NEILSON 0-4-0ST

This is a standard ‘12in Mineral Engine’ built at the Hyde Park Works of Neilson and Company of Glasgow, and our model is based on a works drawing of 1874. The prototype was a popular design, especially among contractors and industrial users such as colliery owners, and continued in production for many years. Four virtually identical engines were built by the Great Eastern Railway at Stratford Works between 1897 and 1903, while other Scottish locomotive builders such as Grant, Ritchie and Company of Kilmarnock offered locomotives that were uncannily similar in many respects.

Neilson’s were one of the leading Clydeside manufacturers, producing close to 6000 locomotives in the 60-year period before they became part of the massive North British Locomotive Company in 1903. For the last five years of its independence the company had been known as Neilson Reid and Company, which was ironic as Walter Neilson had left the company as long ago as 1876, after a bitter argument with his partner James Reid. After a disastrous flirtation with diesel-hydraulics, North British finally crashed in 1962, bringing to an end a grand tradition of locomotive building in Glasgow’s Springburn district that had stretched back for well over a century.

Like everything Nelson’s ever made, these engines were built to last. Despite a lifetime of hard work, a number survived until well into the 1950s and even beyond. And yet for all its robust qualities, the ‘12in Mineral’ - the Figure relates to the cylinder size - was also a very attractive engine. The marvellously archaic dome, the gib-and-cotter brasses on the coupling rods and the wooden brake blocks are classic period details but perhaps the most intriguing feature of these locomotives is the distinctive ogee shape to the saddle tank. In the late-Victorian period, those sweeping reverse curves would have been the very height of fashion for designers in all disciplines, from locomotive engineers to architects and furniture-makers. Fifty years later, they merely seemed quaint.

As with all industrial locomotives, these 12in Neilsons received piecemeal additions and alterations over the years, dictated by local requirements. Some would have been given home-made cabs or at least a weatherboard, on others an oval-spoke design replaced the original cast-iron wheels with flat-faced T-section spokes. Safety valves, too, may have changed over time. Many engines acquired sprung buffers of various patterns and the old wooden brakes eventually gave way to iron blocks, but right to the end these marvellous old engines retained their unique character.

Motor - Mashima 1220/1224
Wheels - Sharman, ref. S62 (00/EMP4)
Sharman wheels, Glan-Henwy, Golan, Garndolbenmaen, Gwynedd. LL51 9YU
Couplings, pick-ups and hornblocks to choice

GENERAL NOTES ON CONSTRUCTION

Read through the instructions and study the diagrams - preferably more than once - before beginning work. Think ahead, anticipating when are you going to paint the model, for instance, and what kind of pick-up arrangements you will make.

Leave the parts in the fret until they are required for use. This will protect them and makes identification simpler. Small holes can be drilled more easily while the parts are still attached. Where an accurate hole size is required, holes are etched undersized so they can be drilled or reamed out to the correct diameter.

Some of the feeds on the lost wax castings are used to locate parts on the model. Use the illustrations to identify these locators before cutting the parts from the sprues. Where lost-wax parts need drilling to allow pipework to be fitted, drill starts have been provided.

Despite the small size of the prototype, this is not a simple kit to build. While the parts have been drawn and mastered as accurately as humanly possible, much depends on the individual modeller's skill and, in particular, on patience and dexterity. If any procedure appears over-complicated, try to ask yourself what the alternative (if any) would have been.

The model is built as a sequence of sub-assemblies, which only come together at the very last. They fit together in a very particular way - and come apart again. These sub-assemblies clip-fit or are screwed together. They should not be fixed permanently.
Except where you have an exposed edge, such as a cab side or slidebar, it is advisable not to file off the

cusp around the edges of components - the slight alteration to their dimensions could be enough to affect the way they integrate with other parts. Other than the routine cleaning-up and filing-off of parts as they are detached from the frets or sprues, you should not need to modify any of the components in any way. High Level's own pilot models were assembled absolutely straight, without modification, from the same parts you have here. Some parts, however, may be deliberately etched over-size to allow for accurate trimming. This is allowed for in the instructions.

When soldering parts in place, tack-solder first in one spot only and then check that everything is as it should be before final soldering along the joint. Moving a part that isn't aligned correctly can be difficult if it has been tack-soldered at more than one point.

If something isn't right, think twice before reaching for a file or drill. Any problems with the fit or alignment of components are likely to have been caused by errors earlier in the assembly sequence. Distortions and misalignments can build up and it becomes increasingly difficult to get parts to fit until, eventually, the kit becomes almost unbuildable. Backtrack through your work and look for things like excess solder, tabs not fully filed off, inaccurately formed parts or alignments that are not quite true. If you modify any of the components - other than purely cosmetic alterations to model a different prototype locomotive to that on which the kit is based - you might well be storing up trouble for yourself.

As always, plan ahead and think through every move before soldering any parts together. If you are patient and careful, you will find that building this scale model locomotive becomes an immensely rewarding experience.

We want you to enjoy building your kit, but remember that even railway modelling has its risks. Frets contain sharp edges, soldering irons get very hot, adhesives may give off toxic fumes, knives and files are designed for cutting. Please be careful…

ASSEMBLING THE BODY

Carefully open out the holes ‘A’ for the locating wires in the footplate (1) and sub-footplate (2) to the size shown in the Figure 1, and then remove both parts from the fret. Straighten them as necessary - the footplate will almost certainly be curved due to the etching process.

On the sub-footplate, bend the steps (B) down and the chassis top rails (C) upwards – all bends are 90 degrees. Use 0.7mm wire pushed through the holes 'A' to locate the footplate and sub footplate and, after checking both parts are flat, solder them together. The best way to do this is to solder them at a number of points, using pliers to hold them together at these areas as you do so. Trying to do the whole footplate at once is difficult as excess heat from the iron can cause it to warp. Avoid soldering any of area ‘D’, as this will later be removed.

Carefully grind away the half thickness material which attaches the midway stretcher ‘E’ to the sub-footplate. Do the same for area ‘D’ and then clip it off at the front edge of the footplate. Solder an M2 nut into the circular recess at the rear of the sub-footplate.

Splashers
After making sure there is no solder in their bend lines, use flat-nosed pliers to bend the splasher sides 'F' up though 90 degrees from the footplate. Anneal the splasher tops (3 x4) and then curve them so they match the radius of the splasher sides with the half etched groove on the inside of the bend. This can be tricky, but we found the following method worked well. First, bend the splasher top over a rod, which has a much smaller diameter than the one you require (say about 12mm) working the radius right to the end of the metal with your fingers. Now press the splasher over a larger rod (or similar object) which has the diameter you are aiming for (in this case 17mm) making sure there are no kinks.

To fit the splasher top, hold it in place with sides (F) locating in the groove and the bottom edges of the splasher fitting right into their locations. The splashers are etched slightly overlength, so the bottom edges will protrude down below the footplate (they can be trimmed off later). Note - the vertical sides (F) should not be proud of the tops. If the top is a good fit, then it should virtually stay in place by itself. Hold the splasher in place with your finger while you tack-solder it (yes, it does hurt!) and then run solder around the joints. When all the splashers are fitted, stick some masking tape to the footplate to prevent accidental damage and then, using a blade or a file with a safe edge (an edge which has been ground smooth), dress up the vertical side faces before finishing off with fine Emery paper.

Firebox and bunkers
Bend the firebox former 'G' up through 90 degrees, then anneal, bend and fit the firebox (4). The firebox is a structural part and will affect the fit of other components. Make sure it is the correct shape by checking it against the firebox former, and the cutaway in the saddle tank frame (see 'fitting saddle tank' - below). The lower and front edges of the firebox should be parallel and square, and the firebox should not be twisted in any way, When fitted, its lower edges fit between the inner edges of the footplate. Solder the firebox in place, making sure it is also secured to the footplate along the bottom edges, then grind the locator tab from the firebox top. Finally, dress up the back face with Emery paper.

Use flat-nosed pliers to make the bends in the bunker frame (5) – all bends should be exactly 90 degrees. When fitting the frame to the footplate, be sparing with the solder. We found it was sufficient to apply flux around the locator tabs, which drew solder up from between the footplate layers. If there is any excess solder along the joins, use a blade to clean along the bottom edges of the bunker frame. Remove the bunker fronts (6 and 7) from the fret and carefully dress up the outer edges, so the beading is flush with the sides and then solder them in place on the frame. The outer edges of the bunker fronts should be flush with the side faces of the bunker frames. A good way of ensuring this is to lightly tack a piece of spare brass plate to the side of the bunker frame. The bunker front can be butted up to the plate and then, when the part is fixed in place, the plate can be removed.

Now fit the bunker sides (8 and 9) - they should lie flat on the frame sides with their front edges flush with the front faces of the bunker fronts - avoid getting any solder into the bend lines of the crossmember 'H'. When the sides are in place, carefully grind through the crossmember 'H' on the bunker frame, near the centre. When you're completely through, bend the two bits of the crossmember backwards and forwards, until they snap off at the bend lines. Anneal the bunker inner sides (10 and 11) and bend them to shape, using the raised areas and the location slots of the footplate as a guide. When you're happy with their shape, solder them in place making sure they butt right up against the cab frame at the rear and the bunker front at the opposite end.

Smokebox
Carefully open out the location holes (I) in the smokebox frame (12) and in the footplate, so a length of 0.7mm wire is a good fit. Solder two lengths of this wire into the footplate and trim them so 2mm protrudes at either end. Check the wires run vertically and straight though the footplate and remove any burrs. Remove the smokebox frame from the fret, solder an M2 nut into the circular recess and then bend the two ends of the frame up through 90 degrees.

Bend the smokebox wrapper (13) to shape – the method used for the splasher tops (see above) also works well here. If possible, make the radius a fraction tighter than the frame, so the wrapper springs on and holds itself in place. The slots in the wrapper locate on the tabs on the frame (note the orientation of the wrapper – the small etched marker dot goes to the front). Solder it onto the frame, clean up and remove any traces of the tabs.

Now use the location wires to position the smokebox on the footplate and carefully solder it in place, making sure it sits square and level. After annealing them, carefully curve the smokebox saddle sides (14 x2) so they match the radius at the bottom corners of the smokebox saddle frame and then solder them in place with the thicker full-etched strip at the top. Run solder along the top edges, where the sides meet the smokebox wrapper. Alternatively, these parts can be glued on later if you prefer.

Saddle tank
Study Figs. 2 and 3 before beginning work. Remove the saddle tank frame (15) from the fret and place it face down on a flat surface, with the bend lines facing upwards. Hold down area 'J' with a piece of wood held up against the bend line and gently bend area 'K' up through 90 degrees?. Repeat this process for both sides and then bend up the ends (L). Check that everything is square and use the piece of wood to hold the ends in position while soldering them in place.

Bend the side ribs on the tank top stiffener plate (16) through 90 degrees and then tin the top surface. Use the large hole to position the stiffener plate on the underside of the tank top (17) and then solder it in position, ensuring both parts are flat as you do so. Using the frame's four vertical corner lugs for location, solder the tank top in place and then carefully file off the lugs, flush with the top surface. The end lugs (on the ends of the tank top) locate the tanks sides and should be left in place.

Before bending the saddle tank sides (18 x2), ensure the locator lugs on the tank top will fit into the holes on these parts, without forcing. Anneal the sides and then form them to the profile of the frame ends. The best way to do this is to start by forming the bottom radius, as close to the bottom edge of the metal as possible. Bend the material around a smaller bar - go further than is required - and then force the bend

over a larger bar of about 5mm diameter, which is roughly the diameter of the corner. Keep trying the wrapper in place to get the position of the bend approximately right. When it's starting to get near to shape, use a small bar to form the radius near the top bead, this time rolling the bar across the metal on a mouse mat. Unless you're lucky first time, you'll probably have to make quite a few adjustments to the position and profiles of the two radii. This is quite a difficult job so we've provided a spare set of tanks sides, just in case!

When fitting the side, avoid forcing the wrapper at all costs and, when it is on, don't force it downwards (to pull the bottom on) or you'll bow the top edge. During this process you can anneal the metal as many times as necessary. Try to get the wrapper as near as possible to its final shape before fitting, rather than relying on pressure to pull it into shape. When you're happy with the shape of the wrapper, solder it to the frame and finish off by dressing the curves with emery paper. Do the same at both sides, grind off the end locator tabs and then carefully trim the wrapper flush with the frame ends.

Tin the backs of the frame ends (19 and 20) and solder them in place on the frame, making sure their beading lines up with the corresponding beading on the tank sides. These parts are etched slightly oversized so they can be trimmed to match the profiles of the sides and the semi-circular firebox cutaway.

Finally, locate the small balance pipe holes ('M' in Figure 2) in the saddle tank frame and open them out so they will accept a length of 0.5mm wire.

Fitting the saddle tank

Refer back to Figure 1. Grind off all the locator tabs under the footplate, along with any excess splasher material. Be careful not to accidentally trim off the chassis location wires protruding from hole 'I' at the front.

Make sure the footplate itself is straight. Place the saddle tank assembly in position, up against the smokebox, with the rear of the tank resting on the edge of the firebox. You may need to make minor adjustments to the profile of the firebox top, so its shape exactly matches the semi-circular cut-out in the tank.

Now push an M2 bolt through the hole in the rear of the smokebox (N) and loosely fit a nut to it. Tighten the nut up to the front inner face of the saddle tank (finger-tight only). When setting up the assembly, you can rest the loco on the edges of a set of open vice jaws, so the whole thing sits on the underside edges of the footplate, just outside the steps. Adjust the position of the tank while it is lightly held by the nut. When you're satisfied that it's sitting square and level with the footplate, carefully tack the saddle tank to the smokebox and firebox. Make a final check that everything is as it should be and then solder the tank to the smokebox and firebox, along the join lines, being careful not to de-solder the tank assembly itself. Remove and keep the M2 nut and bolt. Solder short lengths of 0.5mm wire into the balance pipe holes 'M', situated in the bottom of the saddle tank (Figures 2 and 5). Solder the bottom end of these wires to the footplate inside edge and trim them flush with the underside.

Platework

Punch out the rivets in the small disc, which is etched onto the smokebox front (21 – Fig, 1) and then tin the back of this part, along with the smokebox door (22). Drill out the two outer handle location holes in the smokebox front and in the smokebox frame. Cut four short lengths of annealed 0.4mm wire. Remove any burrs from the wires, slot two of them through the outer holes in the smokebox front and then use these wires to locate the front on the smokebox frame (12). Solder the smokebox front in place. Now drill out the inner holes, slot the two remaining wires into them and use these wires to locate the smokebox door on the smokebox front. Solder the door and the wires in place. To finish, stick some masking tape on the footplate (to protect it) and file ends of the wires until 2mm protrudes, then carefully bend the ends upwards, as shown in Figure 5.

Bend up the ends of the cylinder cover plate (23 – Fig. 1) and solder it in position, so the webs at the front are flush with the leading edge of the footplate. Fit the semi-circular tank mounting flange (24) up against the tank front, so it sits on top of the smokebox. Bend up the ends of the rear steps 'B', punch out the rivet detail on the step overlays (25 and 26) and then secure these in place so their long rivets strips are in line with the bottom footstep. Carefully fit the small footsteps (27 x2) to complete the step assemblies.

Attach the valances (28 and 29) to the underside of the footplate, making sure the footplate is flat while you are doing this. Butt them up against the side edges of the sub-footplate to position them (the small half etched cutaways in the valances should line up with the handrail holes in the cab floor). Tack-solder at one end first, check for distortion and then do the same at the other end. Now tack-solder at regular intervals along the valance. Check that the footplate is still level, that the valances are straight and that

there are no gaps between valances and footplate. When satisfied, work on a short length at a time and run the tacks of solder into one another – heat only short lengths of the valance at any one time to prevent buckling. Note - the sub-footplate stops just before the steps so take care not to push the valance in at these areas. Finish off by trimming the ends of the valances flush with the footplate ends.

Clean up the tiny lost wax splasher details (30 x2 and 31 x2) while they are still attached to their sprues, then remove them and solder them in place on the footplate. They should sit right up against the splashers, and be central in relation to the beading on the footplate - Note that the front and rear are different, and that the wider rear details have a small flat which sits up against the bunker front. To get them to sit flat you will need to remove all of the feed from the bottom of these parts.

Use short lengths of 0.4mm wire to locate the front sandbox lids (32 x2) on the footplate, solder them in place and then grind the wire flush at both ends.

Bufferbeam assembly

Position the rear bufferbeam casting (33) so the locator strip on the back of the beam touches the underside of the sub-footplate. Use glue or a small amount of low-melt solder to temporarily tack it in place. Remove the cab rear sheet (34) from the fret and straighten as required. Make two bends in the handrail braces – these are the rails extending outward from the top of the rear sheet. The width across the outside of the braces should correspond with the width across the braces on the bunker sides. To position the bends, place a length of 1/6in O.D. tube or bar along the vertical edge of the rear sheet and bend the brace round the tube, through 90 degrees. This will give the approximate position, although a few tweaks with the pliers will almost certainly be necessary to get them spot on.

Lightly tin the rear surface of the cab sheet, on one side only (see diagram) just below the cutaway. Now fit it into the recess in the rear bufferbeam and line the top edge of the cab sheet up with the tops of the bunker sides. After making a final check of its position (both vertically and horizontally) carefully secure the rear sheet it in place with low-melt solder. If you wish, you can use 0.5mm wire to pin the cab sheet in position on the bufferbeam - this will prevent it from moving when you solder on the overlay - and then grind the wires flush. Remove the rear beam assembly.

If you're fitting the dumb buffers (35 x4) supplied with the kit you'll need to carefully grind away some of the rivets on the bufferbeam overlays (36 x2). Tin the backs of the overlays and then solder them in place on the front (37) and rear beam castings. If you're fitting conventional buffers (not supplied) open out the location holes using the drill starts provided in the overlay and fit the buffers. For dumb buffers, solder or glue these in place so they line up with the top corners of the beam.

Fix the beams in place on the footplate (the front bufferbeam locates in the same way as the back) making sure they are central. When you come to fit the chassis it will be necessary to grind two small clearance notches in the seam, which now runs between the beam and footplate. Their position will depend on the chassis width and they can be done when the chassis is tried in place.

Trim the mounting peg on the chimney (38) to about 1mm long and then solder it in place. Fit the tank filler (39) and then grind the locator tab flush inside the tank. Drill a 0.5mm hole in the centre of the tank filler, fit a short length of 0.5mm wire and trim so it sits slightly proud.

Cab fittings

Add the small rivet details (40 x2 handed pairs) to the chassis top rails. Refer to figs 4, 5 and 19. Use a 0.4mm drill bit to open out the handrail locations in the cab floor. Slot short lengths of 0.4mm wire into these holes, with the top end wires running to the outside face of the handrail braces on the bunker sides and cab rear. Check the wires are vertical and solder them to the braces and into the floor. Trim the tops of the wires so they protrude by about 0.3mm above the braces and then trim the braces so their ends are vertical and very slightly proud of the handrails.

Using the drill starts provided, drill all the holes in the dome casting (41) to suit the various components, as shown in Figure 4. While still on the sprue, drill out the holes in the feed taps (42 x2) to accept 0.5mm wire. Solder the feed taps into the sides of the dome (the right hand tap goes into the lower of the two holes) Drill out the Salter balance springs (43 x 2) - again, this is best done while they are still on the sprue – and solder 0.4mm wire into the ends. Trim the top wires to length so they protrude by about 2mm and leave about 5mm sticking out from the bottom. Carefully solder the balance springs in place at the rear of the dome - the bottom wires from the balance springs should just touch the lip of the dome as they protrude down beyond the bottom edge.

Fit the whistle (44) to the right hand side of the dome, above the feed tap. Use the drill-start to drill into the pressure gauge (45) using the bit you have and then fix the gauge in place (hole facing downwards) between the balance springs. Before fitting the dome, make sure the holes in the feedtaps and pressure gauge are free from solder.

Open out the dome's location hole on the firebox, and then use a 0.4mm bit to drill out the holes for the safety valve wires (O – Fig. 1)). Fit the dome assembly onto the firebox, slotting the bottom wires from the safety valves into their location holes as you do so. Note - you may need to open out the dome's location hole further in order to get the safety valve wires to line up with their holes in the firebox.

When everything lines up and the feedtaps are at right angles to the footplate edge, solder the dome in place. Solder the bottom wires from the safety valves into their holes (O) and then grind the ends, along with the dome's mounting pin, flush inside the firebox.

Slot lengths of annealed 0.5mm wire up through holes in the footplate ('P' – Fig.1), into the taps and bend them to shape, so they curve around the firebox (Figs. 4 and 5). When you're happy with the shape, solder the pipes into the feed taps and then into the footplate before finally trimming them flush at the underside.

Drill out the holes in the reverser lever (46) and reverser lever detail (47), use short lengths of 0.4mm wire to locate the detail and then solder the parts together. Trim the location wires so they are slightly proud at either side. To represent the top catch, solder a small piece of bent 0.4mm wire into the hole at the top of the lever and trim it slightly proud of the rear face of the reverser. Bend over the front end of the reverser linkage, locate this in the small hole situated in the right hand bunker inside (Q - see Figure 1) and then solder the reverser assembly in place in the cab floor and bunker.

Fit the lost wax handbrake casting (48) into its location in the cab floor. Drill out the holes in the backhead casting (49) to suit the various parts shown in Figure 4. Fix the gauge glass (50) in place on the backhead. Solder a short piece of 0.4mm wire into the backhead to represent the regulator pivot. Carefully solder the backhead shelf (51) in place.

Bend over the end of the regulator (52), fit this in place on the pivot wire and then trim the wire slightly proud of the etch. Make sure the rear face of the backhead is free of any projections and then fit it to the rear of the firebox. Alternatively, this can be done after painting. Run a length of fuse wire from the hole in the pressure gauge, down into the small hole 'R' in the footplate.

Position the maker's plates (53 x2) on the bunker sides, as shown in Figures 5 and 19, and then solder or glue them in place. Wait until the chassis is complete before painting the body.

ASSEMBLING THE CHASSIS

The chassis can be built either rigid or with simple three-point compensation. Unless you're an absolute expert, building a fully sprung chassis is not advisable due to the limited clearance inside the body restricting the vertical movement at the rear axle.

Refer to Figure 6 and ream out the axle holes in the frames (54 and 55) to accept the 1/8in bearings as a tight push-fit. If you're building a rigid chassis, you can solder them in place at this stage (modellers working to 16.5mm gauge should file the rear axle bushes flush with the inside of the frames to allow clearance for the gearbox). For a compensated chassis, leave the front pair loose.

This paragraph applies to EM and P4 models only. Use a 0.4mm drill to open out the spring hanger pin holes (S) in the frames. Do the same for the brass spring details (56 x4). Use short lengths of 0.4mm wire to locate these details on the chassis with the half-etched cutaways facing away from the frames. The diagram shows the arrangement for a P4 chassis - for EM gauge, the spring details are fitted on the outside of the frames (the opposite side to the hornblock cut-out marks). Solder the details in place making sure they are tight against the frame etches. Trim the wires at the ends of the hangers until they are very slightly proud of the outer face and flush with the inner. Drill though the reverser rod location hole (T) and solder a short length of 0.4mm wire into it. Trim the wire flush at the outside, with about 1.5mm protruding at the rear. Use a sharp blade to dress up the springs, so the two layers of etching look like one solid piece. Clean any excess solder from slots in the springs, but note that the narrower slots in the nickel chassis etch locate the boiler mountings, whereas the larger slots in the brass spring details are for clearance only (in other words, don't try make the slots the same size).

For a OO chassis, solder short lengths of wire into the holes ‘S’ at the ends of the springs on the frames. Trim these wires so they are very slightly proud of the front face and flush with the rear.

Assemble the frames, according to gauge, using the appropriate spacers (57 - 59). Solder in the front and rear spacers first, with the L-shaped spacer (58) in place, but not actually soldered in position. Check the frames are square and parallel.

The location of the top horizontal section of the L-shaped spacer (58) is critical as it sets the height and angle of the cylinders. With the front and rear spacers fixed and thus holding the chassis together, push the top section of the L-shaped spacer down so it sits absolutely flat on the chassis top as you solder it in place. Once the top section is fixed, you can go on to solder in the vertical section. Grind off all the excess locating tabs.

For a compensated chassis, open up the hole in the L-shaped spacer (58) so a length of 1.5mm rod is a snug fit. With the front top-hat bearings in place, push an axle through and then thread the rod through the hole so it rests on the axle, with the minimum amount protruding from the front face of the spacer. Check that the rod is level and parallel to the sideframes, and then solder in place. Remove the axle and the front bearings and then, following the half-etched marks, saw away the cut-outs and clean up.

Use flat-nosed pliers to carefully make the bends in the dummy-inside motion (60 and 61). Open out the holes in the ends of the motion, and at the locations in the chassis, so a length of 0.7mm wire is a sliding fit. Pass a length of wire through the chassis, from one frame to the other, threading it through the holes at the rear of the inside motion as you go. Solder the wire in place in the chassis. Now locate the tabs at the front ends of the motion in their slots in the frames, and solder in place. Tweak the motion so it runs parallel to the frames, solder it to the wire and then finish off by grinding the wire flush at the outside of the frames.

Choose the appropriate motion bracket bottom (62) for the gauge you are building to. Try the motion bracket in its slots ‘U’- it should go fully home. If you will be using a wheel press to fit and quarter your wheels, you may find it preferable to permanently fit the motion bracket only when the wheels are on, otherwise it may foul the wheel press.

Coupling rods and connecting rods

Layer up the connecting and coupling rods (63 - 70) as illustrated in Figure 16, and then ream out the holes so to suit the crankpin bushes. When assembled, the clearance between the crosshead and leading crankpin will be limited in P4. To prevent them touching, the front layer of the rods can be cut as shown (best done before layering the rods) and the top hat bush reversed after having been filed to length. If this is done, the top hats on the other crankpins should also be reversed, so the connecting rods run parallel to the frames. The rods will now run close to the wheels, so make sure the axle ends are the correct lengths and don’t stick out beyond the wheel face. Note that Sharman S62 type wheels have a spacer boss moulded at the base of the crankpin, which prevents the back of the rod from shorting out on the face of the tyre. Optional crankpin spacer washers (71 x4) have been provided for use with other types of wheel (i.e. without a raised boss).

For a compensated chassis, assemble the hornblocks (not supplied) according to the manufacturer's instructions. Use the rods in conjunction with jig axles to set the lateral position of the hornblocks in the front frame openings, and then fix them in place. Remove the wheels and axles.

Punch out the rivets in the firebox bottom (72 - OO or 73 – EM/P4) and bend to shape, using a needle file handle to form the corners. Trim the ashpan (74) so its length is equal to the distance across the rear angle, and solder it in place. Fold down the four mounting lugs, strengthen the bends with solder and then try the assembly in place on the chassis. Do not solder the firebox bottom in place - it is removable to allow the gearbox to be fitted. When the body and chassis are fixed together, the firebox lugs are nipped between them, preventing it from moving.

Boiler assembly

Use the gear cutaway to identify which is the inside and outside of the boiler (75) and then carefully bend the boiler to shape, so that it exactly matches the boiler former (76). Solder the boiler former into the boiler and file off the surplus lug at the bottom.

Open out the location wire holes in the boiler hangers (77 x2) and in the appropriate boiler mounts (78 x2 – OO, EM or P4), so a length of 0.7mm wire is a good fit. Locate one of the boiler hangers, so its central tab fits into the front slot 'T' in the boiler, and tack in place.

Make sure the hanger (which also acts as a former) is tight up against the boiler, and that it is vertical so it doesn't cover the side slots. Hold the hanger in position by gripping the bottom tab with pliers as you solder it in place.

Check the holes in the boiler front hanger is free from solder and then push one of the boiler mounts (78) (OO, EM or P4) though the front slot 'V' in the side of the boiler, until the location holes line up with those in the hanger (77). Push short lengths of 0.7mm wire through the holes, nip the parts together with pliers, and solder the mount to the hanger, taking care not to de-solder the hanger from the boiler wall. Do the same at the rear hanger, making sure the gear cutaway in the boiler mount lines up with the boiler cutaway.

The boiler is removable and simply clips into place on the chassis. Try the assembly in position, with the small pegs on the side of the boiler mounts locating in the bottom of the slots in the springs. Make sure the boiler isn't pushing the chassis frames outwards as this could cause the wheels to bind.

For a OO chassis, you'll need to bend the chassis springs outwards very slightly, in order to get the boiler to fit between them. When its in place you'll notice the mounting pegs on the OO boiler mounts are slightly overlength and these should be trimmed flush with the outside face of the springs.

Now remove the boiler and offer it up to the body. The boiler should fit snugly between the inner edges of the saddle tank, with the extensions at the rear of the boiler sitting between the inside faces of the firebox.

Once you've got the boiler to fit comfortably, try it on the chassis again and offer the complete assembly up to the body. To provide clearance for the top corners of the chassis, you'll need to grind two small clearance notches in the seam, which runs between the beam and footplate. Do not proceed further until you are satisfied that the various components can readily be fitted and separated again. At this stage you might like to think ahead to how the pick-ups will be wired to the motor, which sits inside the boiler. We recommend passing them inside the boiler and down through the gearbox, using the spacer strut (98) to keep them clear of the gears. This will allow the cylinders to be removed if necessary.

Brakegear

This method of assembly creates a set of brakegear that is fully removable as well as totally prototypical in appearance. The wheels need not be fitted during this procedure. Do not solder anything until the instructions specifically say so.

The first step is to drill out the brakegear components (79 - 87) to the suit the various wire sizes, illustrated in Figure 6. Make sure that all the wires will pass through their holes without forcing.

To represent the cross-shaft, thread a length of 1mm wire, approximately 20mm long, through the chassis and the handbrake lever assembly halves (79) and solder the wire in place making sure that it is central in the chassis. Position the handbrake halves about 2mm from the left-hand side of the chassis and solder them together on the shaft so the lever lies horizontally, as shown. Push a short length of 0.4mm wire into the groove at the end of the rod. Solder in place and then trim it to length, so about 0.5mm protrudes from the bottom, with the top of the wire about 1mm below the top edge of the chassis.

Slot a length of 0.5mm wire through the small holes, which are situated just above the crosshaft, and then use this wire to locate the front brake rods (80 x2) on the chassis sides. The opposite ends of these rods are located on short pieces of 0.5mm wire. Solder the rods right up against the chassis sides and then trim the front wires flush with the rod faces. Due to the limited clearance behind the wheels in OO gauge, it may be necessary reduce the thickness of the rods behind the wheels.

Push the actuators (81 x2) over the crosshaft ends. Use the 0.5mm wire which protrudes from the rear of the front brake rods to position them at the correct angle, with the rear end of the brake rod setting them the at the correct distance from the frames. The actuators should lean slightly forward and lie vertically when viewed from behind. Solder the actuators in place and then trim the 0.5mm wire and crosshaft almost flush on the outside. Trim the 0.5mm wire flush with the chassis on the inside. Slot another length of 0.5mm wire through the bottom of the actuators and solder it in place. Cut away the middle section of this wire and then trim the remaining lengths flush with the inside face of the actuators, with about 1mm sticking out from either side. Solder short lengths of 0.5mm wire into the small holes 'W' situated just ahead of the rear axle holes. Trim these wires flush with the outside of the frames and leave about 0.5mm protruding inwards.

Open out the holes in the brake blocks layers (82 x4 and 83 x8) so a length of 0.5 wire is a tightish fit. Use the wire to locate three layers together, making sure the tabbed layers are in the middle, and solder

together to make two handed pairs (Fig.7). Take one handed pair and file the locating wire flush with the block faces. On the other pair leave it about 1mm proud at one side only – these are now the rear blocks.
Carefully bend the brake hangers (84 x2 and 85 x2) to the profile shown in Figure 8, to make two handed pairs. Make sure the grooves at the top of the hangers are on the outside of the bends.
Refer to Figure 9. On a flat heatproof surface, lay the brake block assemblies and their sides, locate their tabs in the hanger slots and then solder them in place on the hangers to make two handed pairs, one of which (the rear pair) has wires protruding from the block, as shown. Now put these assemblies on their backs and carefully solder short lengths of 0.5mm wire into the grooves at the top of the hangers. Trim these wires almost flush at the outside and leave about 0.5mm protruding beyond the lug, at the inside (see Fig. 11).

Take the rear pair of hangers and slot a rear brake rod (86 x2) over the protruding wires at the back of the blocks, as illustrated in Figure 10. Temporarily push a length of 0.5mm wire into the holes at the bottom of the blocks and use this to set the angle of the brake rods. Use something to hold the rod in position on the block, remove the bottom wire from the block and then carefully solder the rod in place. Be quick with the iron so you don't disturb the alignment of the parts.

Slot a 25mm length of 0.5mm wire through the bottom of one of the rear hanger assemblies, and carefully solder the wire in position. Slide the other rear hanger assembly over the opposite end of this crosswire, but do not solder it in place. (Figure 11 shows the front and rear hangers in place on the crosswires.) Offer the pair of rear hangers up to the chassis and locate the pins at the top of the hangers in their holes in the frames, nipping them between your finger and thumb to hold them in place. Now locate the rear ends of the brake rods over the wires at the bottom of the actuators and then adjust the width across the bottom of the hangers. Make sure the hangers are vertical when viewed from behind and that the brake rods are more or less parallel with the frames. When you're happy with their position, careful solder the loose end of the crosswire into the bottom of the brake hanger assembly. You can now remove the hangers by carefully springing their tops away from the chassis and the backs of the brake rods from the actuators.

The front hangers should be assembled onto the bottom crosswires in the same way as the rear (see Fig. 11), but this time include the short front rod extensions (87 x2) on the crosswire. Do not solder these extensions in place.

Locate the pair of front hangers on the chassis, nipping them between your finger and thumb, as above. Now position the hangers, so the crosswire rests across the bottom edges of the frames, thus ensuring that both hangers lie at the same angle. Slide the front rod extensions to the centre of the crosswire (so they don't get soldered in place), make final adjustments to the hangers so they hang parallel to the frames, and then solder the loose end of the crosswire into the hanger to set the width. To set the distance from the wheels for the front hangers, slide the front rod extensions along the crosswires and locate the ends on the small pins in holes 'W' (situated just ahead of the rear axle holes). Check the rod extensions are parallel to the frames and then solder them to the crosswire only. To remove the front hangers, spring the rod extensions from the pins at 'W', swing the hangers away from the wheels and then spring the tops of the hangers outwards.

Remove both the front and rear brakes and put them to one side. They can be fitted after the chassis has been painted.

Form the offset in the railguards as shown in Figure 7. Refit the rear brakegear to check the railguard doesn't get in the way of the brake rods and adjust the railgaurd as necessary.

Refer to Figure 19, While they are still on the sprue, drill out the holes in injectors (88 x2) so they accept 0.5mm wire. Solder a length into each valve, clip the parts from the sprue and then file off the remainder of the mounting peg and make a sharp bend in the wires on each injector, so you end up with a hander pair. Solder the tops of the wires directly onto the frames, so the valves are suspended over the frame cutaways. Try the firebox bottom in place and, if necessary, tweak wires to move the injectors away from its sides. Now try the rear brakes in place to check they don't catch the injectors.

Cylinders and Motion

Some of the individual parts used in this section are very fragile and should be handled with great care. Once assembled and in situ, you'll be surprised how strong the whole assembly is. Any adjustments to the parts should be minimal - no more than the removal of the tiniest amounts of metal cusp. Opening out of holes should be done using tapered reamers and never force anything into place

Before bending it to shape, modellers in EM and P4 will need to file away an appropriate amount of the half-etched areas from the cylinder saddle (89) to allow for the different frame width (see Figure 13). Gently open up the four holes (X) in the cylinder saddle, until a length of 1.6mm OD tube is a tightish fit.

Fold the saddle to shape, as shown. Countersink the bolt holes to suit the 14BA fixing bolts – when fitted the bolt head must be flush with the saddle top. Make sure the vertical faces of the saddle are at right angles to the top surface and secure the saddle with 14BA nuts and bolts (this makes the whole of the cylinder assembly removable at any stage - it shouldn't be soldered into the chassis). Do not overtighten the bolts or the saddle may bow. When you're satisfied the saddle fits, remove the bolts and the saddle.

Refer to Figure 12. Gently open out the holes in the discs on the slidebars (90 and 91) to accept the same tube as above. Handle the slidebars with particular care - until they're soldered into the cylinder assembly, they're very delicate.

Bend up the slidebars at the motion bracket end and then bend the discs at the other end. The slidebars can be lightly clamped while you are doing this to avoid distortion. Add little fillets of solder to strengthen the bends. Use 0.7mm wire to pin the two halves of the motion bracket, solder them together and then file the wire flush.

Hold the cylinder saddle in one hand and, working at one side, slide the narrow area of the slidebars ('Y' in Figure 12) along the slots in the rear cylinder face, until the bars sit at the cylinder centreline. Don't force anything - if necessary, relieve the cusp from the chassis slots with a blade. Now, carefully spring the opposite slidebar outwards and do the same at the other cylinder, until both slidebars are located on the cylinder centrelines. Now slide the motion bracket forwards, until the disc at the front is up against the cylinder front. Carefully fit the assembly into the chassis, so the motion bracket simultaneously drops into its slot as the saddle is fitted. Note - there may be a slight gap between the slidebar disc and the front cylinder face, as in Figure 14. This will not affect the running.

Dress and lightly countersink one end of a length of 1.6mm O.D. tube and push this through the front of the cylinder/slidebar assembly, until the dressed end is absolutely level with the end of the narrowed area of the slidebars, as shown in Figures 13, 14 and 15. Check the alignment of all the parts by pushing a piece of 0.8mm wire or a drill into the tube (it should project along to the rear wheel centre). Check that the motion bracket and the cylinder faces are all vertical, and that the wire runs centrally between the slidebars (Fig. 14). Now solder the slidebars to the cylinder saddle and to the tube at each point of contact. Solder the slidebar disc to the front cylinder face and/or to the tube, then solder the tube into the cylinder faces. Trim the front end of the tube flush using a file or carborundum disc (avoid cutters - they may collapse the tube end and impede the motion of the piston rod).

Bend and fit the cylinder wrappers (92 x2). Form them to shape as exactly as possible (make sure the half-etched lines are on the inside. (It's easiest if you form the radius near the top of the wrapper first). The wrapper is fitted that equal amounts are overhanging at the front and rear, with the narrower area tucking up between the bottom inside faces of the cylinder saddle. The top edge of the wrapper should be in line with the top of the cylinder saddle, otherwise there'll be a visible gap behind the valances when the body is fitted. When soldering in place, take care not to dislodge the slidebars.

Now punch out the rivets on the cylinder covers (93 x2) (94 x2). Fit the rear covers over the slidebars and solder them in place (Figs. 13 and 15). Fit the cylinder front covers. Use a length of bent 0.4mm wire to represent the cylinder lubricators but make sure the wire does not protrude into the tube or it may impede the travel of the piston rod.

Crossheads and connecting rods

Remove the crossheads (95 x 2) from their sprues and trim them so their total length is 14mm. Straighten them as necessary and remove any mould lines from the piston rod. Try them in a spare length of 1.6 O.D. tube to check they are a smooth sliding fit.

Stick a piece of masking tape over the filing guide (see fret diagram) and cut it out around the opening. Lay the crosshead (front face upwards) on the guide, turn it over and file the rear face until it is flush

with the back of the guide. This creates clearance for a smooth sliding fit of the crossheads on the slidebars. Repeat with the other crosshead.

Refer to Figure 13. Offer up the crossheads to the slidebars. They should slide smoothly but without any slop, right up to the glands. Fit the small end of the connecting rod over the pivot on the rear of the crosshead, making sure the rod is correctly oriented and checking that the rod pivots freely. Put a tiny drop of oil on the pivot and on the slidebars and then, using the smallest possible quantity of solder applied at the piston-rod end, fit the crosshead backing plates (96 x2). Check again that everything runs smoothly and that the crossheads travel the full length of the slidebars, right up to the tube.

With the cylinders in place, the sandpipes can be fitted (Fig. 19). Drill two 0.5mm holes in the cylinder wrappers, at their midpoint, about 2mm outward from the frame edge. Solder lengths of annealed 0.5mm wire into these holes and bend them to shape so they line up with the wheels. Trim the ends so they are about 1mm from track level. The rear pipes can be made from the same wire, soldered into the small holes under the coal bunkers (‘Z’ in Figure 1) and then bent inwards towards the wheels.

Boiler bands can be represented by strips of 0.8mm wide tape cut from a length of 'Sellotape' stuck down on a piece of glass. There should be one band at the front and one at the rear (approximately level with the bunker fronts) with two further bands equally spaced in between them (Figure 19).

Fitting the gearbox/boiler and cylinder/slidebar assemblies
Though this sequence is described as it would be done on the final, working model, it is best to practice it several times first, so you are sure of where the various parts and sub-assemblies are to go and how best to get them into position. Remember that nothing is soldered or otherwise fixed permanently in place unless specified.

At this preliminary stage, you can try out the assembly sequence (Fig 16) using just the folded up gearbox (see the gearbox section overleaf) before the gears themselves are fitted. Temporarily screw the mount to the motor. Make sure the motor mounting screws are central in their slots, otherwise the motor may sit too high, or too low.

First, sit the mounting tabs on the firebox bottom in their locations in the chassis. Hold the motor inside the boiler, so the gearbox butts up against the rear edge of the boiler, and then locate the lugs on the boiler mountings in their slots in the chassis springs. Make sure the boiler is not twisted in any way and push an axle through the bearings. If the gearbox shell is square and the chassis bearings are correctly aligned, it should be free to revolve. If these are fine but it is still tight, then the boiler is probably off centre, or sitting too high on its mountings. Tweak gently to put things right.

To fit the cylinders, tilt the gearbox back slightly without forcing and at the same time lift up the front of the boiler sufficiently to slip the cylinder/slidebar assembly into place. If you get stuck, do not force anything. Remove the assembly and check for any excess solder, slots that are not fully opened up or anything catching on the boiler.

With the above assemblies in place, offer up the chassis to the body and secure using M2 bolts. The rear bolt must be cut to the correct length - if it's too long and you tighten it too far, then it will push up and damage the thin loco floor. The front bolt should be cut to about 6mm long to prevent it from causing damage inside the smokebox. The chassis' top edge sits up against the top footplate layer, so it's important to check that all the recesses in the sub-footplate are free from excess solder. If the chassis still won't go fully home then the cylinders could be fouling. Check that the cylinder saddle is sitting fully down in its locations, and that cylinder wrappers are a good fit. When all is well, dismantle the assembly.

108:1 Gearbox assembly
Study Figs 17 and 18. Before cutting the gearbox etch (97) from the fret, progressively drill out or ream each of the holes to accommodate the shafts or bushes shown in the diagrams. Components should be offered up until they a tight push-fit in their holes. Once the gearbox is assembled, the shafts are fixed but the gears are free to revolve.

Remove burrs by inserting the tip of a drill bit (of much larger diameter than the hole) and gently rotating it between your fingers. Solder the 1/8in bushes into place with the larger-diameter shoulders on the same side of the etch to the bend lines. Now cut the etch from the fret with a heavy blade and trim off the tabs.

Before folding the gearbox etch, check that the tabs on the spacer strut (98) will fit easily into their slots and then fold up the gearbox as indicated in Fig 17. AII bend lines are on the inside of the gearbox. First, bend the sides thought 90 degrees, then bend the strengthening ribs (A2) though 45 degrees. Fold the motor mounting plate (B2) round though 90 degrees, hold it in position, and make any necessary adjustments to the position of the ribs, so their tabs locate in the slots on the plate.

Release the pressure from the motor mounting plate – it will spring back slightly – and slot the half-etched tab on the spacer strut into its location at the rear of the gearbox. Take a piece of wood (to protect your fingers from the heat) and push the mounting plate back up against the gearbox, making sure the tabs on the strengthening ribs and both the tabs on the spacer strut locate in their slots.

Keep applying pressure with the wood and solder the mounting plate firmly place. Slot a length of shaft through the stage one gearshaft holes to check the position of the spacer strut and then solder it into the front and rear of the gearbox. File off any tabs which protrude through the motor mounting plate.

The shoulders on the gearbox axle bushes can be used to centralise the gearbox in the chassis, thus eliminating the need for washers. File the shoulders on the bushes (equal mounts both sides) until the gearbox fits centrally between the axle bushes in the chassis. Remove burrs as above.

Using a carborundum disc in a mini-drill, cut 2mm silver steel gearshafts, so their lengths equal the overall width of the gearbox. Wear effective eye protection – cutting discs can and do disintegrate if they snag. Remove any burrs with a fine file. Offer up the shafts to their respective holes. Because the shafts are a tight fit, you will only be able to pass them through both sides of the gearbox if it is truly square. If they won't go through, then the gearbox hasn't been folded accurately. Light finger-tweaking should put things right.

De-flux the gearbox by scrubbing with household cleaner, then rinse and allow to dry. Check that the gears themselves are free from any dust or swarf left over from manufacture. Cut your motor wires into two equal lengths and solder them to the motor brush tags. Insulate the lower terminal with tape. For testing, connect the other ends to the output leads of your controller.

Some brass worms supplied to us are fractionally tighter than others and if they aren’t an easy push-fit, they can be gently forced onto the shaft in a vice. Don’t use excessive force or the shaft may bend. Instead, use a broach to ease the fit of the worm and then, if necessary, secure the brass worm with a small drop of Loctite 601 at the outer end of the motor shaft.

Fit the worm onto the motor shaft (at the mounting screw end) so it’s mid-point is about 7.3mm from the motor face (i.e. - so the worm centre lines up with the stage 1 gearshaft when the motor is fitted into the gearbox). Grind off the excess motor shaft and screw the motor onto the mounting plate.

Fit the first-stage gearshaft with the 27/10T. gear and test under power. To adjust the mesh, loosen the motor fixing screws slightly and move the gearbox relative to the motor until you have a good mesh - neither too tight nor too loose. When satisfied, tighten the motor screws and lightly glue the shaft on one side only - this will make it easier to remove.

Fit the second stage gearshaft into the gearbox along with the 20/10T. gear. Test under power and then glue the shaft in place.

Temporarily fit a 1/8in axle along with the final brass 20T. (making sure the latter is correctly meshed with the 10-tooth part of the stage 2 gear). The brass gear should run close up against the side of the gearbox, away from the side face of the stage 2 gear. This clearance, shown in Figure 18, must be maintained at all times. With the gears positioned correctly, test the gearbox under power.

The gears are notionally self-lubricating but a little plastics-compatible lubricant, such as RS Multi-purpose Grease, will do no harm. Do not use general-purpose modelling oil, which attracts dust and grit. Metal-on-metal contact areas (motor bearings, axle bushes) should be lubricated with a tiny amount of Seuthe ultra-adhesive oil.

Fitting the wheels

When the gearbox is completed and you are ready for the final assembly sequence (Fig 16), offer up the motor/gearbox/boiler sub-assemblies, as before, but this time with the leads from the motor brush tags passing down through the firebox.

As you fit the rear axle, slip on the final drive gear. Fit and quarter the wheels - the right hand cranks lead by 90 degrees?. The kit includes axle washers of varying thicknesses, which should be used to eliminate sideplay. The amount of movement at the rear axle may be small, but if unchecked, it will cause the gears to sandwich together, causing premature wear. Remember, clearance between the stage 2 gear and the brass final drive gear must be maintained at all times (see previous section and Figure 18).

Fit the bushes to the crankpins, add the coupling rods and check for free-running. Fit the securing nuts to the front crankpins and cut these crankpins off flush. Leave the rear crankpins at full length for the time being. Fit the balance weights (99 x4 – Fig 6) to the wheels, directly opposite the crankpins - epoxy is best for this. Make sure they lie flat and don't foul the rods.

Secure the cylinder assembly to the chassis using 14BA nuts and bolts. Attach the connecting rods to the rear crankpins and make sure the chassis runs smoothly without any tight spots. Once satisfied, cut off the surplus crankpins and secure the nuts with a tiny drop of Loctite 601 retainer. To prevent them from catching the underside of the footplate, P4 modellers should remove the tiny corks from the top of the connecting rods.

Secure the final drive gear to the axle using a small amount of glue or Loctite. Use the minimum amount and avoid getting adhesive in the bearings - heat from the soldering iron can destroy unwanted bonds that may form, but be careful of the plastic gears.

Finally, with the body removed, slot the front end of the reverser rod (100 in Figure 16) over its location pin, situated behind the front right hand spring. Swing the back end of the rod down, so the notch locates on the rear boiler mount. Use nail varnish, or a non-permanent adhesive (in case the cylinders ever need to come off) to secure the rod onto the pin.

Pick-ups

Most modellers have their own preferred method of fitting pick-ups. Suitably shaped wiper pick-ups (phosphor-bronze or 0.33 hard brass wire) can be run to the wheel rims from busbars running between strips of gapped copperclad fixed across the chassis at suitable points, such as under the smokebox and between the inside motion, in front of the rear axle. Make sure you allow adequate clearance around the chassis components to prevent shorting. The motor leads can be fed down through the firebox and, after being cut to length (allowing a reasonable amount of slack), they can be soldered to the copperclad strips.

Once the body is in place, it acts as a retainer for the various sub-assemblies. Check that the boiler and cylinders are correctly positioned and lower the body onto the chassis, this time making sure the firebox bottom is also fitted, as described earlier. Slip a small piece of packing or Blu-tack between motor and body to deter the motor/gearbox from trying to rotate about its own axis (but don't make this too thick as there isn't much clearance).

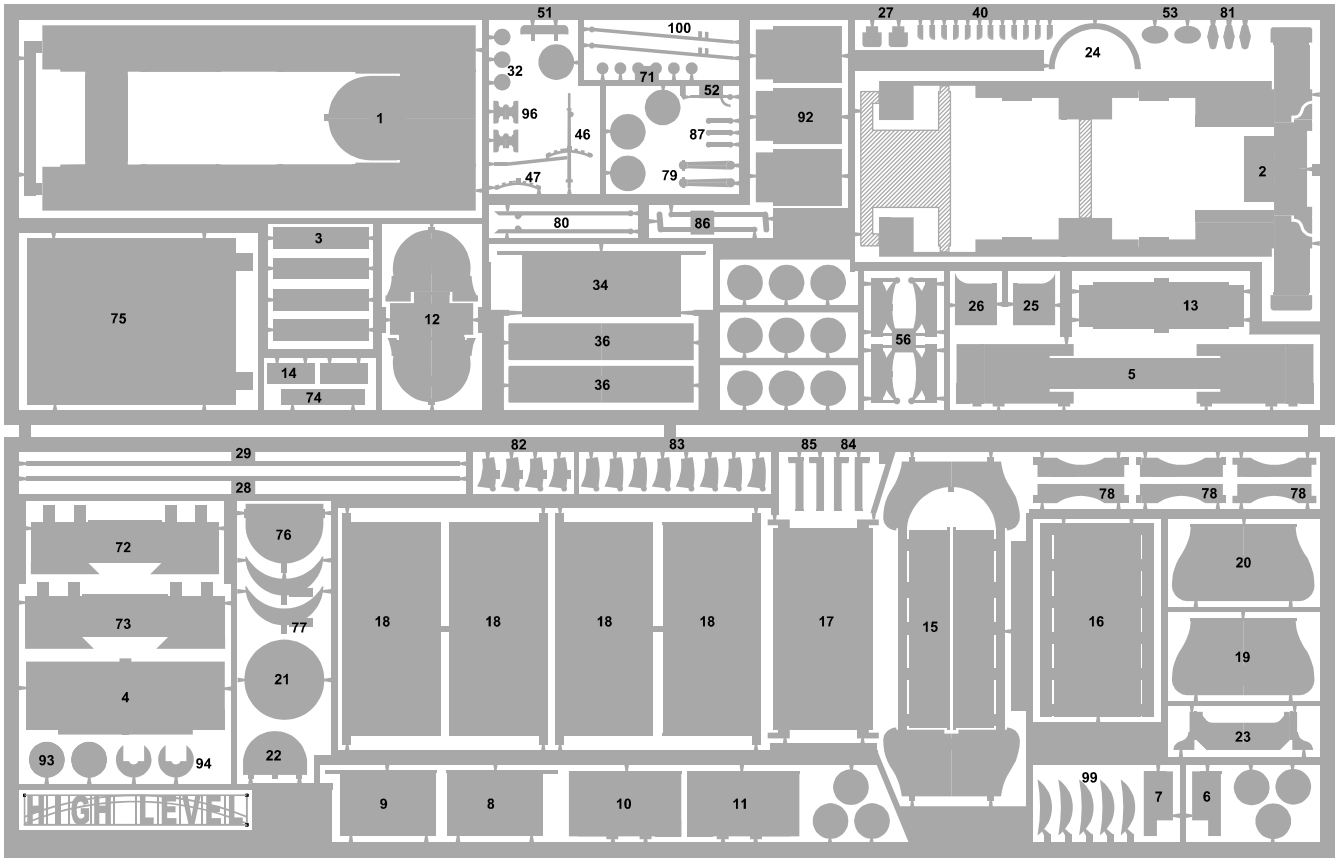
Fine tuning

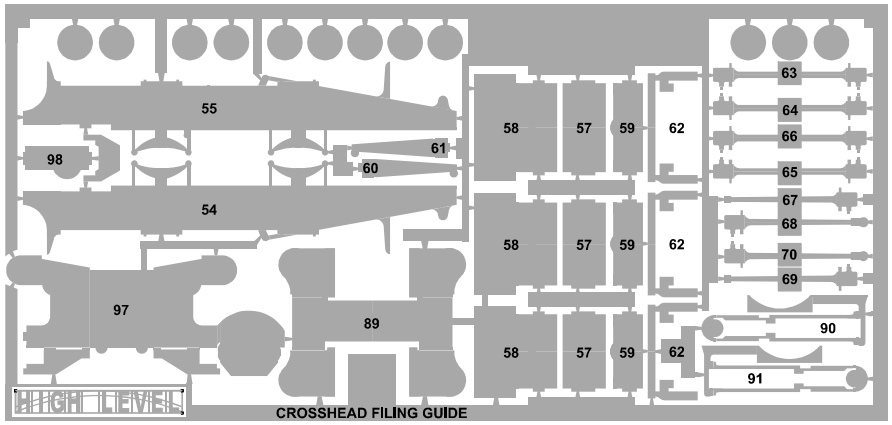
Invert the loco and fit M2 bolts at either end. Fit the brake gear as described earlier and test the loco on the track. Eliminate shorts by gentle tweaking and carefully adjust the pick-ups to make sure each one is working perfectly. After half an hour or so, the components will bed in with one another and the running will be even smoother than before.

If you've followed the instructions and worked carefully, it's unlikely that you'll have any kind of problem when you reach the stage of on-track testing. If you do, don't rely on running in to eliminate tight spots of any kind. Above all, don't crank up the revs in an effort to blast your way through any mechanical obstruction - the mechanism has sufficient power to bend the motion work. The sensible solution is to dismantle the loco, find what's binding, check through the instructions to see what you should have done and the put the problem right.

We doubt, however, that you'll have any such difficulties, because High Level locomotives are designed both to run well and to look good. We try as far as possible to eliminate any variables at the design stage and to make it easy for everyone to attain a consistently high standard when assembling our kits. We hope, therefore, that building your Neilson will have been as enjoyable as the pleasure you'll gain from operating the finished model on your layout.

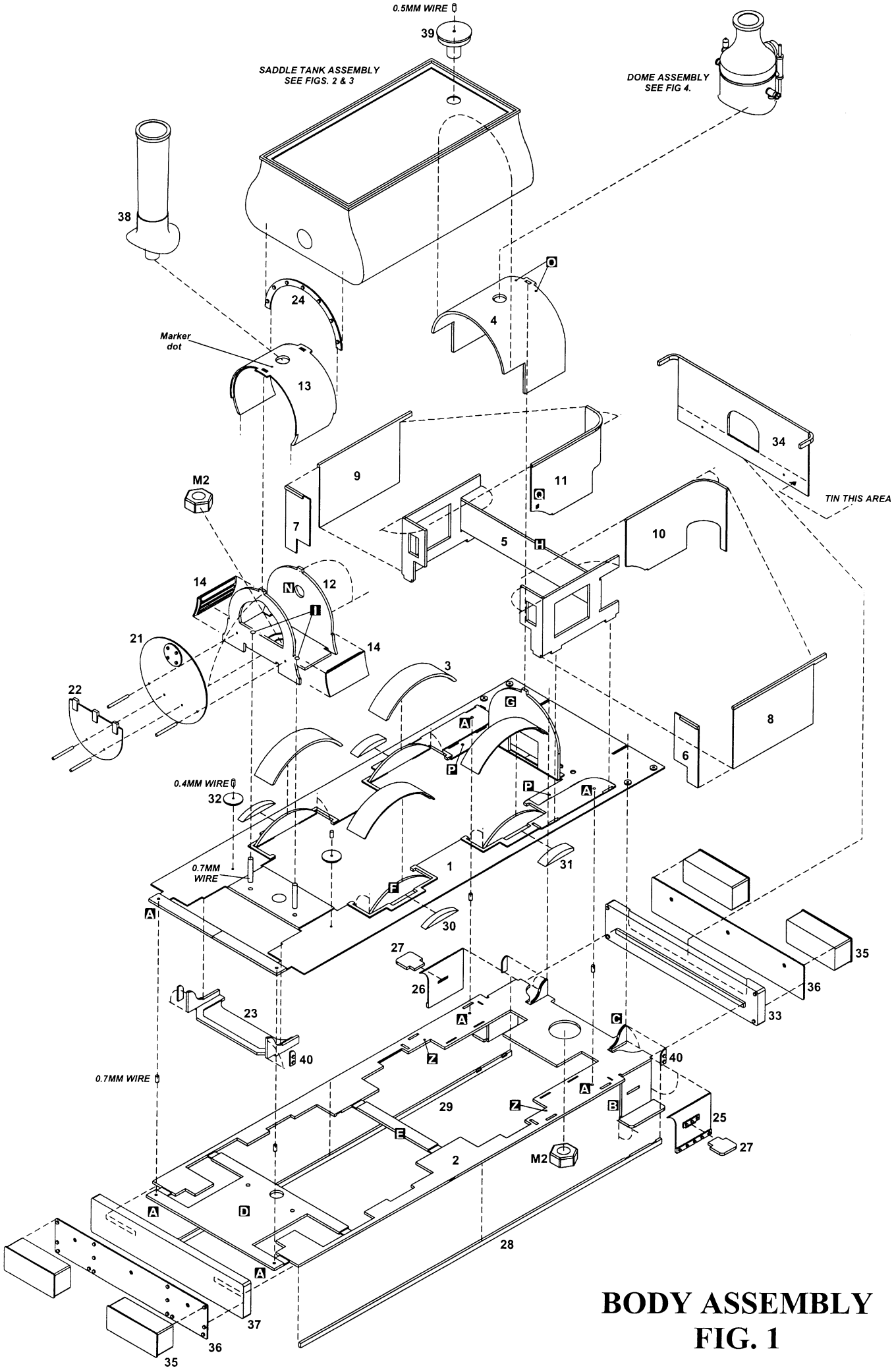
NEILSON 12IN MINERAL ENGINE





PARTS LIST

1. Footplate
2. Sub-footplate
3. Splasher tops (x4)
4. Firebox
5. Bunker frame
6. Left bunker front
7. Right bunker front
8. Left bunker side
9. Right bunker side
10. Left bunker inner side
11. Right bunker inner side
12. Smokebox frame
13. Smokebox wrapper
14. Smokebox saddle side
15. Saddle tank frame
16. Tank top stiffener plate
17. Tank top
18. Saddle tank sides (x2)
19. Front saddle tank end
20. Rear saddle tank end
21. Smokebox front
22. Smokebox door
23. Cylinder cover plate
24. Tank mounting flange
25. Left step overlay
26. Right step overlay
27. Footsteps (x2)
28. Left valance
29. Right valance
30. Font splasher details (x2)
31. Rear splasher details (x2)
32. Front sandbox lids (x2)
33. Rear bufferbeam
34. Cab rear sheet
35. Dumb buffers (x4)
36. Bufferbeam overlays (x2)
37. Front bufferbeam
38. Tank filler
39. Chimney
40. Top rail rivet details - (x4)
41. Dome
42. Feed taps (x2)
43. Salter balance springs (x2)
44. Whistle
45. Pressure gauge
46. Reverser lever
47. Reverser lever detail
48. Handbrake
49. Backhead
50. Gauge glass
51. Backhead shelf
52. Regulator
53. Maker's plates (x2)
54. Left chassis frame
55. Right chassis frame
56. Spring details (x4)
57. Front spacer - OO, EM or P4
58. L-shaped spacer - OO, EM or P4
59. Rear spacer - OO, EM or P4
60. Left dummy-inside motion
61. Right dummy-inside motion
62. Motion bracket bottom - OO, EM, P4
63. Coupling rod - left - back layer
64. Coupling rod - left - front layer
65. Coupling rod - right - back layer
66. Coupling rod - right - front layer
67. Connecting rod - left - back layer
68. Connecting rod - left - front layer
69. Connecting rod - right - back layer
70. Connecting rod - right - front layer
71. Crankpin spacer washers (x4)-optional
72. Firebox bottom - OO
73. Firebox bottom - EM/P4
74. Ashpan
75. Boiler
76. Boiler former
77. Boiler hangers (x2)
78. Boiler mounts (x2) - OO, EM, P4
79. Handbrake lever halves (x2)
80. Front brake rods (x2)
81. Actuators (x2)
82. Brake blocks layers - inner (x4)
83. Brake blocks layers - outer (x8)
84. Brake hanger - rear left, front right
85. Brake hanger - rear right, front left
86. Rear brake rods (x2)
87. Front rod extensions (x2)
88. Injectors (x2)
89. Cylinder saddle
90. Slidebars - left
91. Slidebars - right
92. Cylinder wrappers (x2)
93. Cylinder covers, front (x2)
94. Cylinder covers, rear (x2)
95. Crossheads (x2)
96. Crosshead backing plates
97. Gearbox
98. Spacer strut
99. Balance weights (x4)
100. Reverser rod



BODY ASSEMBLY
FIG. 1

SADDLE TANK ASSEMBLY

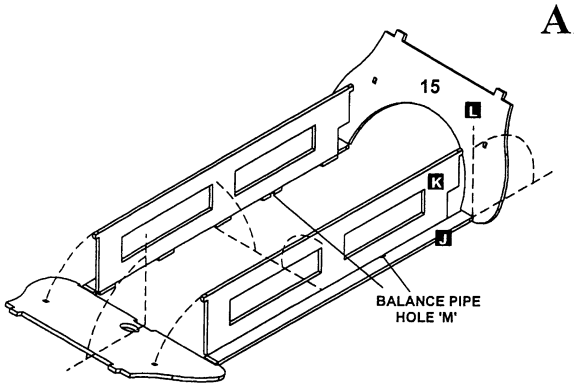


FIGURE 2

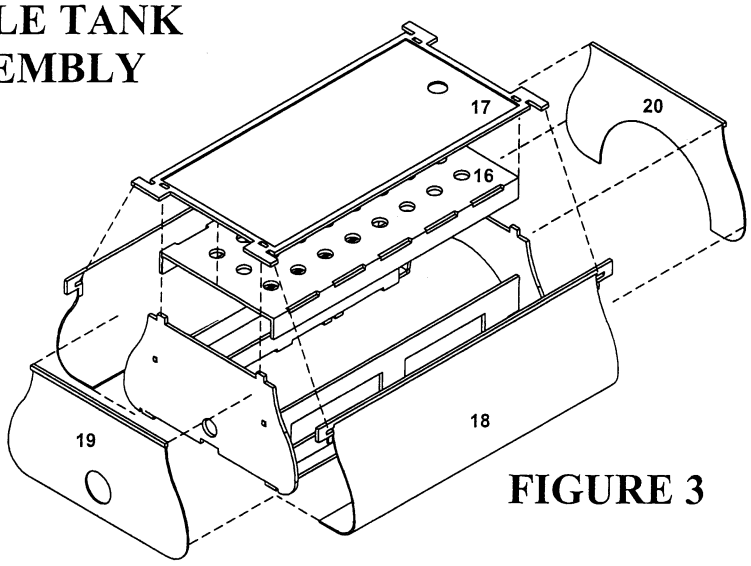


FIGURE 3

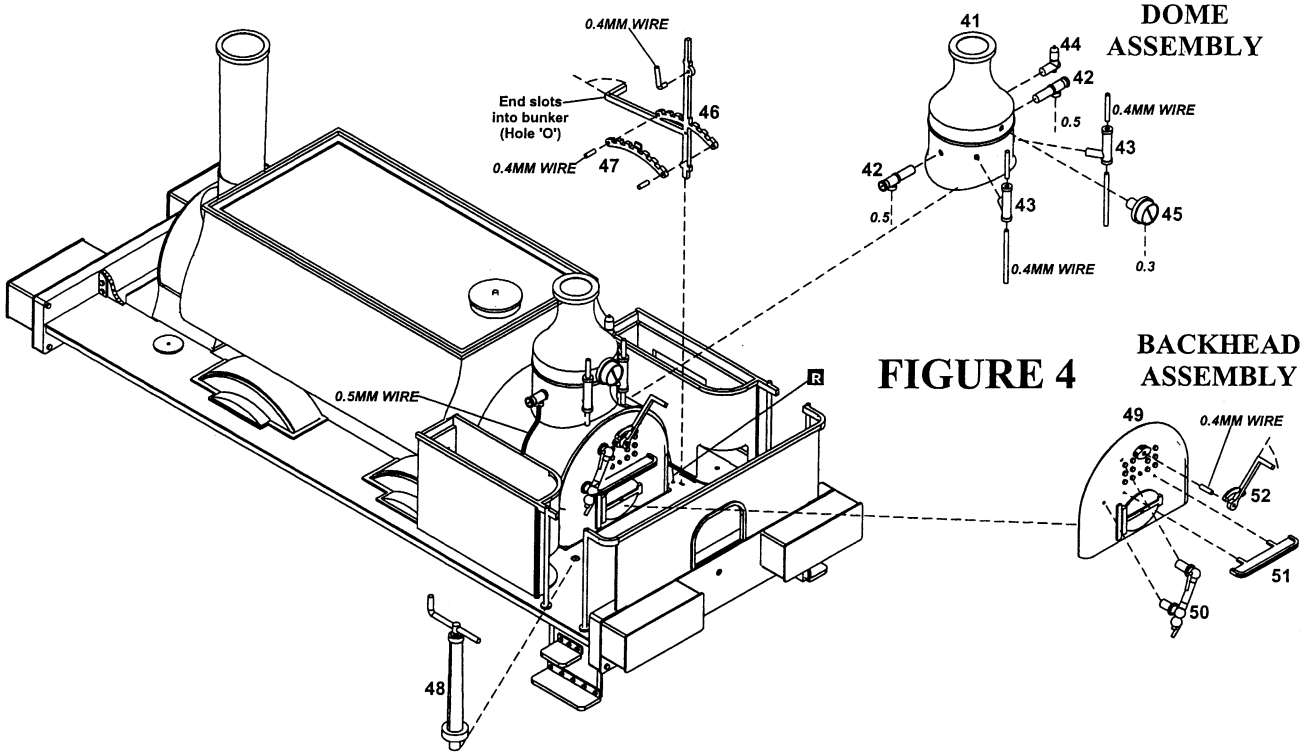


FIGURE 4

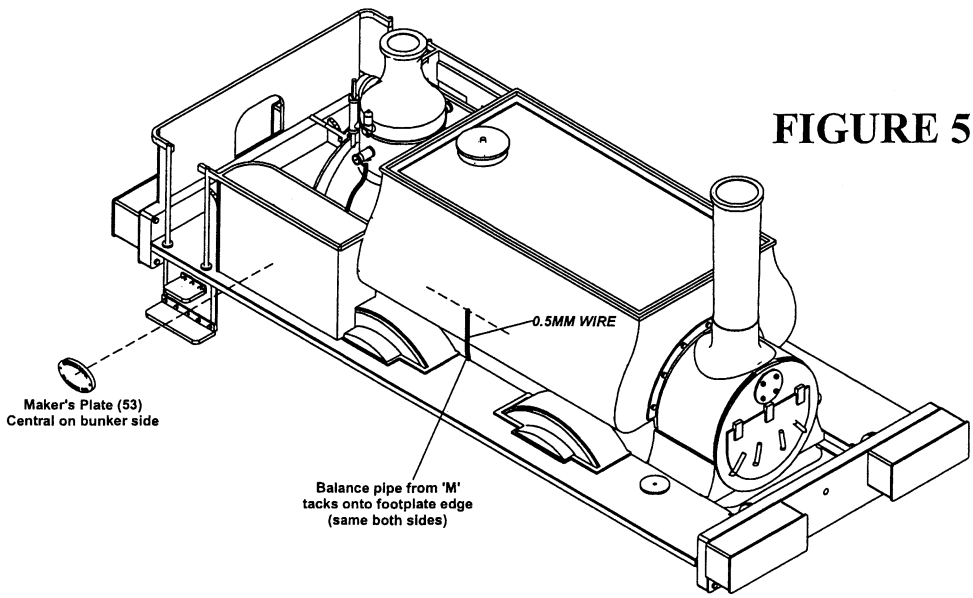


FIGURE 5

CHASSIS ASSEMBLY

FIG. 8

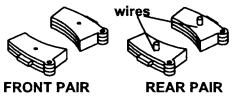


FIG. 7

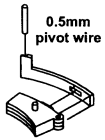


FIG. 9

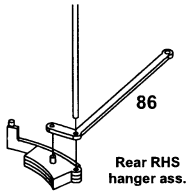


FIG. 10

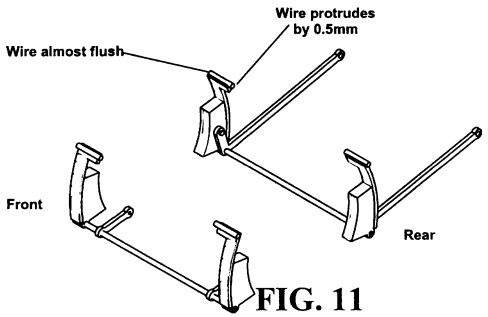


FIG. 11

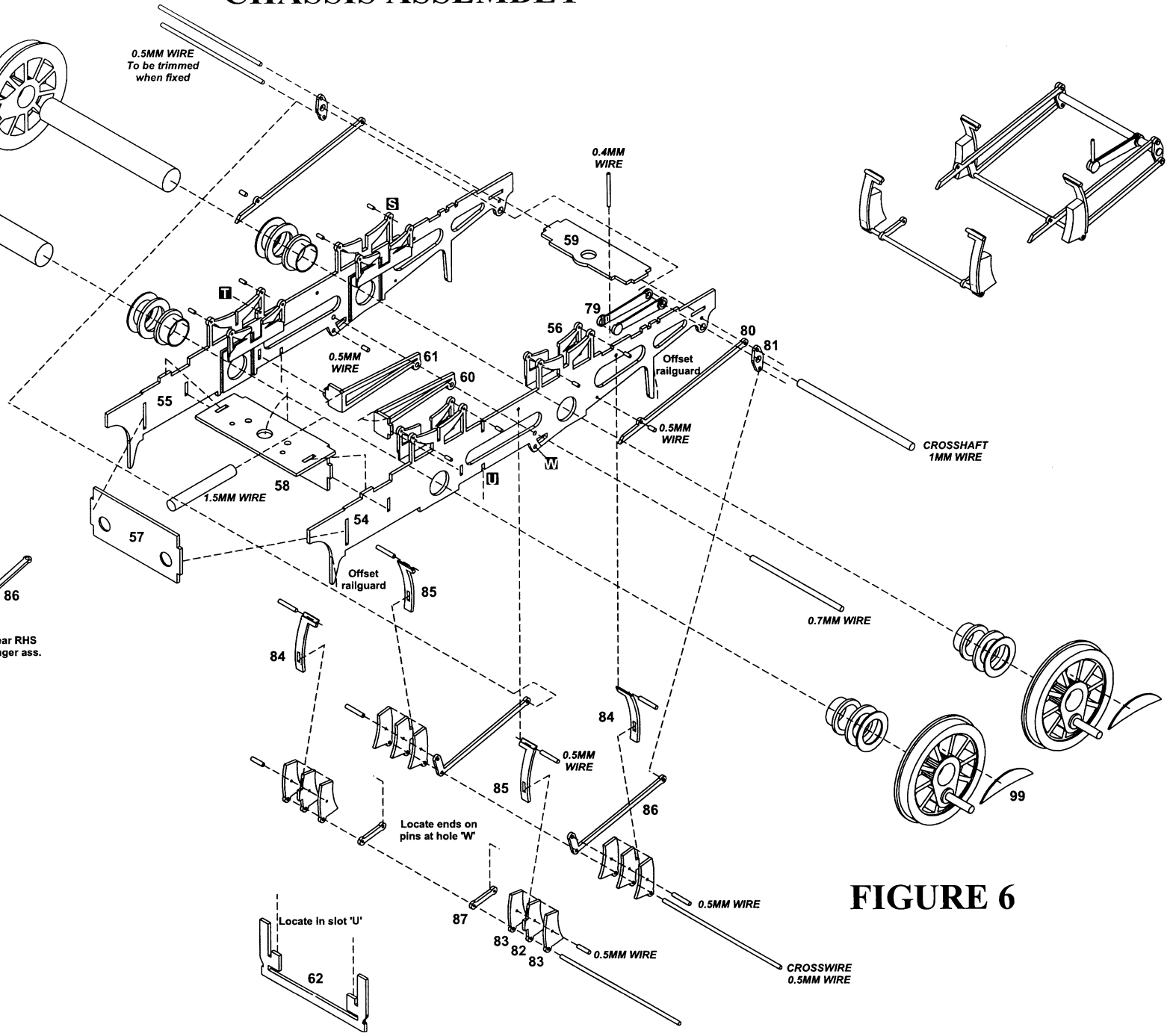


FIGURE 6

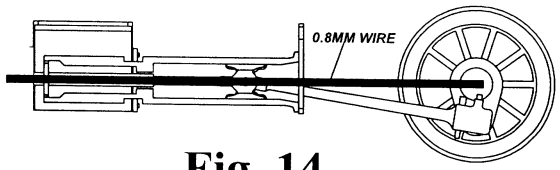


Fig. 14

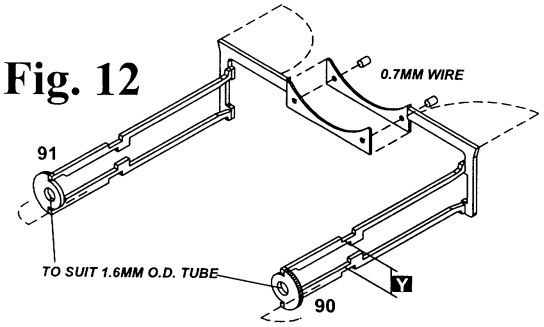


Fig. 12

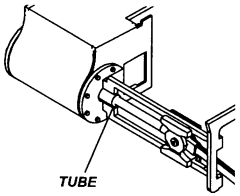


Fig. 15

CYLINDERS AND MOTION

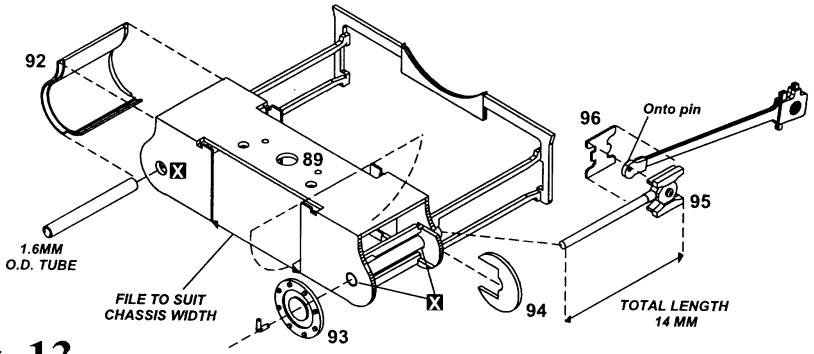


Fig. 13

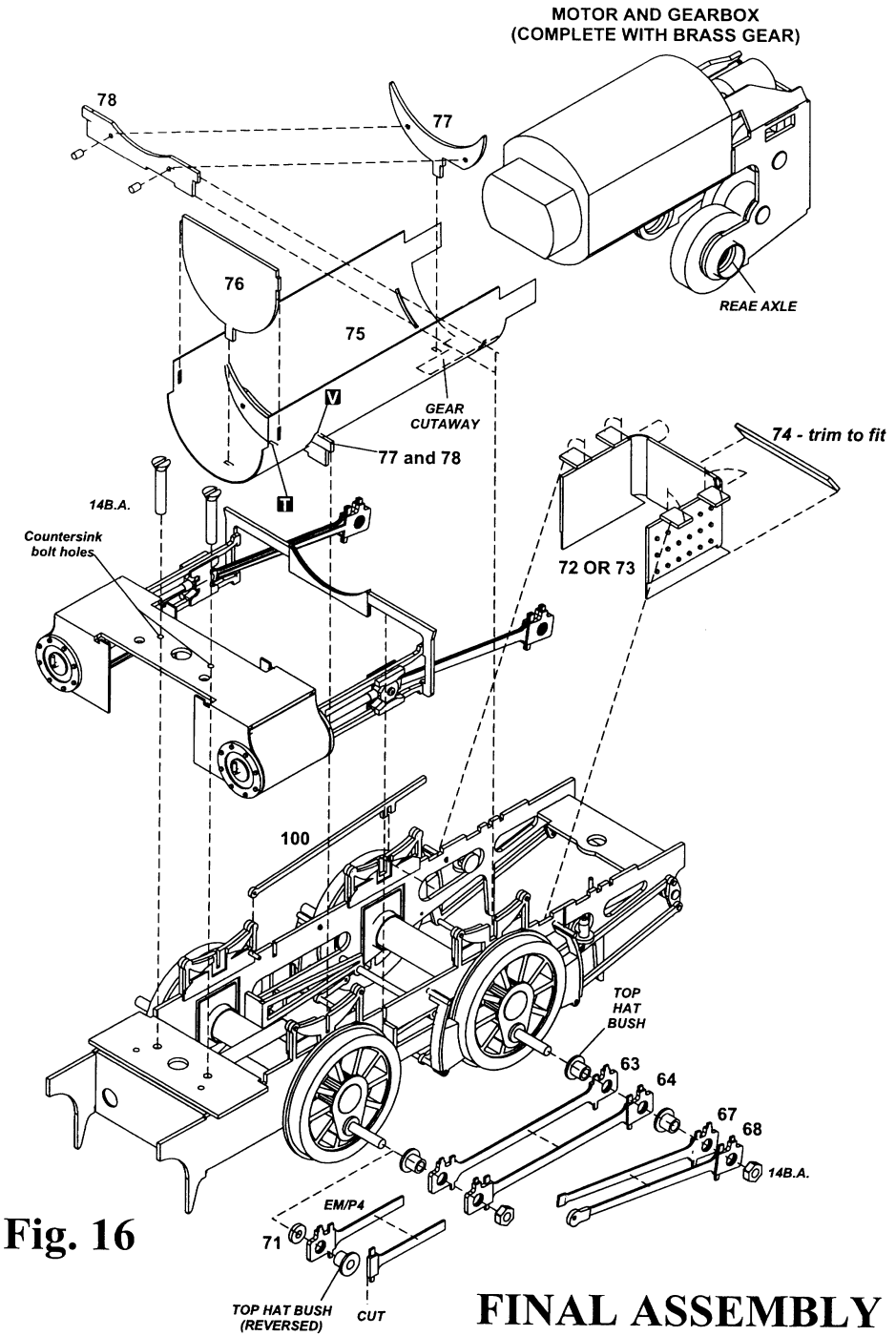
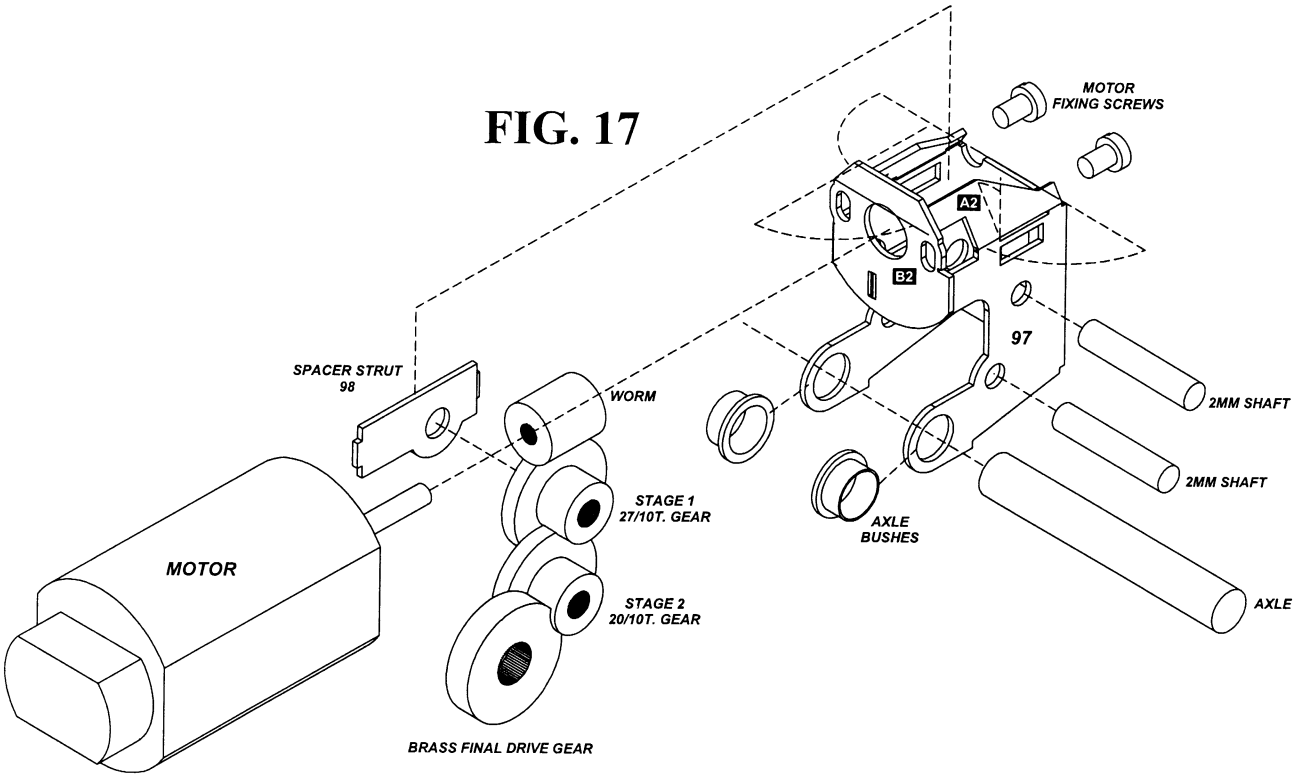


Fig. 16

FINAL ASSEMBLY

FIG. 17



GEARBOX ASSEMBLY

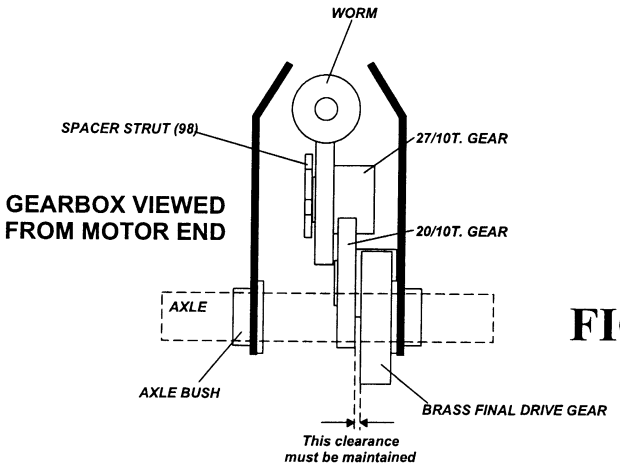


FIG. 18

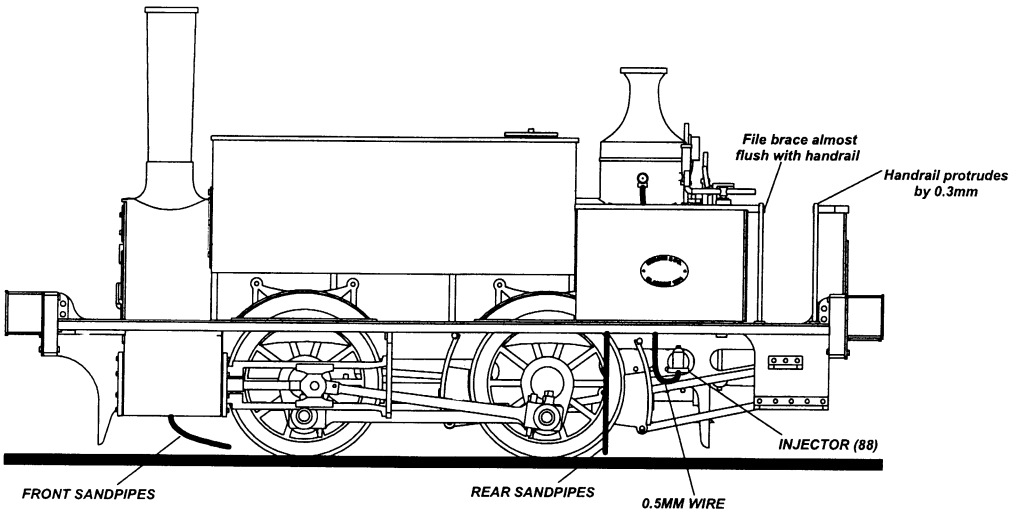


FIG. 19