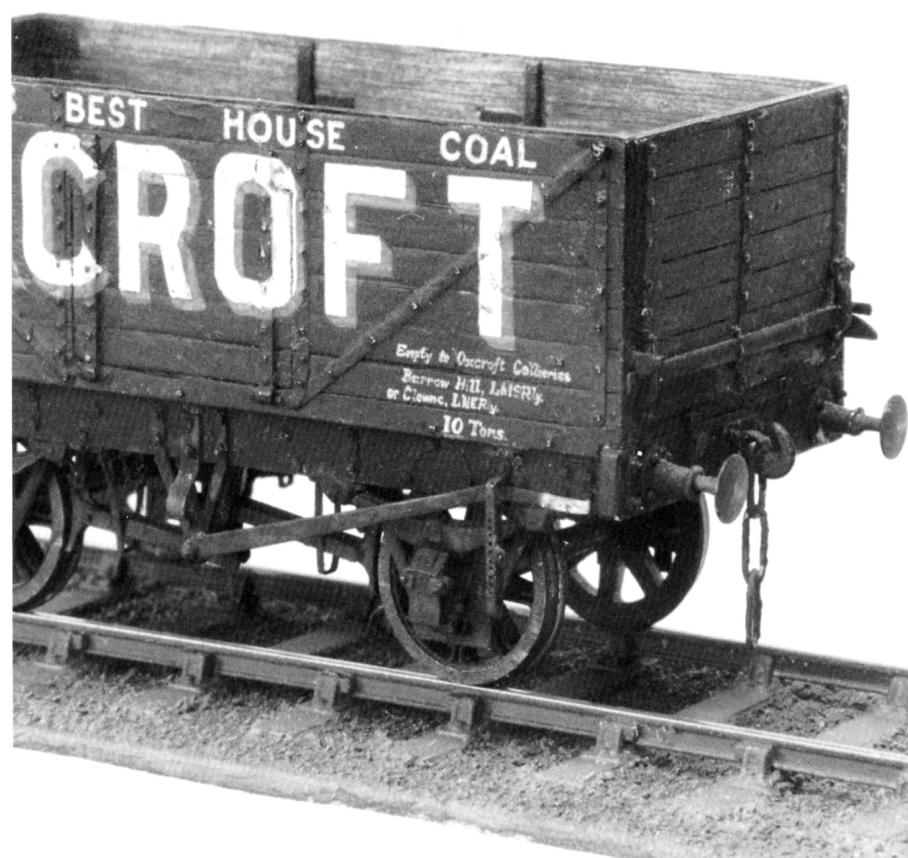
End door

The end door fastener bar has already been described. It should really have a disc, with a flat cut off, at each end, but this can quite well wait until after assembly. Door band washer plates are made in the same way as diagonal braces. They go over the end door fastener bar; it is easier to fit them if you soften them with solvent. You may break a washer plate at this

stage, but it doesn't matter, you can easily rectify matters with solvent. Some wagons had end door bands outside the sheeting, probably best made of strips of 0.010 in metal for greater strength.

Adding the nuts

You have now arrived at a most exciting (!) stage of the work – putting the nuts on the ironwork. You will, of course, have remembered that they are not rivets, or even bolt heads (usually), because these have quite a different shape. Unfortunately, modellers have



End door detail.

been calling them rivets for such a long time that quite a number of otherwise good models (including some kits) have been spoilt. You may think that the difference is insignificant, at least in 4mm scale, but I think it really shows.

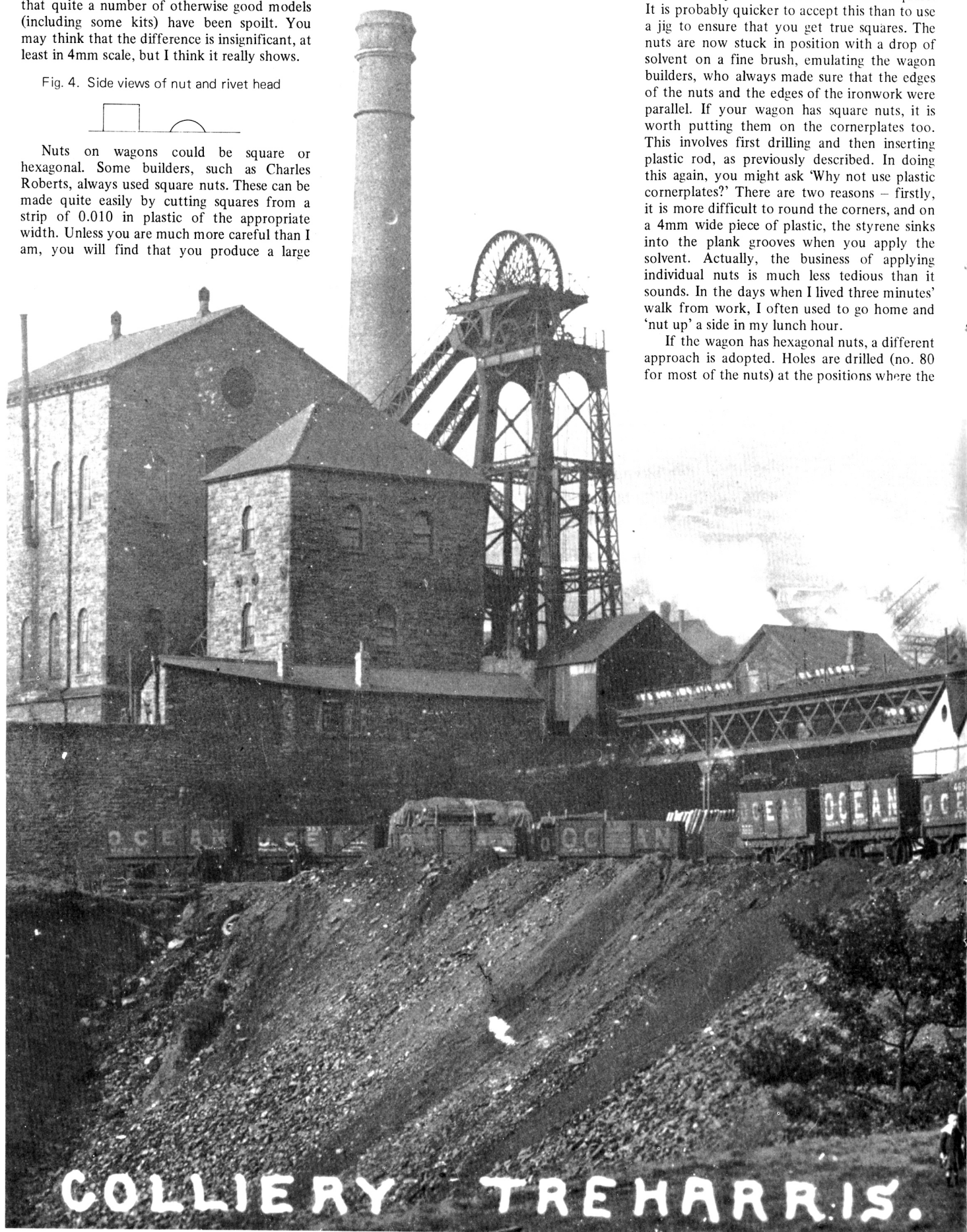
Fig. 4. Side views of nut and rivet head



Nuts on wagons could be square or hexagonal. Some builders, such as Charles Roberts, always used square nuts. These can be made quite easily by cutting squares from a strip of 0.010 in plastic of the appropriate width. Unless you are much more careful than I am, you will find that you produce a large

number of rejects that are nowhere near square. It is probably quicker to accept this than to use a jig to ensure that you get true squares. The nuts are now stuck in position with a drop of solvent on a fine brush, emulating the wagon builders, who always made sure that the edges of the nuts and the edges of the ironwork were parallel. If your wagon has square nuts, it is worth putting them on the cornerplates too. This involves first drilling and then inserting plastic rod, as previously described. In doing this again, you might ask 'Why not use plastic cornerplates?' There are two reasons - firstly, it is more difficult to round the corners, and on a 4mm wide piece of plastic, the styrene sinks into the plank grooves when you apply the solvent. Actually, the business of applying individual nuts is much less tedious than it sounds. In the days when I lived three minutes' walk from work, I often used to go home and 'nut up' a side in my lunch hour.

If the wagon has hexagonal nuts, a different approach is adopted. Holes are drilled (no. 80 for most of the nuts) at the positions where the



nuts will be. Short lengths of plastic rod are inserted, pressed down to the right height (judged by eye), and fixed with solvent from the back. In following this procedure it will sometimes be found that you have started the hole a little off centre of the ironwork. I drill the holes by hand, holding the drill in a pin chuck with a drawing pin in the top to act as a bearing and after a few twists, inspect the depression made by the tip of the drill (hardly a hole at this stage) to see that it is truly central. If it is not, incline the drill a little so that the tip points in the direction you want to go. When you judge a suitable correction has been made, carefully straighten up the drill and proceed. It is particularly important to have the nuts truly central in the case of some of the larger ones, where you are drilling a 0.020 in hole through a strip of plastic only 0.030 in

wide. Obviously, if you are 0.005 in out you will be up to the edge of the ironwork! To represent a hexagonal nut with circular rod, choose a diameter about halfway between the distance across the flats and the distance across the points of the nuts.

NUT SIZES		
Whitworth size (in.)	Across flats (in., 4mm scale)	Across points (in., 4mm scale)
1/2	0.012	0.013
5/8	0.014	0.016
3/4	0.017	0.019
7/8	0.019	0.021
1 1/8	0.024	0.027

- Strapbolt to solebar
- Monkey tail eyebolt
- Buffer trimmer to sole
- V-irons to sole
- Door bang springs
- Side rail to sole

- Axleguard wing and crown
- Cross rod

- Drawbar front plate - 3/4 in. and 1 1/8 in.

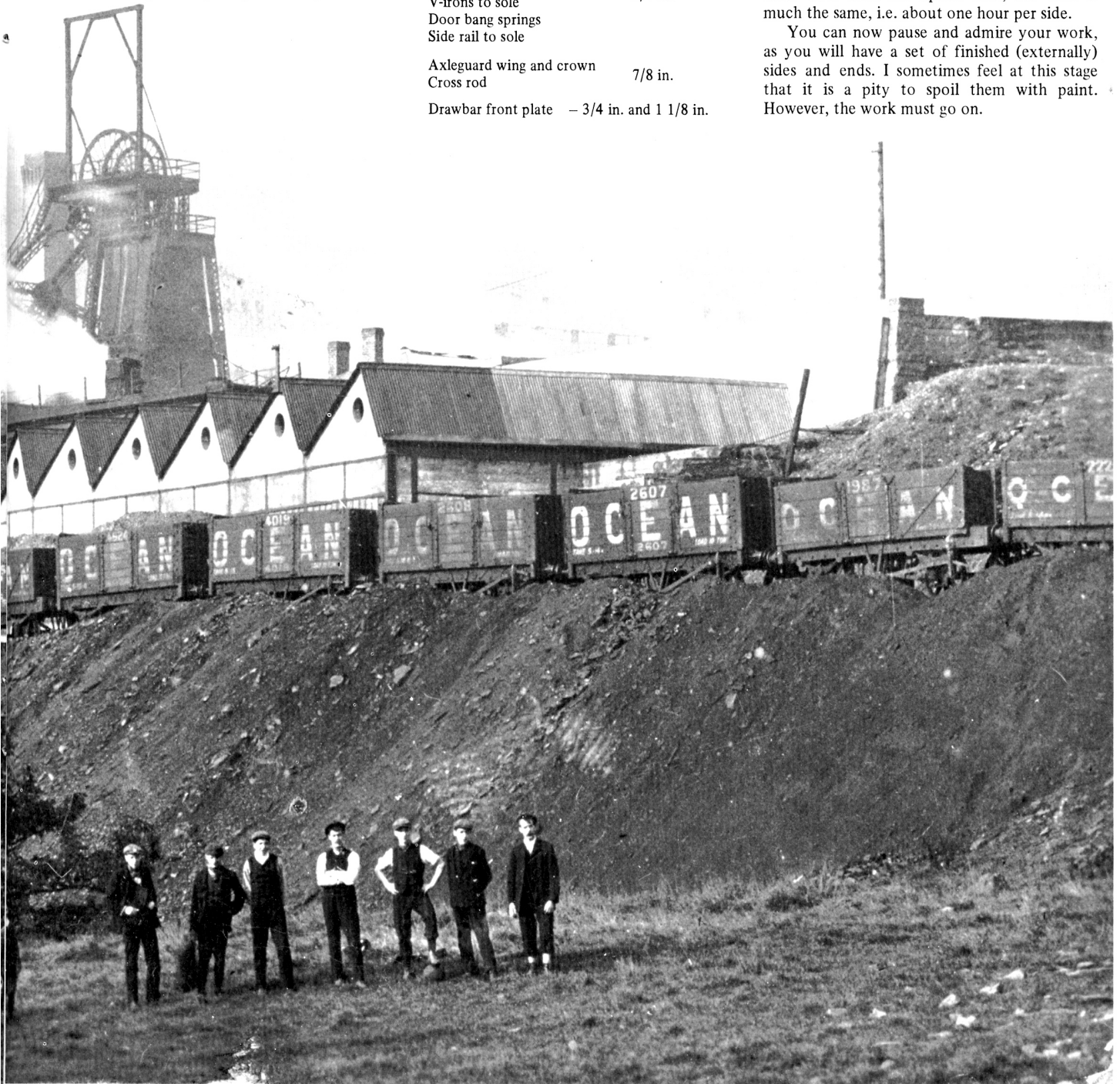
3/4 in.

7/8 in.

At this point a snag raises its ugly head. The best rod for most of the nuts was the Mopok 0.013 in rod (blue). This has been off the market for some time, although I still have a small stock left. Possible alternatives are a thicker rod (or sprue) stretched in a flame to the right diameter, or wire (preferably nickel silver) fixed with cyano glue. Remember to square it off with a file, if you are particular. You could also induce a manufacturer to produce 0.013 in rod! A newer idea, if using wire, is to first file an end length square, snip off a short length straight into Carr's metal black. Alan Gibson's straight wire 0.33 mm (mentioned in *MRJ* No. 11) sounds ideal for this job. Slater's 0.010 in rod is, unfortunately, just too small for this job.

Although this approach is quite different from that used for square nuts, the time is much the same, i.e. about one hour per side.

You can now pause and admire your work, as you will have a set of finished (externally) sides and ends. I sometimes feel at this stage that it is a pity to spoil them with paint. However, the work must go on.





This wagon was built early in 1974 from a picture in the Model Railway Constructor. I suspect now that a post-war photograph was used to prepare the illustration – the tare weight seems very low. I have chosen this photograph to illustrate the too thin lettering – a common error among beginners – and the incorrect hanging of the brake safety loops. I didn't know about middle bearers when I built this one!

PAINTING AND LETTERING

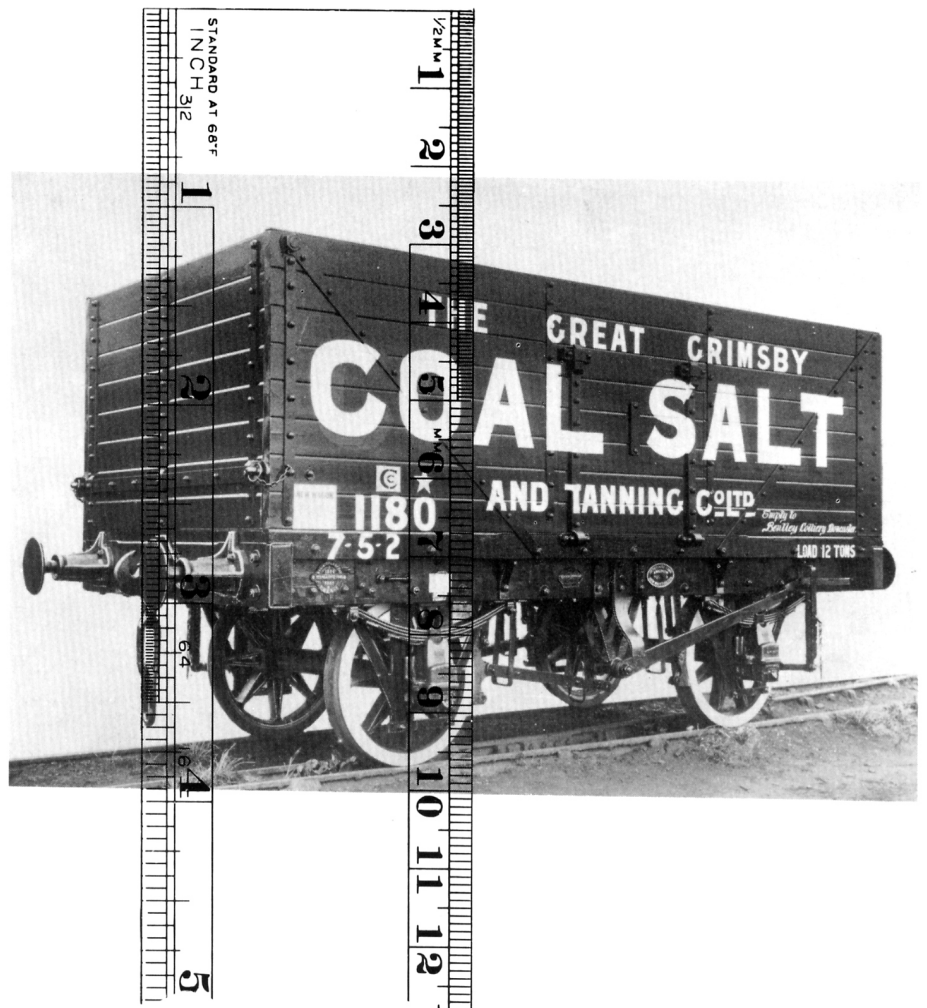
The sides and ends are now ready for painting. I find that up to three coats are needed to get a good solid colour. Try to contain your impatience and let the sides dry overnight between coats. There are plenty of other jobs to be starting on while you are waiting! I have always used a brush rather than an airbrush. Paint up to the ironwork rather than trying to go over the whole lot. Avoid leaving paint in the corners of the ironwork; when it dries it will detract from the sharpness of the finish. I like to stick the sides (and ends) to a piece of hardboard, using double-sided tape. The ends with the corner plates hang over the edge of the hardboard. The sides stay fixed to the hardboard for the lettering. In this way you apply the lettering to a flat surface, and it is no more difficult than writing on a sheet of paper on the table (well, not much more!).

For the lettering, I first put in the outlines of the main letters, using Winsor & Newton's Process White and a very fine mapping pen. There is nothing magic about this choice of material; I was given some several years ago and found I liked it. Get it out of the jar with a brush, dilute it with water, and apply it to the pen with the brush. The nice thing about the process white is that it can be removed with water and a cloth or tissue if you find you have made a mistake. There are no doubt other paints, such as white emulsion paint, with similar properties. Lettering a wagon is, in a sense, much easier than lettering a plain board, because you have the ironwork to help you. If you have a photograph, even the usual three-quarter view, the ironwork will give you a guide to the spacing.

The position of the left-hand edge of the first letter will usually be clear; it will be within an inch or two of the corner plate or end knee washer plate. Now put your ruler vertically on the photograph, just touching the right-hand edge of the first letter. Note where the edge of the ruler intersects the diagonal brace. It may go through a nut, or where the top or bottom of the brace intersects a plank join. Move the ruler to the same relative position on the wagon

side. Check that it is vertical (use a square if necessary) and draw in the line. Repeat for the other letters. Apart from the diagonal braces, washer plates, hinges, door protectors, and nuts on the siderail can all be used as landmarks (if you have modelled them correctly in the first place. In this connection, I might add that I lettered some white metal kits some time ago and found difficulties with the spacing because the dimensions were not quite right.) Curves are put in freehand, S, C, and G being the most difficult. Don't try a Stephenson Clarke wagon until you have some experience! If you are dissatisfied in any way with the outlines of the letters (poor shape, wrong position, not vertical/horizontal, etc.), you can rub out the offending line with a fine brush moistened with water or spit. It was not unknown for this to happen with real wagons, and an old wagon letterer once remarked to me that a side was never quite as good if you had to paint some out and begin again. You may well find the same applies to models!

When you are satisfied with the outlines, the letters can be filled in carefully using a fine brush and either process white or paint. You may not cover the body colour completely with the first coat. This does not necessarily matter



To find position of left-hand of 'A' in 'COAL', place rule as shown. Left-hand edge of 'A' is where middle of diagonal brace crosses top of second plank up. AUTHOR'S COLLECTION

because if the body colour shows through a little it can give the impression of worn lettering (try reproducing that with Letraset!). When the lettering is dry, the shading can be applied. I do this with Indian ink, using the mapping pen and ruler again. The application of the shading gives you the opportunity to correct some of the mistakes you made with the lettering. Red shading on black wagons cannot be done this way and there is really no alternative to doing it the hard way with a fine brush. I once had the bright idea of painting the wagon side red, applying the lettering, and then blacking out the side of the wagon except for the red shading; result – disaster! The red showed through the letters, producing a most unrealistic pinkish tinge, so that in the end I had to paint the whole side black and letter it properly. (This was, in fact, the Oxcroft wagon shown on the cover of *MRJ* No. 5.) Another point about red shading on black wagons is that a narrow black line should be left between the white of the letter and the red shading. On a full-size wagon, this line would be about 1 inch wide. The line has the effect of making the shading stand out much more sharply. Without it, the eye tends to blend the shading and the lettering to give a pinkish effect.

A point to note about the layout of letters is that the better wagon letterers used to put the shading on the same plank as the letter if at all possible. This bit of information is useful if you are building models from sketches or making up fictitious liveries. The position of the lettering also helps one to decide whether shading is present or absent when only a poor photograph is available.

The number and the smaller lettering can now be added. For the very small lettering

(empty to, etc.) you will need your finest mapping pen and all your patience. It is often only possible to do a few letters at a time. Some sort of aid to vision is virtually essential. The most difficult lettering I know is on the fast end of Stephenson Clarke wagons. It is about ½mm high and shaded! It also has to be crammed in between the end pillars. I find the only way to do it is to apply it before fixing the pillars. If it's any consolation, the full-size wagon letterers found it difficult, too. I find it useful to draw a guide line for any very small lettering that does not sit on a plank join. I do it very carefully with a sharp scalpel blade, just scratching the surface of the paint. If you are careful you will not see the line except under magnification, and when you varnish the side the line will disappear completely. Add the Cc labels (for wagons after 1926) and the five-pointed stars (after October 1933). Both these should be yellow – not white as one frequently sees on proprietary models. I find the stars one of the most difficult things to paint; a sheet of transfers would be useful here. The actual letters Cc (standing for commuted charge) are easily added using Indian ink in the fine mapping pen. Sometimes these letters were stencilled on; leave suitable 'cut' gaps on the characters to simulate this.

When all the work is dry, the side should be subjected to a very close scrutiny under the highest magnification you have available. I use a combination of sharp scalpel blade and cocktail stick to trim up the edges of letters where I have made any mistakes. Blacken the ironwork where necessary; Indian ink does not stick to plastic so if you have left the ironwork unpainted you will need paint and a fine brush. If you have painted the ironwork in body

colour (you probably will have done whether you meant to or not!) you can use Indian ink and a mapping pen, preferably with an old nib; this work is hard on expensive new ones. When dry, trim away the black paint/ink where you have gone over on to the woodwork. Note 'where' not 'if' – you will have gone over somewhere!

The final stage is a coat of matt varnish to protect the lettering. I use Humbrol for this, and when it needs thinning I use genuine turpentine (from the art shop), not white spirit. I did try Precision Paints matt varnish but found it very disappointing; it gave quite a glossy finish and made their red oxide look orange. Perhaps I didn't stir it enough.

Red oxide

All the people who can remember newly painted red private owner wagons must now be aged fifty-five or more. There is a danger that future generations will believe that the colour was a pale milk chocolate colour (like the proprietary Sheepbridge hopper wagon) or bauxite. It was not. Although I am not old enough to have first-hand memories, the following points have emerged from research: 1. Wagons described as red or red oxide had a definite red shade. 2. Different reds appeared on different wagons, even when new. 3. A shade somewhere between Midland red and bauxite is probably suitable for many wagons. 4. The red weathered to pink.

THE FLOOR

While you are waiting for the paint to dry in one of the earlier stages, you can be making the floor. Prototype floors were made of deals 7 in x 2½ in. Mine are made of a single piece



The Oxcroft wagon. I have selected this shot to show the nuts on the ends and the bottom door pins and chains. This model was built in 1978 to a sketch by Gordon Heywood. The prototype really did have unevenly-spaced lettering, apparently. Note the lack of a black line between the letters and the shading – I hadn't learnt this trick in 1978!

of 1/32 in ply, with the planks scribed on. The grain should, of course, run across the wagon. I make my floors the full outside length of the wagon (as in the prototype), so the ends have to be finished as they will show. I finish the ends with sanding scaler as with the other external surfaces, and then paint. If the wagon has bottom doors it is best to cut out holes for these, and then stick in separate pieces. This is because the grain on the bottom door deals runs along the length of the wagon – and it shows.

Remove the top ply in the place where the bottom door band washer plates will be, and insert strips of 0.010 in plastic 0.030 in wide. These represent the washer plates. The bolt heads here were on the top side, but were countersunk, so there is no need to represent them. Paint the door band washer plates black. Stick the bottom doors into the holes in the floor (I use Evostick Resin W). When a wagon had been in service for some time, the bottom doors would have got slightly out of line with the floor, and it is possible to represent this if you use separate pieces for the bottom doors. If your wagon is to run permanently loaded, you can, obviously, omit all this work except for the preparation of the floor to the correct size and the finishing of the ends.

It has occurred to me, while writing this section, that Norman Dale, in his series in the *MRN* in 1964, found it necessary to scribe both

sides of the floor to stop it bending. I have never experienced this problem, so I only scribe the top of the floor. Strictly speaking, there should be a longitudinal line scribed along each edge of the floor, about 0.5mm in, because the side rail is thicker than the sheeting. I have tried this, but it is hardly worth the trouble and I now omit it.

INSIDE THE WAGON

It is convenient at this stage to add some of the internal ironwork. First of all, the side and end knees are cut from 0.030 in plastic. They have to be tapered so that they are 0.010 in thick at the top, widening to 0.026 in at the bottom. The knees are fixed in place with solvent. It is also possible at this stage to make and fix the side door band washer plates and the washer plates behind the door catches. These are made from the same 0.005 plastic strip that we used for the outside diagonal braces. It is also possible to add the vertical washer plates behind the corner plates, but only those on the sides in this case. The end door bands are made of 0.010 in plastic 0.033 in wide. These have to be bent over at the top to take the end door bar. To do this, dip the plastic strip into boiling water, holding it in pliers or tweezers, and put a 90° bend into it. Then bend it round a length of the end door bar material, hold it in the pliers, and dip it into the boiling water again. It is best to use smooth-jawed pliers for this

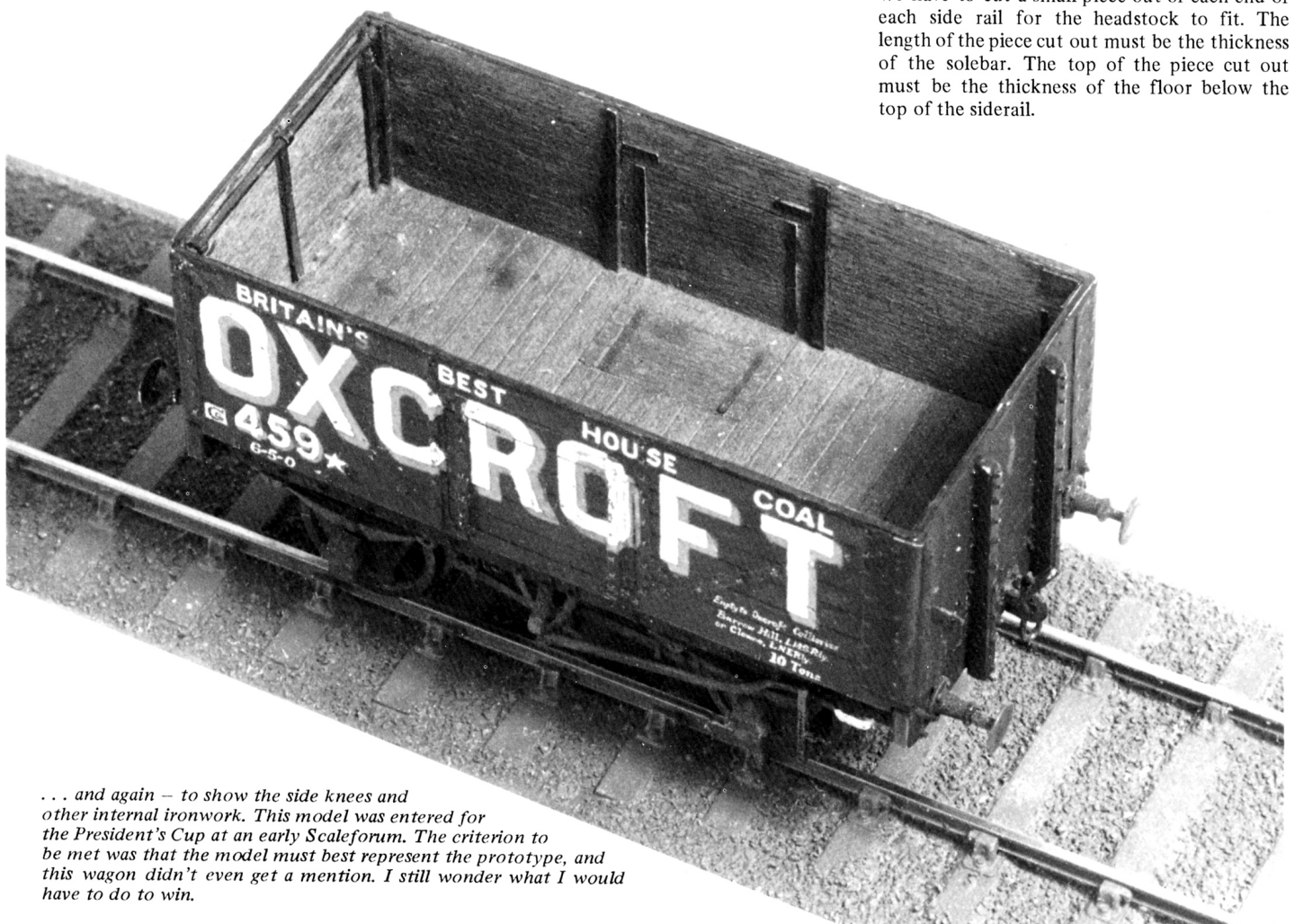
operation, otherwise you run the risk of imprinting the serrations on the plastic. Finally, cut off the surplus plastic with a sharp blade. Put a scrap piece of thin metal (0.004 in as for cornerplates) under the piece you are cutting off, otherwise you may accidentally cut through the piece you want to keep! Yes, this is the result of experience!

I make the end door bar either from piano wire or nickel silver wire 0.028 in thick. Piano wire gives a good appearance but is fiendish to cut. I use the cutters on my car pliers rather than ruin my Swedish end cutters, which are kept for much more delicate work. The pointed end left on the wire by the cutters is then filed square; the stuff seems to be amenable to filing. Sometimes there is a cotter in the end of the door bar, and this can be simulated by sawing a slot in the end of a piece of nickel silver wire, using an M4/0 blade, inserting a sliver of metal and filling the rest of the slot with solder. The Yorkshire Main wagon has this feature, though I doubt whether 1% of the people who have seen it have ever noticed . . .

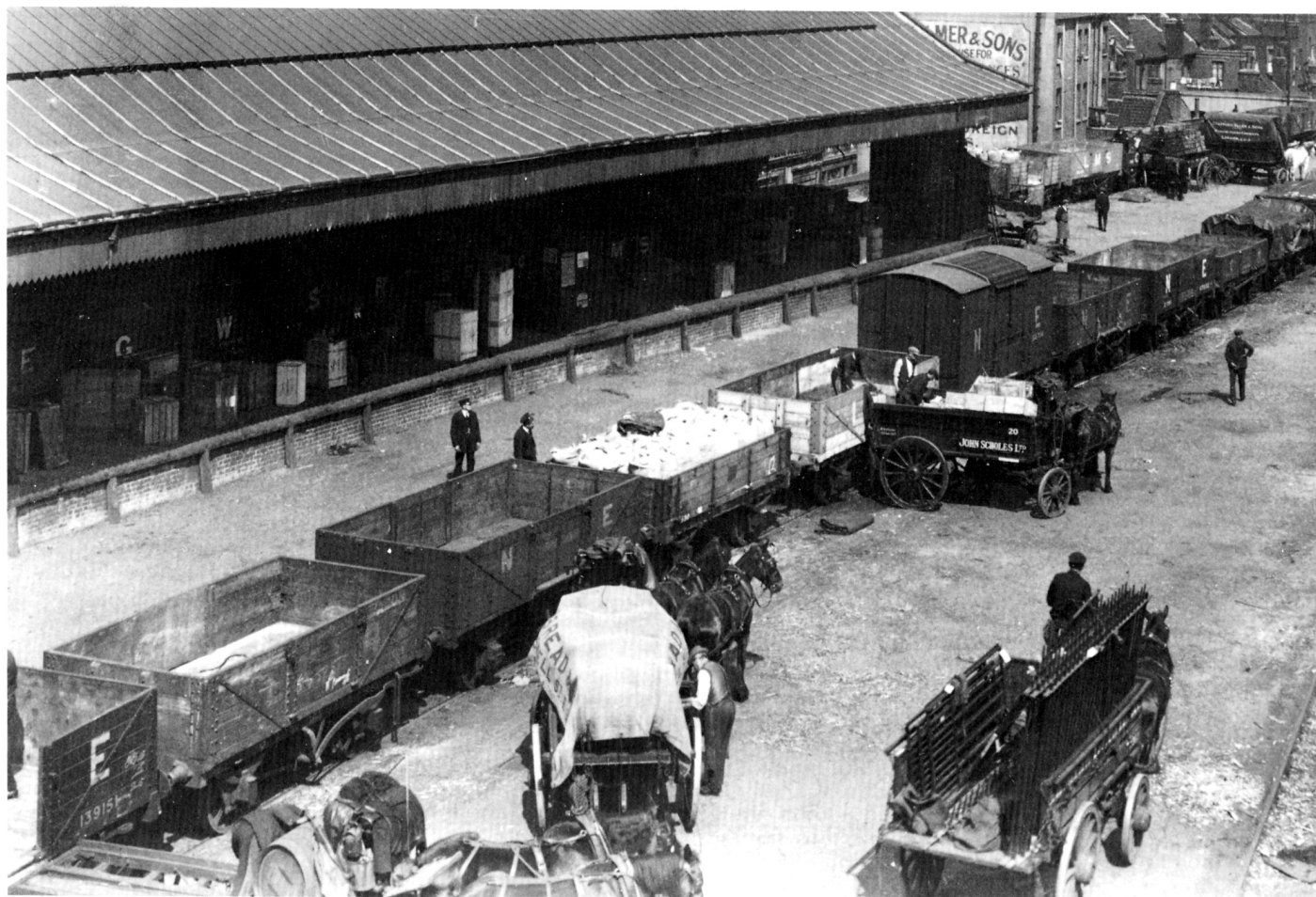
The internal ironwork added up to this stage can now be painted black. Don't forget the edges, and try not to go too much on to the wood.

ASSEMBLY

We are now virtually ready to assemble the body, but there is one little job to do first. We have to cut a small piece out of each end of each side rail for the headstock to fit. The length of the piece cut out must be the thickness of the solebar. The top of the piece cut out must be the thickness of the floor below the top of the siderail.



. . . and again – to show the side knees and other internal ironwork. This model was entered for the President's Cup at an early Scaleforum. The criterion to be met was that the model must best represent the prototype, and this wagon didn't even get a mention. I still wonder what I would have to do to win.



The ironwork inside these wagons is only too apparent and the unpainted wood inside is a characteristic which can make the world of difference to a model.

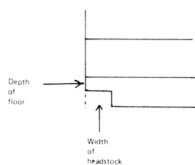


Fig. 5. Cutting piece out of siderail for headstock

To begin the assembly, first fix the fast end to one side (I usually choose the left-hand side as you face the outside of the fast end), using 5-minute epoxy. This type of adhesive gives you just enough time to adjust the two pieces for squareness and so that their tops are in the same plane. As the epoxy sets, remove any surplus from the edge of the corner plate on the fast end. Ideally, the side and end should now be left overnight (i.e. nearly 24 hours if you have to go to work next day) for the epoxy to harden fully, because the next step is to drill the end of the corner plate for the simulated nuts. You do this with the end on the table (workbench if you have such luxuries!) and the side hanging over the edge. That's why I choose to fix the left-hand corner first. If you are left-handed, of course, you do it the other way round.

The rest of the assembly can all be done in one go. Use epoxy to fix the remaining corner plate, and Resin W for all the other joints. Make sure that the floor is straight throughout its length. The way you have made the wagon ends will automatically ensure that

the floor is right at the ends. Slip a couple of elastic bands round the body, one at the level of the floor and another nearer the top, and knock off for a bevy while the whole lot dries. When you take the elastic bands off, you will be able to admire your (wagon) body provided you look at it from the door end. When you go round to the fast end, you will be confronted by the horrid realisation that you have still to put the nuts on the right-hand corner plate. The operation of adding them is tricky and needs care, but cannot be considered difficult. It might be possible to devise some kind of cradle to hold the wagon on end for this operation, but so far I have not considered it worthwhile. Cut off any pieces of plastic rod projecting on the inside of the corner plates, add the remaining vertical washer plates and the corner brackets, and paint them. Yes, it is difficult not to get the paint on the wood, but try. It won't matter too much if some paint gets on to the wood. Also paint the ends of the corner plates.

Most modellers seem quite oblivious of the existence of ironwork inside the wagon. I think the only reference I have ever seen in the model railway press was an article by my LMS Society colleague Noel Coates in the August 1980 *Railway Modeller*. Wagon kits are often praised for having 'full internal rivet detail' yet a full size wagon built in the manner of some of the kits I've seen would have the body attached to the frame by the end pillars and four short

lengths of 2 1/4 in x 1/4 in mild steel – at the bottom of the diagonal braces! Assuming such a wagon survived having ten tons of coal regularly tipped into it, it would surely disintegrate at the first hint of a rough shunt. Ah, well . . .

What we have done up to this stage is to make a fully painted and lettered wagon body kit, which we have then assembled. I hope you will agree that there has been nothing too difficult so far. We can now go on to consider the frames and running gear in the fourth and final article in the next issue.

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