Great Eastern Railway Class 209/ LNER Y5

The Great Eastern Railway had eight of these engines, Nos. 209/10 and 228-31, of which four survived into Grouping and one, incredibly, into the early months of British Railways. The first four were standard '12in Mineral Engines' built at the Hyde Park Works of Neilson and Company of Glasgow in 1874-6. They lacked cabs and had a dome over the firebox (we do a separate kit covering this version). In 1894-5 the quartet was rebuilt with new boilers at Stratford and cabs were fitted; in 1897 Stratford produced a pair of near-identical copies and in 1903 built two more. They were needed to shunt tightly-radiused locations such as the goods yard at Mile End and the Blackwall Pepper Warehouse in Canning Town. Others worked on the quayside lines at Lowestoft and Colchester. In LNER days two engines passed into service stock for use at Stratford Carriage Works.

The four which entered LNER stock (and had 7000 added to their numbers) were No. 209 (Neilson, 1874), 228 (Neilson 1876), 230 and 231 (both Stratford 1903). The last Y5 survivor was No 230, notionally BR No 68081 but not renumbered as such; it was withdrawn in April 1948. However in 1917 No 229 (Neilson 1876) had been sold to the Admiralty to work at Beachley Dock, Chepstow. It subsequently passed to the nearby Fairfield Shipbuilding and Engineering Company and survived long enough – though latterly derelict – to be acquired for preservation; it is now at the Great Eastern Railway Museum in North Woolwich.

There were a number of differences between the Neilson and Stratford engines. The Neilsons had low bunkers topped by three coal rails and the tank fillers were virtually flush with the tank. Stratford engines had deeper bunkers with two coal rails (No 7230 later had four, closely spaced) and a tall tank filler. All eight originally had dumb buffers but Nos. 228-30 subsequently acquired sprung buffers (these could have tapered or parallel stocks, or both). All types of bunker are accommodated in the kit – buffers will need to be bought separately. In 1916 No 230 was fitted out with Westinghouse brakes and steam-heat apparatus (removed c. 1944) while No 231 was modified with side skirts, cowcatchers and warning bell to work the quay at Hythe (Colchester); scratchbuilding will be necessary if you want to depict these alterations. Full details of the Y5s will be found in Part 9B of *Locomotives of the LNER*, published by the Railway Correspondence and Travel Society.

Motor - Mashima 1220/1224
Wheels - Sharman, ref. S62 (00/EM/P4)
Sharman wheels, 13 Orwell Court, Wickford Business Park, Wickford, Essex. SS11 8YJ,
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

Remove the parts from the centre of the footplate (1) and sub-footplate (2) and store them safely. Carefully open out the holes ‘A’ for the locating wires in the footplate and sub-footplate 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 chassis top rails (B) up through 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 ‘C’, as this will later be removed.

Leave the fold-down step backing pieces (D) as they are for the time being. You can solder a length of brass material - anything reasonably strong will do - across the bottom of the footplate and the steps to protect them from accidental bending. This can be removed later.

Splashers

After making sure there is no solder in their bend lines, use flat-nosed pliers to bend the splasher sides 'E' up through 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 (E) 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 (E) 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. Finally, clip off the stretcher ‘C’ at the front of the footplate and file the burr away so it is flush with the front edge. Leave the midway stretcher ‘H’ in place for the time being.

Smokebox

Carefully open out the location holes ‘F’ in the smokebox frame (4) 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 through 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.

We know of at least one engine which had a row of visible rivets around the front of the smokebox. If you wish to model this feature, punch out the rivets using the holes at the rear of the smokebox wrapper as a guide - a row of practice rivets is provided on the side of the fret . Bend the smokebox wrapper (5) 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 open out the blower pipe hole to 0.4mm and, before attaching the smokebox to the footplate, solder a short length of 1mm wire into the hole 'G' and trim it so about 1mm protrudes at the back.

Now use the locating 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 (6 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.

If you are modelling a locomotive which had rivets standing proud on the smokebox door (7) (some locos had flush-riveted doors), punch these out using the holes provided. For all locos, punch out the rivets in the small disc, etched onto the smokebox front (8) and then tin the back of this part, along with the smokebox door. Drill out the two handle location holes in the smokebox front and, if necessary, open out the small clearance slot (for the lower wire) situated at the bottom of smokebox frame. Cut two short lengths of annealed 0.4mm wire. Remove any burrs from the wires, slot them through the holes in the smokebox front. Now use these wires to locate the front on the smokebox frame - the bottom wire locates in a small notch in the frame – and solder it in place. Position the smokebox door on the smokebox front - the centre of the doors lines up with the wires - and solder the door in place. To finish, stick some masking tape on the footplate (to protect it) and file the ends of the wires, until 2mm protrudes, then carefully bend the ends through 45 degrees. (see Fig. 13)

Bend up the ends of the cylinder cover plate (9) and solder it in position, so the webs at the front are flush with the leading edge of the footplate.

Cab and bunkers

Take the reverser lever (10), solder a small piece of bent 0.4mm wire into the hole at the top of the lever (to represent the catch) and trim it slightly proud of the rear face of the reverser. Use another shorter length of the same wire to represent the bolt at the corner of the reverser and trim this so it protrudes very slightly from both sides, and then solder the reverser assembly in place on the footplate.

Drill out one of the small holes, in each of the lost wax injectors (11 x 2) to 0.4mm, to make a handed pair, but do not solder any wire into these holes for the time being. Remove the injectors from the sprue, leaving the locator pegs as long as possible. Solder the injectors in place, on the underside of the footplate, so the drilled holes face outwards - the gap between the top of the circular flanges on the injectors and the underside of the footplate (Distance ‘I’ in Fig.1) should be 0.7mm. Trim the tops of the locators flush with the top surface of footplate.

Use 0.5mm wire to locate the cab floor (12) on the footplate ,solder the floor in place and then trim the wires flush at both sides. Fit the lost wax handbrake casting (13) into its location in the recess in the floor. Position the top at about 45 degrees, so it won’t foul the cab frame (this doesn’t exist on the real loco but is necessary on the model) as shown, and solder in place.

Remove the cab frame (14) from the fret. Be careful not to accidentally remove the small locators from the top edge.

Three styles of coal bunker can be modelled. For option 1 (low bunker sides with tall rails – Neilson built engines) leave the rails which are attached to the cab frame in place. For options 2 and 3 (Stratford engines including No 7230) they should be removed and then the top edge of the frame dressed with a file.

Curve the half-etched bends ‘J’ in the bunker insides through 90 degrees. Now fold area ‘K’ through 90 degrees, followed by areas ‘L’ to form a box shape for the bunker top. Go on to do the front corners ‘M’ of the bunker frame (take extra care if the coal rails are still in place) and then finally form the rear corners (N) - the bunker insides should fold round so they almost touch the bunker box at the front.

Fit the cab frame into its numerous location slots in the footplate, taking care not to damage the details that are already in place. At this stage, you may need to tweak the shape and position of the curves on the bunker insides, so the tabs fit into the slots and the shape corresponds with the profile of the bunker lids. When fixing the frame to the footplate, be sparing with the solder - we found it was sufficient to apply flux around the locator tabs, which draws 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 frame.

Punch out the rivet detail in the bunker lids (15 & 16) and open out the holes to 0.4mm diametre. Use a short length of 0.4mm wire to locate the sandbox filler caps (17 x2) on the lids, solder in place and then trim the wire so it protrudes by 0.4mm from the lid. Locate the bunker lid assemblies in place on the tops of the bunkers and solder in place.

Building the cab

Clean up the inside of the cab and make sure there is no solder in the holes in the bunker lids, so a length 0.4mm wire will fit easily into them, as shown in Figure 2. Now bend the cab roof area ‘O’ (part of the sub-footplate) up through 90 degrees. Do the same for the cab rear section ‘P’ clipping the roof tabs into the slots in the cab frame as you do so. Nip the sides hard up to the roof, solder the roof area in place and file off any protruding tabs from the side faces of the frame. To represent the sanding gear linkage shafts, slot lengths of 0.4mm wire down through the holes in the top of the cab frame, into the pre-drilled holes in the sandbox lids, solder them in place and trim the tops flush.

Before removing the cab wrapper (18) from the fret, draw a line along the centre of the bends, using the marks on the fret as a guide to their position. Open out the two holes in front of the cab wrapper (Figure 4) then remove the part from the fret and straighten as necessary. Use a length of bar, of about 1/16in diameter, to form the bends on the wrapper. Try it in place on the cab frame by locating the holes in the wrapper onto the small locator tabs on the frame, as shown in Figure 3. Note - the cab front slots down behind the bunker top, (Figure 4) and the tongue at the bottom of the wrapper locates in a slot in the footplate. To get the wrapper to fit snuggly, it's likely you'll have to make adjustments to the position of the bends. This can be done by bending the material further around the bar at one end of the bend (the direction in which you wish to move the bend) and then flattening out the opposite end of the bend between two pieces of wood. When making the final adjustments to the shape, note that the cab roof is also very gently curved at the top.

Run a straight edge across the surface of the wrapper to check for bows and kinks, and remove these as necessary. When you’re happy with the fit and finish for the wrapper, solder it in place, making sure it sits exactly central on the frame. Run solder along the joint between the cab front and the box at the top of the bunkers. File off any excess at the sides of the wrapper so it is flush with the vertical outer faces of the cab frame. Remove the small locators from the top of the wrapper and dress up the curves using fine files and emery paper. Finally, cut the braces away from the cab doorways and finish off the opening with a file.

Remove the cab sides (19 & 20) and the bunker fronts (21 & 22) from the fret. If you’re modelling bunkers with low sides and tall rails (Option 1 - Neilson-built engines), cut off the top parts of the cab sides and bunker fronts, going down as far as the beading, as shown in Figure 6. For bunkers with tall sides and solid rails (Option 3 - No 7230 only), carefully cut off the rails on the cab sides and bunker fronts (shaded in Figure 5) and dress up the top surfaces with a needle file. If you’re modelling the bunkers with tall sides and slotted rails (Option 2 - all Stratford locos except No. 7230), leave things as they are (see Figure 4).

Locate the cab sides on the frame – make a visual check to ensure that the cab side is central in relation to the frame and wrapper, so there are equal amounts of the cabside protruding at the front and rear (this will be trimmed later). When you’re happy with the position of the side, solder it in place on the frame.

Fit the bunker fronts onto the frame so they butt up against the cab/bunker sides to form a corner, as illustrated in Figure 7 (The front leading edges of the cab sides are etched slightly overlength). Trim the excess material from the sides at the front corners, so the leading edges of the sides are flush with the outer faces of the bunker fronts. Carefully dress up the top edges of the coal rails with a fine file. To strengthen the corner of the coal rails, you can add a short length of 0.4mm wire to the inside. Add the small footsteps (23 x2) to the fronts of the bunkers.

For engine No. 7230, sit the bottom edge of the solid coal rails sides (24 x 2 – Fig. 5) on top of the cab/bunker frame, pushing them into the front corner, and then solder in place. Locate the solid coal rail fronts (25 x 2) in the same way, butting them against the previous parts, and solder these in position to form a corner.

Use a blade to make the front and rear edges of the cab sides flush with the front and back vertical faces of the cab wrapper, so the joins are not visible. At the top corners of the cab, the sides should stand proud of the roof surface (to provide a rain strip). Use a blade or a fine file to carefully ‘blend’ the profiles, so they ‘flow’ into the vertical front and rear faces, as shown in Figure 8.

Saddle tank

Study Figs. 9 and 10 before beginning work. Remove the saddle tank frame (26) from the fret and place it face down on a flat surface, with the bend lines facing upwards. Hold down area ‘Q’ with a piece of wood held up against the bend line and gently bend area ‘R’ up through 90 degrees. Repeat this process for both sides and then bend up the ends of the frame (S). 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 (27) 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 (28) 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 noting that the arrows should be at the front - and then carefully file off the lugs, flush with the top surface. The horizontal lugs at the ends of the tank top locate the tanks sides and should be left in place.

Before bending the saddle tank sides (29 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 of about 1/8in diameter - go further than is required - and then force the bend over a larger bar of about 4.5mm 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 tank side, just in case!

When fitting the side, avoid forcing the wrapper at all costs and when it's 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. Before, fitting, run a straight edge across the surface of the curves and tweak as necessary to remove any bows. 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, file or grind off the end locator tabs and then carefully trim the wrapper flush with the frame ends.

Tin the backs of the tank ends (30 and 31) 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 tank sides.

Start off with a small drill and work up the sizes and, using the drill starts on the underside of the tank top, open out the location holes for the tanks filler and tool box , shown in Figure 13 (parts 52 or 53 and optional part 55). Note -. Locate the small balance pipe holes ('T' in Figure 9) in the saddle tank frame and open them out so they will accept a length of 0.5mm wire.

Referring to Figures 9 and 10, without bending them, solder the sanding gear control rod guides (32 x2) in place on the underside of the tank, so they line up with the marks (U) and with the centres of the thicker area at 19mm apart. Now use a length of 0.4mm wire to get the correct shape, and bend the thinner strap area of the parts through 180?.

Use a 0.4mm drill bit to open out the blower pipe hole in the front of the tank, drilling right through the tank frame. Solder the small lubricators brackets (33 x2) into their locations at the front of the tank, and then very carefully open out the holes in the brackets to suite the locator pegs on the lost wax lubricators. Finally, solder the lubricators (34 x 2) into the brackets and trim the locator pins flush at the back.

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 holes 'F' at the front.

Make sure the footplate itself is straight and then locate the hole at the front of the saddle tank onto the wire which protrudes from the rear of the smokebox - the footplate should be flexible enough to allow you to do this. With the tank roughly in position, push a 14BA bolt through the hole in the rear of tank, through the slot in the cab frame ('V' – Fig 13) and then fit a nut. Tighten the nut until it holds the tank in place, but can be adjusted if necessary. There may be a small gap at the rear of the tank (depending on how thick the solder is behind the ends of the tank) and this can filled using the brass or nickel packing pieces (35) of appropriate thickness, slotted between the rear of the tank and the cab frame, as shown. (see also Fig. 10).

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 rear nut - the back of the tank can be raised or lowered in the slot. When you're satisfied that it's sitting square and level with the footplate, carefully tack the saddle tank to the smokebox and bunkers. Make a final check that everything is as it should be and then solder the tank to the smokebox and bunkers, along the join lines, being careful not to de-solder the tank assembly itself. Solder the curved saddle tank rivet strip (36) between the smokebox and the saddle tank. Alternatively, this can be glued on after the chimney has been fitted. Remove and keep the nut and bolt (or grind them away if they're soldered in place) and grind the 1mm wire flush at the front.

Platework

Remove the length of material used to prevent damage to the step backing pieces and bend them down through 90 degrees. Refer to figs 11 and 12. Use a 0.4mm drill bit to open out the front handrail locations in the floor at the cab door opening. Slot short lengths of 0.4mm wire into these holes, with the top end wires running to the inner face of the handrail braces on the cab sides. Check the wires are vertical and solder them to the braces, and into the floor. Trim the tops of the wires flush with the tops of the braces. Leave the braces in place for the time being.

Using flat nosed pliers, carefully bend up the bottoms of the cabs steps (37 & 38). Noting that they are a handed pair, secure the steps in place using the small footsteps (39 x2) to help locate them on the backing pieces.

Attach the valances (40 x2) 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. 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 the valances and the 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 (41 x2, 42 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 on them, which sits up against the bunker front. To get them to sit flat you'll need to remove all of the feed from the bottom of these parts.

Bufferbeams and handrails

Solder the front bufferbeam inner overlay (43) to the front beam casting (44) and then solder the beam in place, using the strip on the rear of the beam to locate it. Now solder the rear bufferbeam inner overlay (45) to the rear bufferbeam casting (46), making sure it is exactly central. If necessary, trim the sides of the cast bufferbeams so they line up with the etches.

Using the slots in the overlay (45) as a guide, drill a 0.4mm diametre hole at the bottom of the slots, and through into the beam casting – it doesn't matter if you go right through the beam. Tuck the beam assembly up behind the cab rear, so the central ledge on the beam butts up against the underside of the cab, as illustrated in Figure 11, and solder it in place.

Make a sharp bend in two lengths of 0.4mm wire and slot them into the pre-drilled holes in the rear beam. Adjust the top ends of these wires, so they touch the crossbrace in the cab opening (as above – Figs 11 and 12) and solder them in place in the beam and up against the brace. Cut the wires flush with the outer face of the beam casting and trim the top of the wire flush with the top of the brace. Now carefully cut away the crossbrace. Use a fine file to neatly trim the cut ends of the crossbrace, so they are vertical and almost flush with the handrails. Do this at both sides of the loco.

If you're fitting the dumb buffers (47 x4) supplied with the kit you'll need to carefully grind away some of the rivets on the bufferbeam outer overlays (48 & 49). Tin the backs of the overlays and then solder them in place on the front and rear beam castings, as shown in Figure 13. 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 beams. Finally, slot the bufferbeam filler strip (50) into the space between the chassis rails, inside the cab, and fix in place with adhesive (Fig. 11).

Body fittings

Trim the mounting peg on the chimney (51) to about 1mm long and then solder it in place (Fig. 13). If you're using the taller type tank filler (52) solder this in place in the tank. For the shorter type (53) drill out the hole in the centre of the filler using the drill start provided. Solder a short length of 0.4mm wire into the hole, and then fit the part to the tank top. If you're fitting the toolbox, curve the etched toolbox lid (54) fix it to the toolbox (55) and then fit the toolbox in place. Grind all the locator tabs flush inside the tank. Drill out the two holes in the safety valve bonnet (56) - one hole should be 0.3mm diametre with the other to suite the lost wax whistle casting. Solder the safety valve lever (57) and whistle (58) in place on the bonnet. Drill a tiny hole, just behind the whistle, to accept a length of fuse wire which will be fitted later. Now solder the safety valve assembly in place, on top of the bunkers - the back end of the safety valve lever should protrude though the slot in the cab front.

If you've fitted the taller type of tank filler, locate a length of 0.4mm wire in the grooves at the ends of the tank filler latch halves (59 & 60) so it sits at 90 degrees to the lever and solder

the halves together. Solder this assembly in place, on top of the tank filler, using the central pip on the latch to locate it. Solder the whole filler assembly in place on the tank top – the end of the wire on the lever locates in the small slot at centre of the bunkers, on the front edge, just behind the tank (you may need to clean the solder from the slot).

Open out the holes in the tops of the front sandboxes (61 x2) and solder short lengths of 0.4mm wire into them. Use this wire to locate the front sandbox levers (60 x2) on top of the boxes and then carefully solder the levers in place, at right angles to the sides of the boxes, to make a handed pair. With the etches in place, drill the second hole through the ends of the levers and down into the sandbox casting. Fit the sandboxes to the footplate, noting that the levers face inwards.

Body details

Refer to figure Figures 14 - 16. Fit the injector drain pipes using lengths of 0.5mm wire bent to shape. Solder the wires into the injectors, solder the opposite ends of the wire to the bottom of the steps and trim the wire to length, as shown. Slot short lengths of 0.5mm wire into the balance pipe holes 'T', which are situated in the bottom of the saddle tank (Figures 9, 14,17 & 18) with the bottom end of these wires running into the small holes 'W' (Fig 18) at the inside edge to the footplate. Solder the wires in place and then trim them flush with the underside of the stretcher.

Drill out the clack valves (63 x2) while they are still on the sprue. To represent feedwater pipes, solder 0.5mm wire to the clacks as shown in Figures 16 - 18. Remove the clacks from the sprue, trim the mounting pegs flush and bend the wire to shape -the feedwater pipes locate in the small holes 'X' (see Fig. 18) at the footplate edge - then bend sharply as they lie across the footplate before bending up into the clacks. The rear face of each clack should be in line with the inner vertical face of the saddle tank frame. This allows clearance for the boiler to be fitted into the body at a later stage - the clacks only appear to be touching.

Carefully grind away the half thickness material which attaches the midway stretcher ('H' in Fig 1) to the sub-footplate and dress up the edge, behind the feedpipes.

Refer to figures 14 and 16. Bend two length of 0.4mm wire to shape, to represent the right and left hand sanding gear control rods. Put a sharp bend at the ends and hook them into the holes, which you've previously drilled in the sandboxes/levers. The rods run along the underside of the saddle tank, through the guides and locate on the notches ('Y' in Fig. 1) on the bunker front, where they can be soldered in place. When these are in place the blower pipe can be fitted. To do this, bend a length of 0.4mm wire to shape and run it down from the small hole in the front of the saddle and into the left side for the smokebox, as shown.

Cab details

Refer to Figure 19. Open out the holes in the tiny lugs, situated at the sides of the backhead surround (64) to 0.4mm diametre, and bend the lugs through 90 degrees. Drill out the holes in the backhead casting (65) to suit the various parts shown in Figure 19. Fix the gauge glass (66) and the small wheel valve (67) in place on the backhead. Solder a short piece of 0.4mm wire into the backhead to represent the regulator pivot. Bend over the end of the regulator (68), 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 solder it to the backhead surround.

Slot a 17mm length of 0.4mm wire through the small etched lugs at the sides of the backhead and solder it in place with equal amounts protruding at each side. Slot the draincock linkage assembly (69) onto the wire at the left hand side and solder in place. Carefully solder the draincock/sandgear actuator linkage (70) onto the right hand side of the wire, so it sits at the same angle as its counterpart at the opposite side. Finish off the backhead by trimming the wire ends, so they are very slightly proud of the etches at either side.

Position the maker's plates (71 x2) or the larger shed plates (72) centrally on the bunker sides, as shown in Figure 20, and then solder them in place. Alternatively, you can glue them on after painting. Drill out the four lamp iron locations (three at the rear and one in the smokebox) to accept the etched lamp irons (73 x4 - Figs. 14 & 15). Carefully bend the irons to shape and solder them in place.

Using the starts provided, drill out the rear handrail holes, shown in Figure 15. Solder handrails knobs into these holes and then fix a 26mm length of 0.4mm wire centrally between them. Refer to Figures 14 and 19. Run short lengths of 0.3mm wire from the holes in the safety valve bonnet, to those in the cab front, and solder in place. Carefully grind the ends of these wires flush inside the cab.

Use a 0.3mm bit to pre-drill the hole in the pressure gauge (74 – see Figure 19). Now solder the gauge onto the instrument panel (75) with the hole in the gauge at the bottom, then file the location peg flush at the back. Loop a short length of fuse wire from the bottom of the gauge, and into the hole in the panel, as shown in Figure 20. Bend the whistle lever (76) to shape and strengthen the bends with solder. Now solder a short length of 0.3mm wire into the panel, use it to locate the lever - you may need to trim the wire to length - and solder the lever to the panel.

The Backhead and instrument panel can be pre-painted and glued into the cab after the body has been painted. The Panel should be sited so its left edge is about 1mm from the left hand window opening, with the top edge just below the safety valve lever tail (Fig. 20)

Although the sandpipes are part of the body assembly, they are best fitted when building the chassis (see below). We recommend painting the loco body after the chassis has been built, so you can fit the various assemblies together, and make adjustments without damaging the paintwork.

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 21. Punch out the rivet detail in the frames (77 &78) and straighten them as necessary. Now ream out the axle holes 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 (Z) in the frames. Do the same for the brass spring details (79 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 (A1) 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 'Z' at the ends of the springs on the frames, then trim the wires very slightly proud of the front face and flush with the rear.

Assemble the frames, according to gauge, using the appropriate spacers (80 - 82). Solder in the front and rear spacers first, with the L-shaped spacer (81) 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 (81) 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 (81) 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.

Drill out the brake hanger pivot holes in the frames to accept 1mm OD tube. Solder short lengths of tube firmly into the holes and trim the ends so about 1.8mm protrudes from the frame. Cut away any excess tube inside the chassis, file flush and then remove any burrs so a length of 0.5mm wire will pass through.

Use flat-nosed pliers to carefully make the bends in the dummy-inside motion (83 and 84). 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 (85) for the gauge you are building to. Try the motion bracket in its slots ‘B1’- 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 coupling rods (86 x4) and connecting rods (87 - 90) as illustrated in Figure 26, 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 (91 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 axles jigs 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 (92 - OO or 93 – EM/P4) and bend to shape, using a needle file handle to form the corners. Trim the ashpan (94) 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. For P4, you may need to trim a small amount from the length of the rear lugs, so they clear the injectors.

Boiler assembly

Use the gear cutaway to identify which is the inside and outside of the boiler (95) and then carefully bend the boiler to shape, so that it exactly matches the boiler former (96). 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 (97 x2) and in the appropriate boiler mounts (98 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 'C1' 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 front boiler hanger are free from solder and then push one of the boiler mounts (98) (OO, EM or P4) though the front slot ‘D1’ in the side of the boiler, until the location holes line up with those in the hanger (97). 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 it's 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 bunkers.

Once you've got the boiler to fit comfortably, try it on the chassis again and offer the complete assembly up to the body. 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 (121 - see Fig. 27) to keep them clear of the gears. This will allow the cylinders to be removed if necessary.

Boilerbands 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 29).

Brakegear

This method of assembly creates a set of brakegear that is fully removable, as well as totally prototypical in appearance. Do not solder anything until the instructions specifically say so.

The first step is to drill out the brakegear components (99 - 108) to the suit the various wire sizes, illustrated in Figure 21. Make sure that all the wires will pass through their holes without forcing.

Solder the brake cylinder casting (99) in place on the rear spacer. To represent the cross-shaft, thread a length of 1mm wire, approximately 20mm long, through the chassis. Include the steambrake lever (100) as you do this and solder the shaft in place. Fit short lengths of 0.5mm wire, about 2-3mm long, into the small holes just above the crossshaft, then locate the journals (101 x2) over the ends of the crosshaft and the wires, and solder them in place on the chassis. Fit the left hand actuator/handbrake lever (102) and the right hand actuator lever (103) over the ends of the crosshaft and wires. Solder the levers in place, hard up against the journals – leave the wires at the tops protruding for the time being. Now solder a piece of 0.5mm wire between the lever's bottom holes, cut the wire between the frames and trim it almost flush at the outside, with about 1mm protruding inwards.

Make a sharp bend in a length of 0.5mm wire and locate the bent end of the wire in the hole at the end of the long part of the actuator/handbrake lever (102). Solder the bottom end of the wire into the lever and the top end flat against the chassis side. Trim the bottom end of the wire so a small amount protrudes and trim the top flush with the top of the chassis.

Use 0.5mm wire to locate the brake shoes (104 x4) on their hangers (105 x4) - noting which is the top and which is the bottom of each - and solder them up to make two left and two right-handed hanger assemblies. Trim the wires slightly proud of the brake shoe faces to represent the fixings. Solder short lengths of 0.5mm wire into the tops of the hangers. Trim these wires almost flush with the outside faces, with about 0.5mm protruding inwards.

Solder the rod details (106 x4) (they represent the hexagonal adjusters) to the brake pull rods (107 x2, 108 x2). Form the offset in the railguards as shown. When fitting the brakegear, you may need to make minor adjustments to the shape of the rear railgaurd, so it clears the brake rods.

Temporarily fit the rear wheels. Slot a 25mm length of 0.5mm wire through the bottom hole in one of the front hanger assemblies, and carefully solder the wire in position. Add the front brake rods to the crosswire, plus the hanger for the opposite side. Offer this front brake hanger assembly up to the chassis and locate the pins at the top of the hangers in the tubes holes in the frames, nipping them between your finger and thumb to hold them in place. Push the brakes onto the wheel and make sure they lie vertically. When you're happy with their position, careful solder the loose end of the crosswire into the bottom of the brake hanger assembly.

Now locate the rearmost hole, at the back end of the front brake rods, over the wires at the bottom of the actuators, on their inside face – the rod should run along behind the railgaurd. Adjust the position of the rods on the crosswires, so they run parallel with the chassis, and then solder them in place on the crosswires. 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 rear hangers and brake rods should be assembled in the same way as the front, but note that the brake rods sit on the outside of the actuators and run along the outside the railguards.

The boiler feed pipe from the injectors, shown in Figure 29, is part of the chassis and is best fitted with the brakegear in place. Put a sharp bend in a length of 0.5mm wire and hook the end into the holes 'E1' (shown in Fig. 21) at the top of the frames. Bend the wire to shape as shown in Figure 29, so it runs down behind the rear wheel, and then up the inside face of the frames. The wire should run behind the brakerods and above the crosswires, otherwise the brakegear will be trapped in place. The top end of the wire should line up with the small mark inside the frames – when the body is fitted, the pipe seems to continue up to the clack valve, on the body assembly. When you have the wire bent to shape, solder in into the hole 'E1', and to the inside face of the chassis.

With the brakes correctly set in position, you can remove both the front and rear hanger and rod assemblies and put them to one side so they can be fitted after the chassis has been painted. Now that the railguards are also set at the correct angle, you can strengthen their bends with solder.

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 (109) to allow for the different frame width (see Figure 23). Gently open up the four holes (F1) 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 22. Gently open out the holes in the discs on the slidebars (110 and 111) 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 ('G1' in Figure 22) 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 24. 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 24 & 25. 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. 24). 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 (112 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 so 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 (113 x2) (114 x2). Fit the rear covers over the slidebars and solder them in place (Figs. 23 and 25). 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 (115 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 23. 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 orientated 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 (116 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 front sandpipes can be fitted (Figs. 26 & 29). Make a sharp bend in a length of annealed 0.5mm wire and locate the end into the small hole/notch at the top of the cylinder saddle. Tack it in place, so it runs downwards and about 1mm away from the front face of the saddle. Now bend the wire inwards, towards the wheels and rail, as shown, so it just touches the bottom of the saddle. Tack it to the saddle at this point and then trim the end of the wire to length, so it is about 1mm from track level. Do the same for both sides. The rear pipes (Fig. 29)can be made from the same wire, soldered into the small holes ('H1' see Fig. 1) under the coal bunkers (on the body assembly) and then bent inwards towards the wheels.

Go back to Figure 23. Remove the cylinder assembly from the chassis and draw a line on the bottom of the cylinder wrappers, about 1mm inwards of the slidebar centre line. Place the drilling guide (117) on the line and drill three 0.4mm holes in each cylinder. Solder six L-shaped pieces of wire into the outer holes on the draincock linkage (118 & 119) and trim almost flush at the front. Now solder these assemblies into the pre-drilled holes in the bottoms of the cylinders.

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 26) 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 27 and 28. Before cutting the gearbox etch (120) 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 (121) 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 (J1) though 45 degrees. Fold the motor mounting plate (K1) 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.

Painting

Now you've checked that all the sub-assemblies will fit together, you can paint the loco body, chassis, backhead assembly, the instrument panel assembly and the reverser rod (125). If your method of fitting pick-ups (see below) involves soldering anything to the chassis, do this before painting

Refer back to Figures 19 & 20. Carefully manoeuvre the backhead assembly into position in the cab and then glue it in place, applying the adhesive through the holes in the cab front. Position the instrument panel assembly, as shown, and glue it in place inside the cab. If you have not already done so fit the maker's plates, or shed plates and then put the body to one side, ready for final assembly.

Fitting the wheels

Offer up the completed motor/gearbox/boiler sub-assemblies, as before (shown in Figure 26), but this time with the leads from the motor brush tags passing down through the right hand side of the gearbox, making sure they do not foul any of the gears.

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 28).

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 (122 x4 – Fig 21) 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 (123 in Figure 26) 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 a strip of gapped copperclad fixed across the chassis at a suitable point. Make sure you allow adequate clearance around the chassis components to prevent shorting. The motor leads can be fed down through the bunkers or gearbox and, after being cut to length (allowing a reasonable amount of slack), they can be soldered to the copperclad strip.

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 the pre-cut 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 locomotive will have been as enjoyable as the pleasure you’ll gain from operating the finished model on your layout.

FOR MORE INFORMATION ON HIGH LEVEL KITS CONTACT
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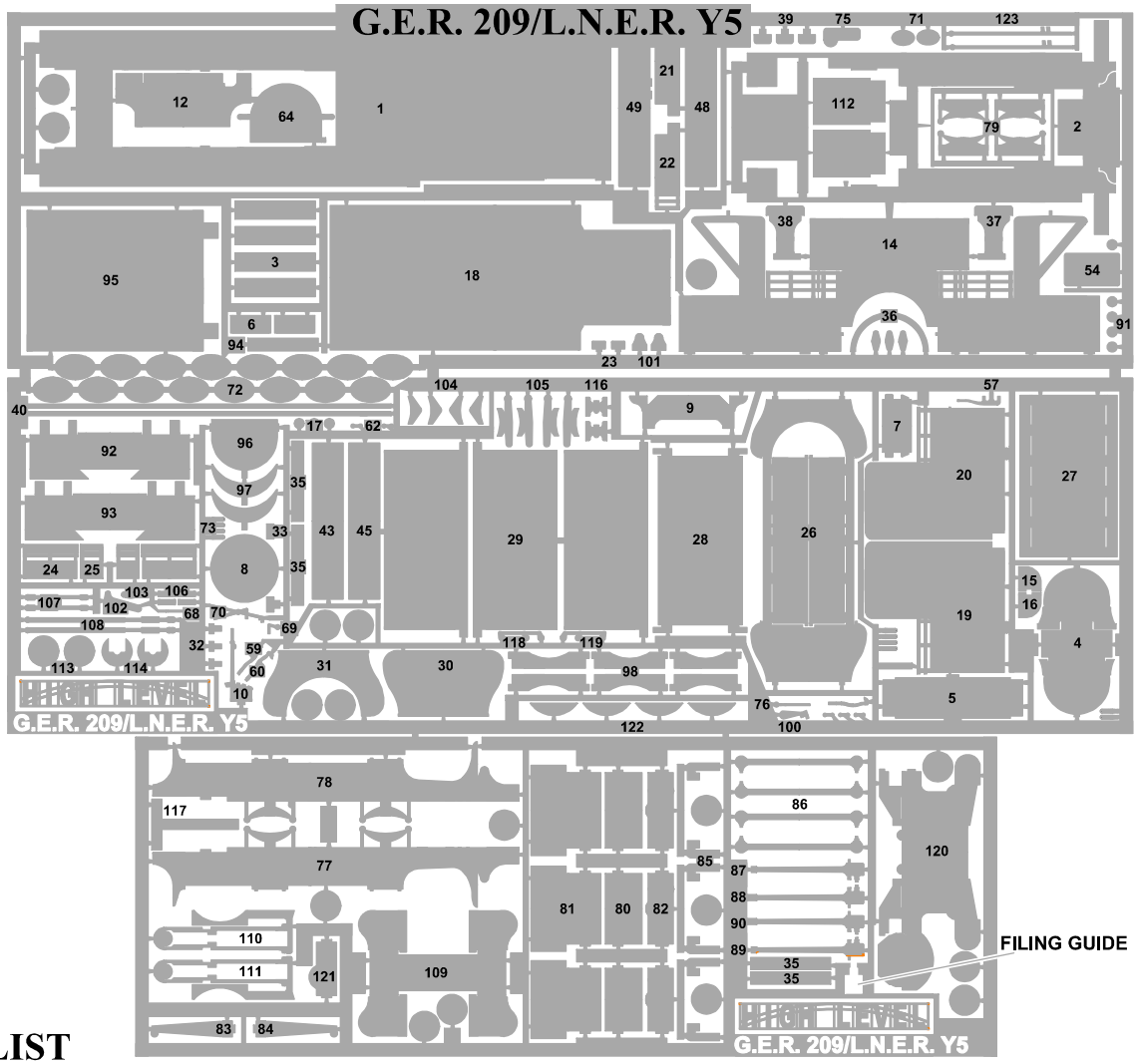
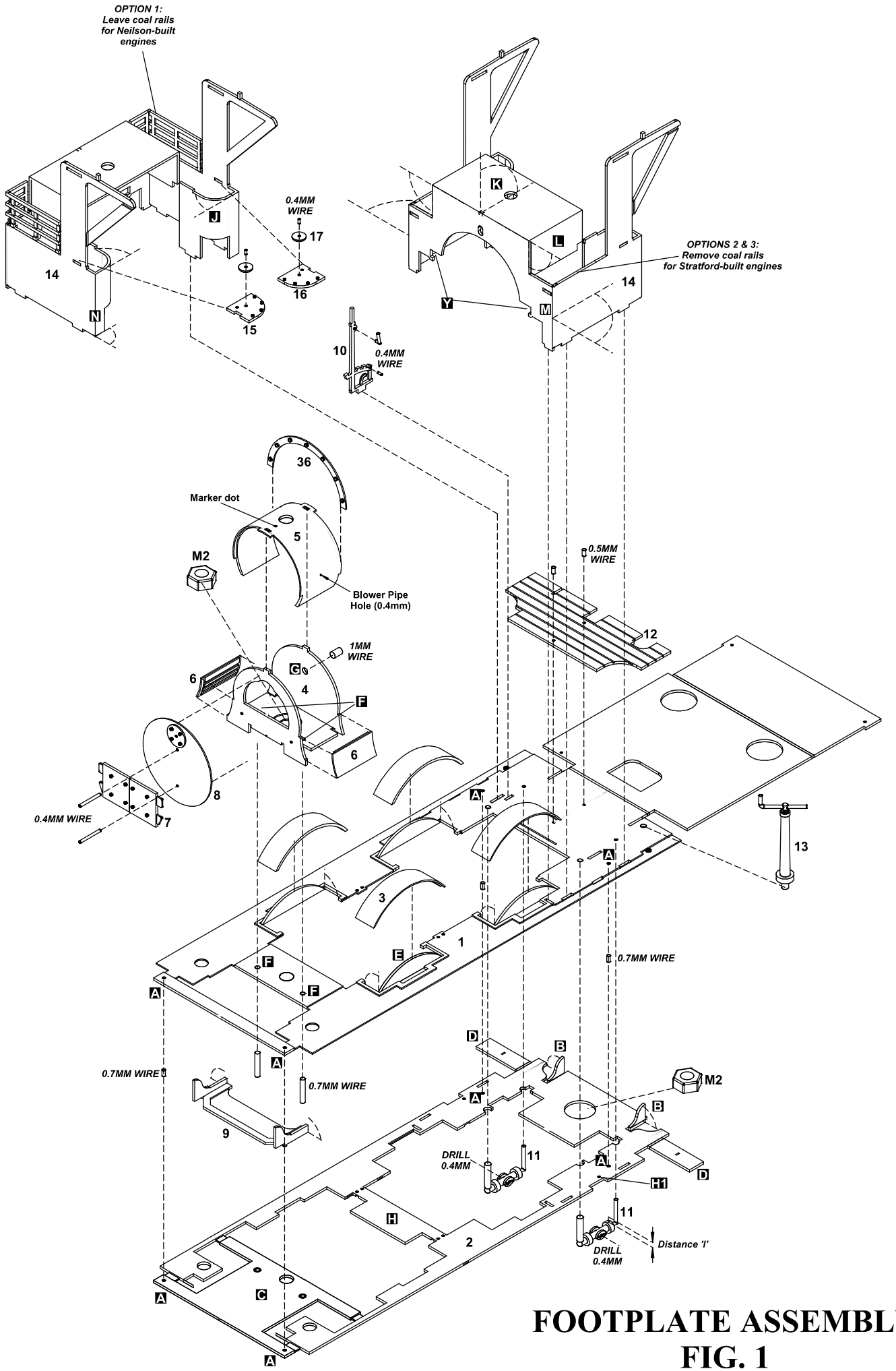
www.highlevelkits.co.uk
Mailto - enquiries@highlevelkits.co.uk



PARTS LIST

1. Footplate
2. Sub-footplate
3. Splasher top (x4)
4. Smokebox frame
5. Smokebox wrapper
6. Smokebox saddle side (x2)
7. Smokebox door
8. Smoklebox front
9. Cylinder cover plate
10. Reverser lever
11. Injectors (x2)
12. Cab floor
13. Handbrake casting
14. Cab frame
15. Bunker lid - LHS
16. Bunker lid – RHS
17. Sandbox filler cap (x2)
18. Cab wrapper
19. Cab side – LHS
20. Cab side – RHS
21. Bunker front – LHS
22. Bunker front – RHS
23. Bunker front steps (x2)
24. 7230 - Coal rail side (x2)
25. 7230 - Coal rail front (x2)
26. Saddle tank frame
27. Tank top stiffener plate
28. Tank top
29. Saddle tank side (x2)
30. Saddle tank end (front)
31. Saddle tank end (rear)
32. Control rod guide (x2)
33. Lubricator bracket (x2)
34. Lubricator (x2)
35. Packing pieces - various
36. Curved rivet strip
37. Cab step – LHS
38. Cab step – RHS
39. Footstep (x2)
40. Valance (x2)
41. Splasher detail – front (x2)
42. Splasher detail – rear (x2)
43. Front bufferbeam overlay – inner
44. Front bufferbeam casting
45. Rear bufferbeam overlay – inner
46. Rear bufferbeam casting
47. Dumb buffer (x4)
48. Front bufferbeam overlay – outer
49. Rear bufferbeam overlay – outer
50. Bufferbeam filler strip
51. Chimney
52. Tank filler – tall
53. Tank filler – short
54. Toolbox lid
55. Toolbox
56. Safety valve bonnet
57. Safety valve lever
58. Whistle
59. Tank latch half – LHS
60. Tank latch half – RHS
61. Front sandbox (x2)
62. Front sandbox levers (x2)
63. Clack valve (x2)
64. Backhead surround
65. Backhead casting
66. Gauge glass
67. Wheel valve
68. Regulator
69. Linkage - LHS
70. Linkage - RHS
71. Maker's plate (x2)
72. Shed plate (x2)
73. Lamp iron (x4)
74. Pressure gauge
75. Intsrument panel
76. Whistle lever
77. Chassis frame - LHS
78. Chassis frame - RHS
79. Spring detail (x4)
80. Front chassis spacer – OO, EM or P4
81. L-shaped chassis spacer – OO, EM or P4
82. Rear chassis spacer – OO, EM or P4
83. Dummy inside motion – LHS
84. Dummy inside motion – RHS
85. Motion bracket bottom – OO, EM or P4
86. Coupling rod layer (x4)
87. Connecting rod - left - back layer
88. Connecting rod - left - front layer
89. Connecting rod - right - back layer
90. Connecting rod - right - front layer
91. Crankpin spacer washer (x4) - optional
92. Firebox bottom - OO
93. Firebox bottom - EM/P4
94. Ashpan
95. Boiler
96. Boiler former
97. Boiler hanger (x2)
98. Boiler mount (x2) - OO, EM or P4
99. Brake cylinder
100. Steambrake lever
101. Journals (x2)
102. Actuator/handbrake lever
103. Actuator lever
104. Brake shoe (x4)
105. Brake hanger (x4)
106. Rod detail (x4)
107. Brake pull rod – front (x2)
108. Brake pull rod – rear (x2)
109. Cylinder saddle
110. Slidebar – LHS
111. Slidebar – RHS
112. Cylinder wrapper (x2)
113. Cylinder cover – front (x2)
114. Cylinder cover – rear (x2)
115. Crosshead (x2)
116. Crosshead backing plate (x2)
117. Drilling guide
118. Draincock linkage – LHS
119. Draincock linkage – RHS
120. Gearbox
121. Spacer strut
122. Balance weight (x4)
123. Reverser rod



FOOTPLATE ASSEMBLY
FIG. 1

CAB ASSEMBLY

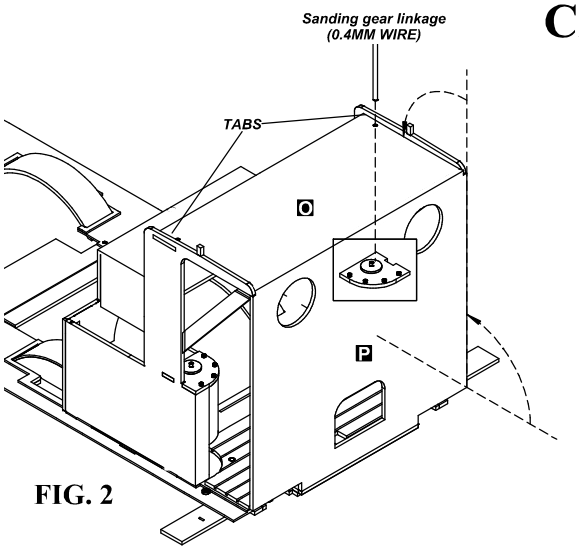


FIG. 2

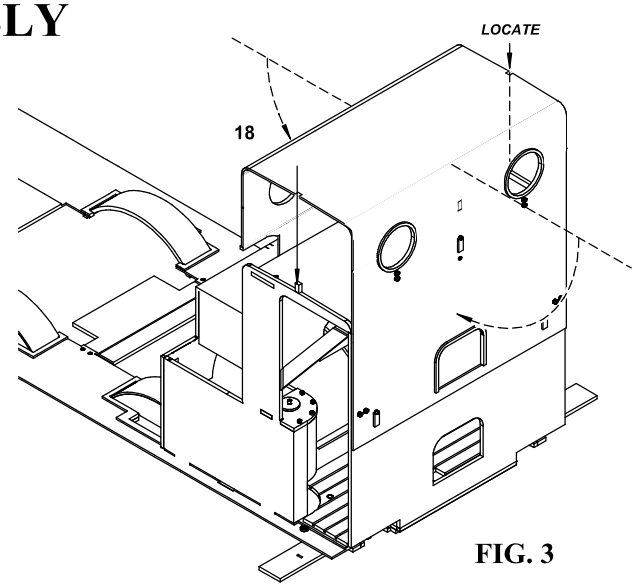


FIG. 3

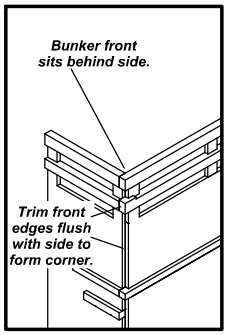


FIG. 7

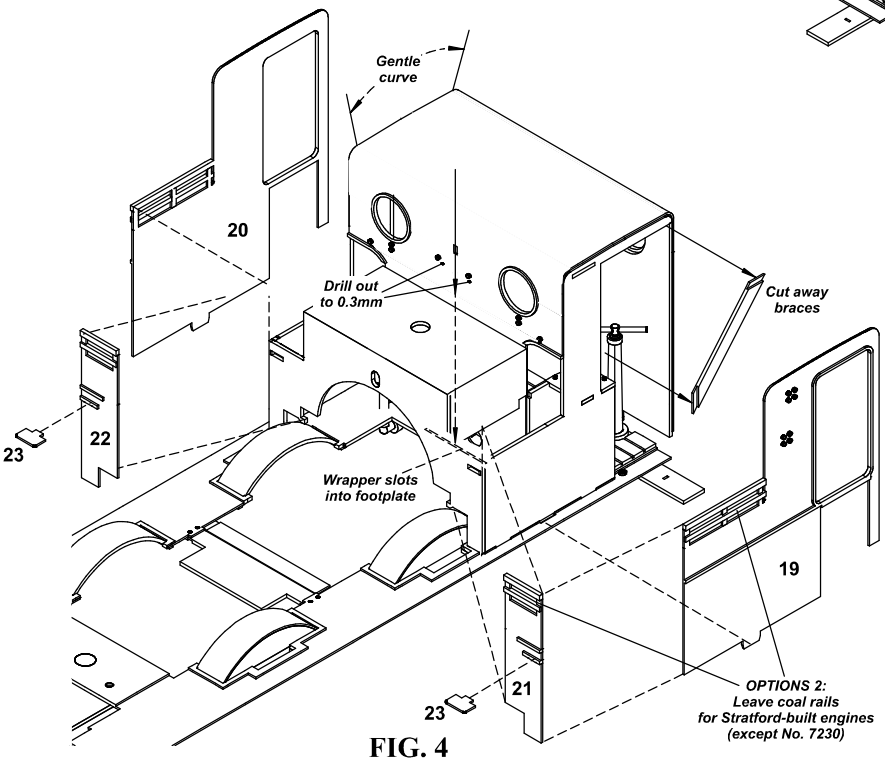


FIG. 4

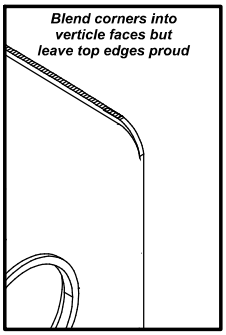


FIG. 8

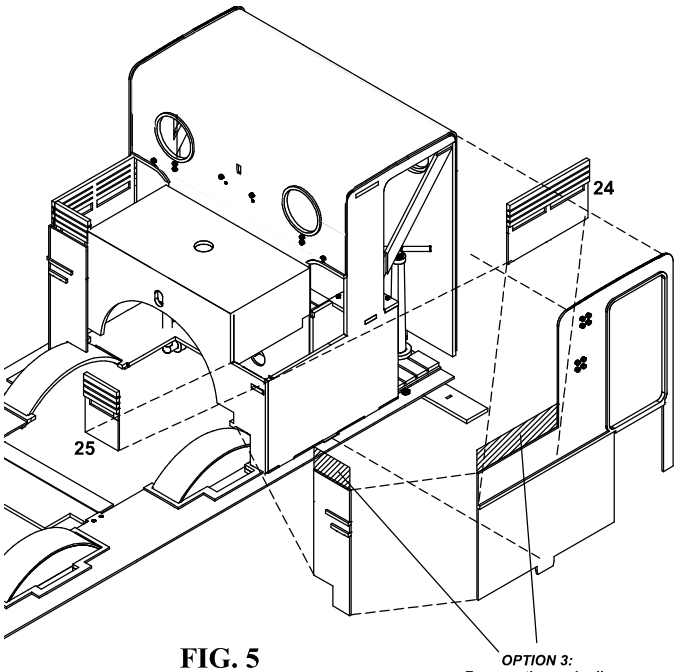


FIG. 5

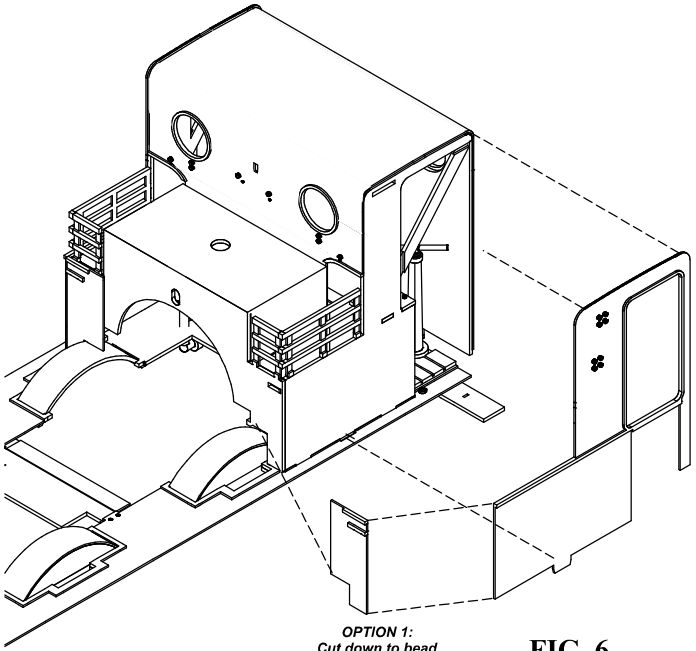


FIG. 6

SADDLE TANK ASSEMBLY

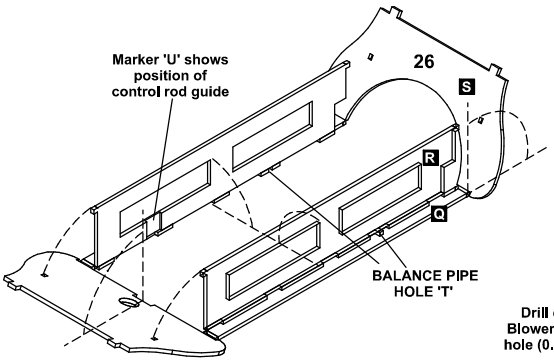


FIG. 9

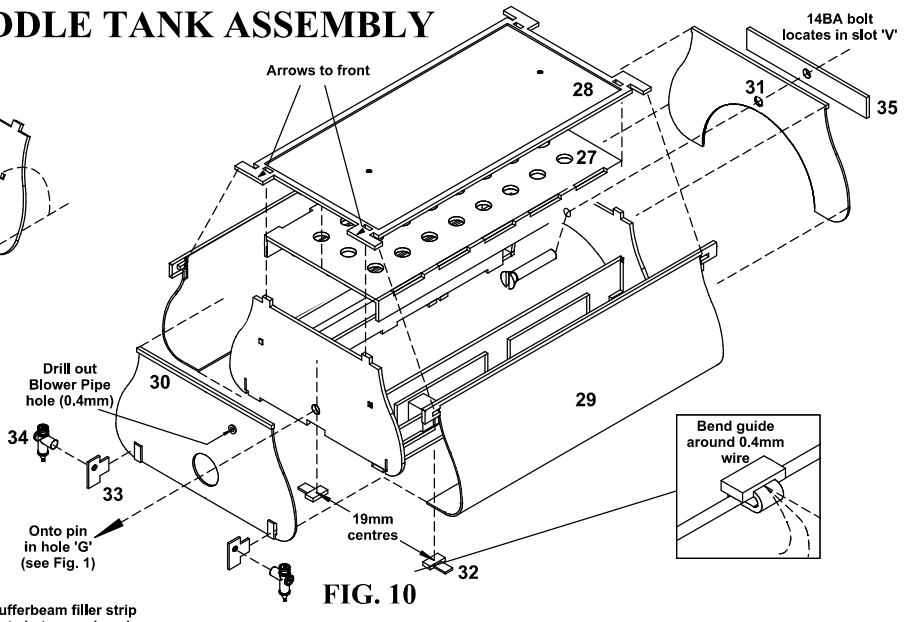


FIG. 10

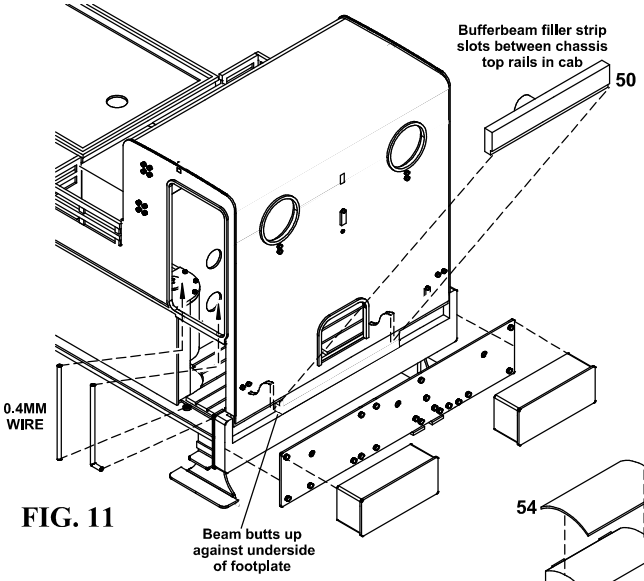


FIG. 11

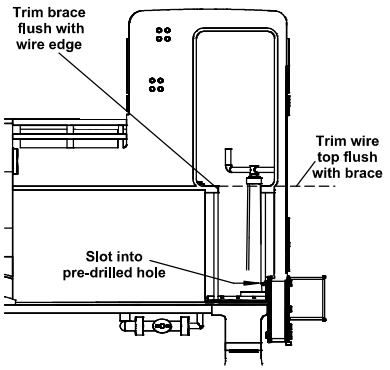


FIG. 12

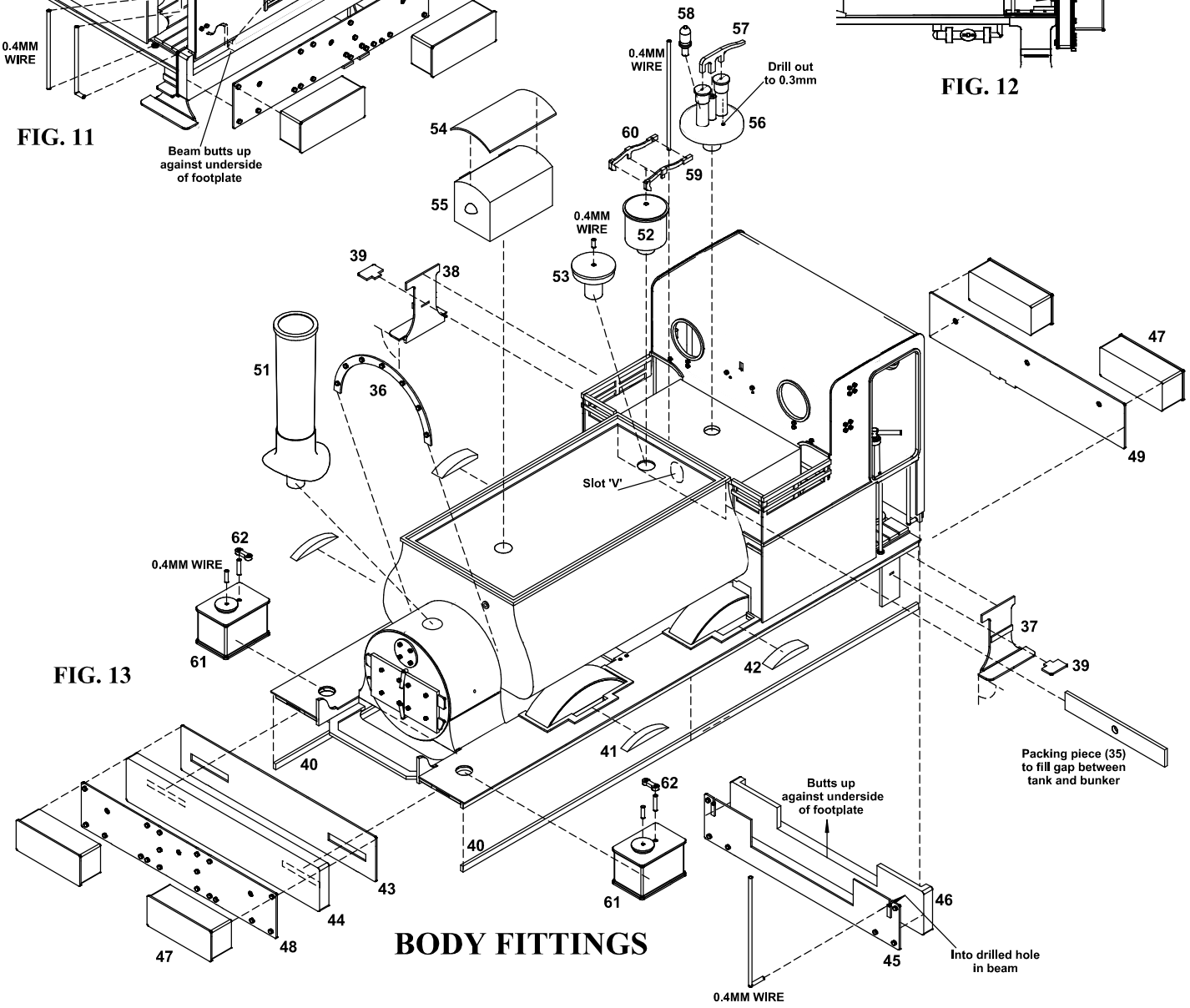


FIG. 13

BODY FITTINGS

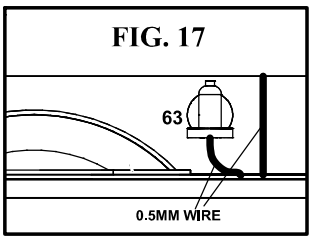


FIG. 17

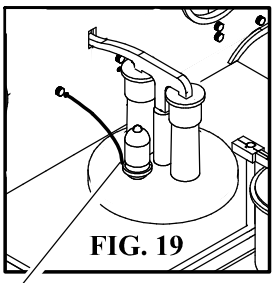


FIG. 19

0.3mm wire into small hole drilled behind whistle

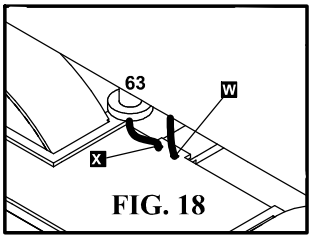


FIG. 18

FIG. 14

BODY DETAILS

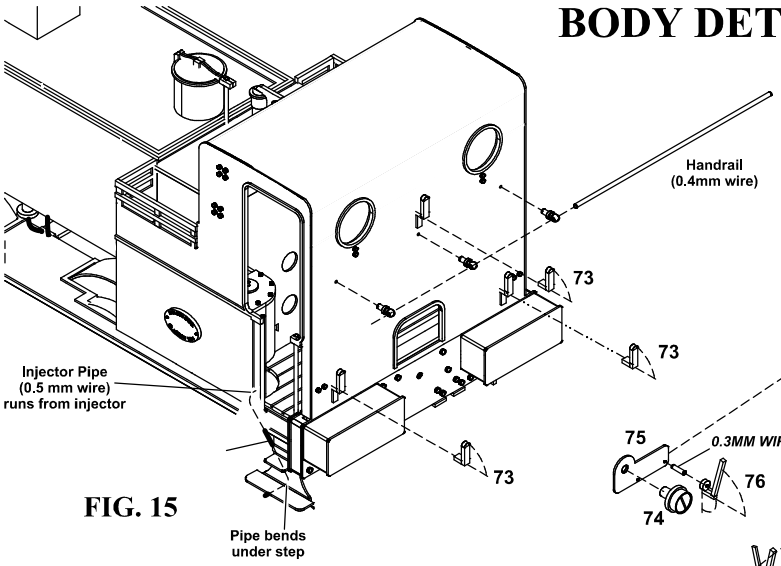
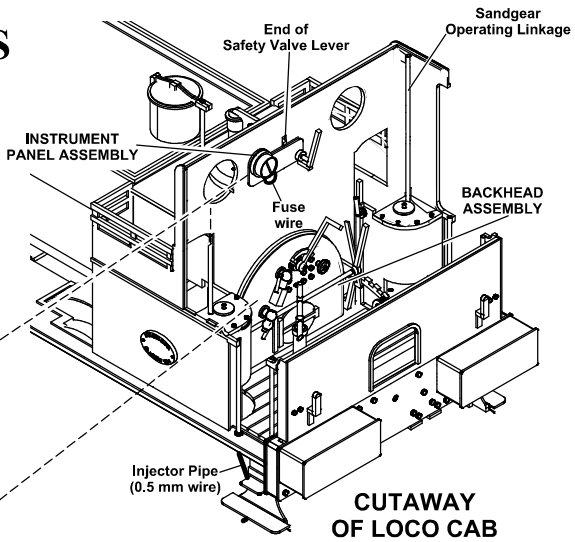


FIG. 15



CUTAWAY OF LOCO CAB

FIG. 20

FIG. 19

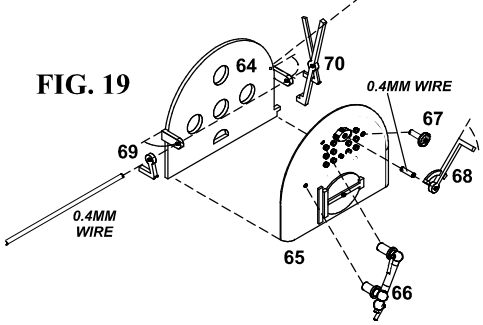
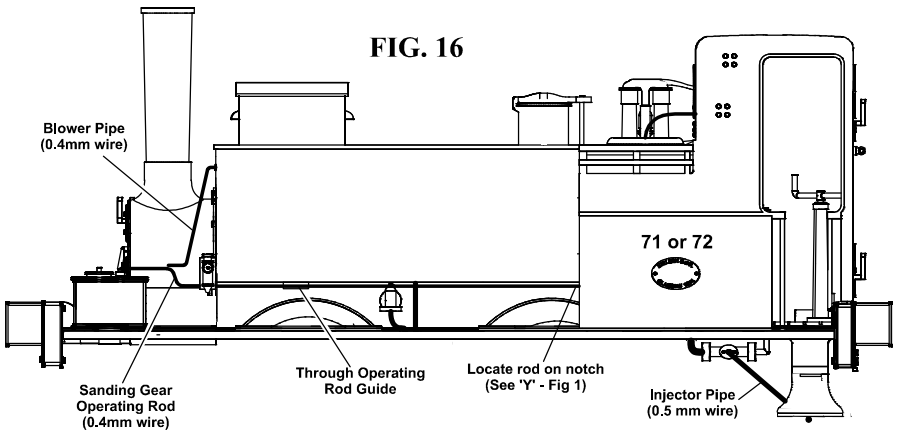


FIG. 16



CHASSIS ASSEMBLY

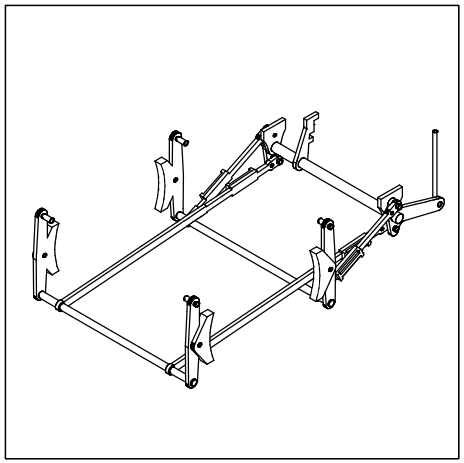


FIGURE 21

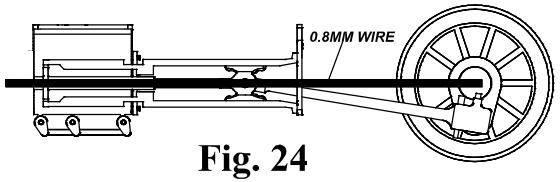


Fig. 24

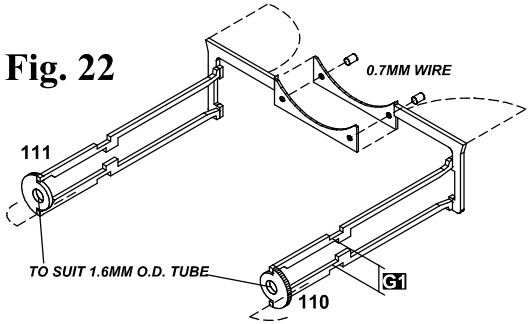


Fig. 22

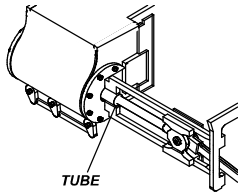


Fig. 25

CYLINDERS AND MOTION

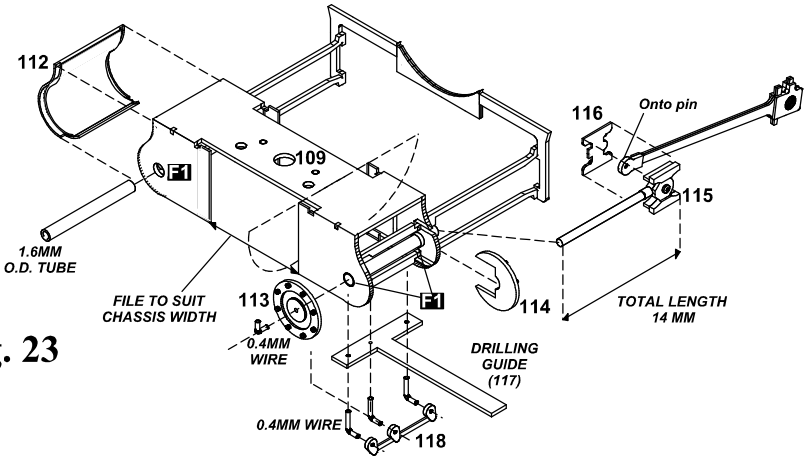


Fig. 23

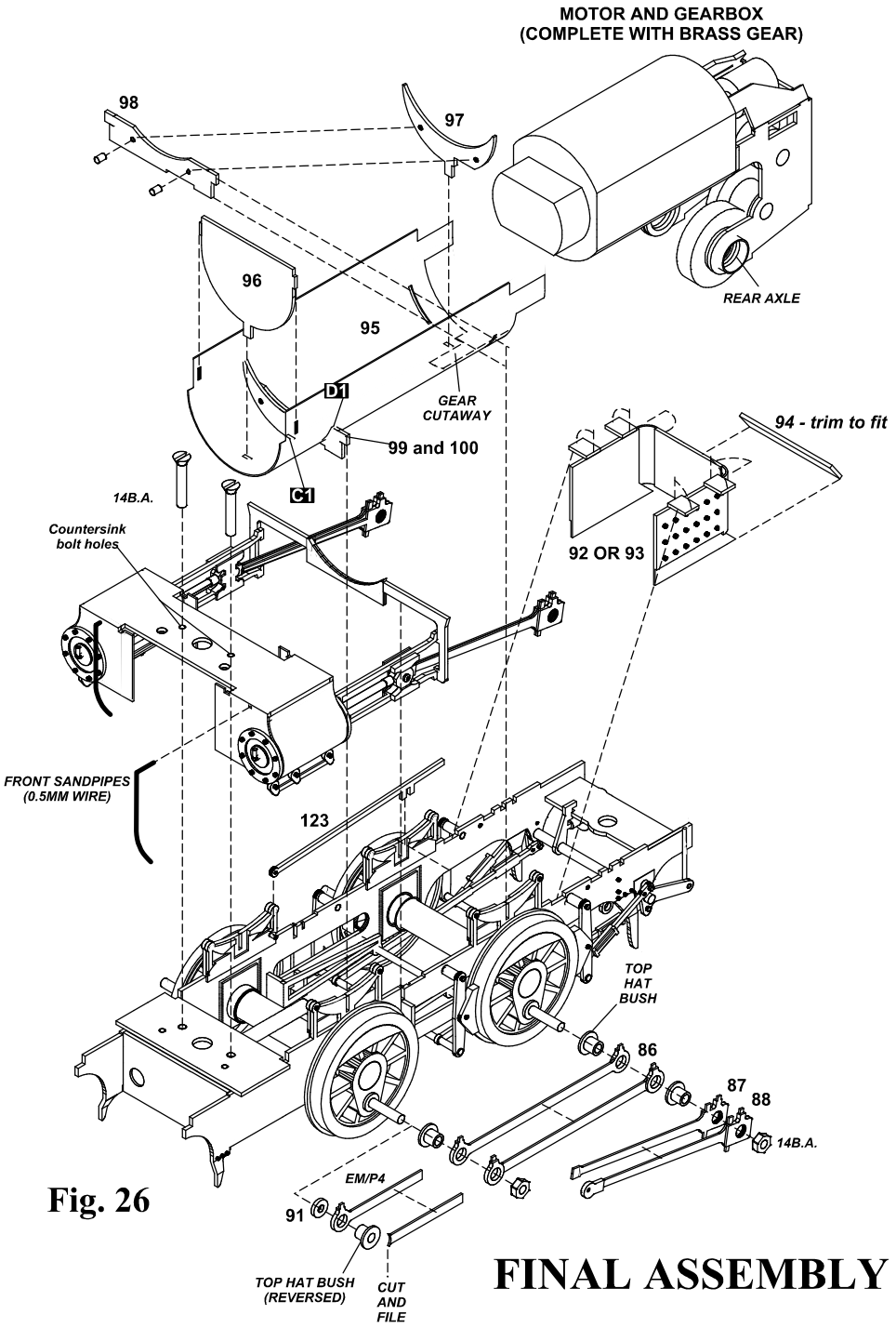
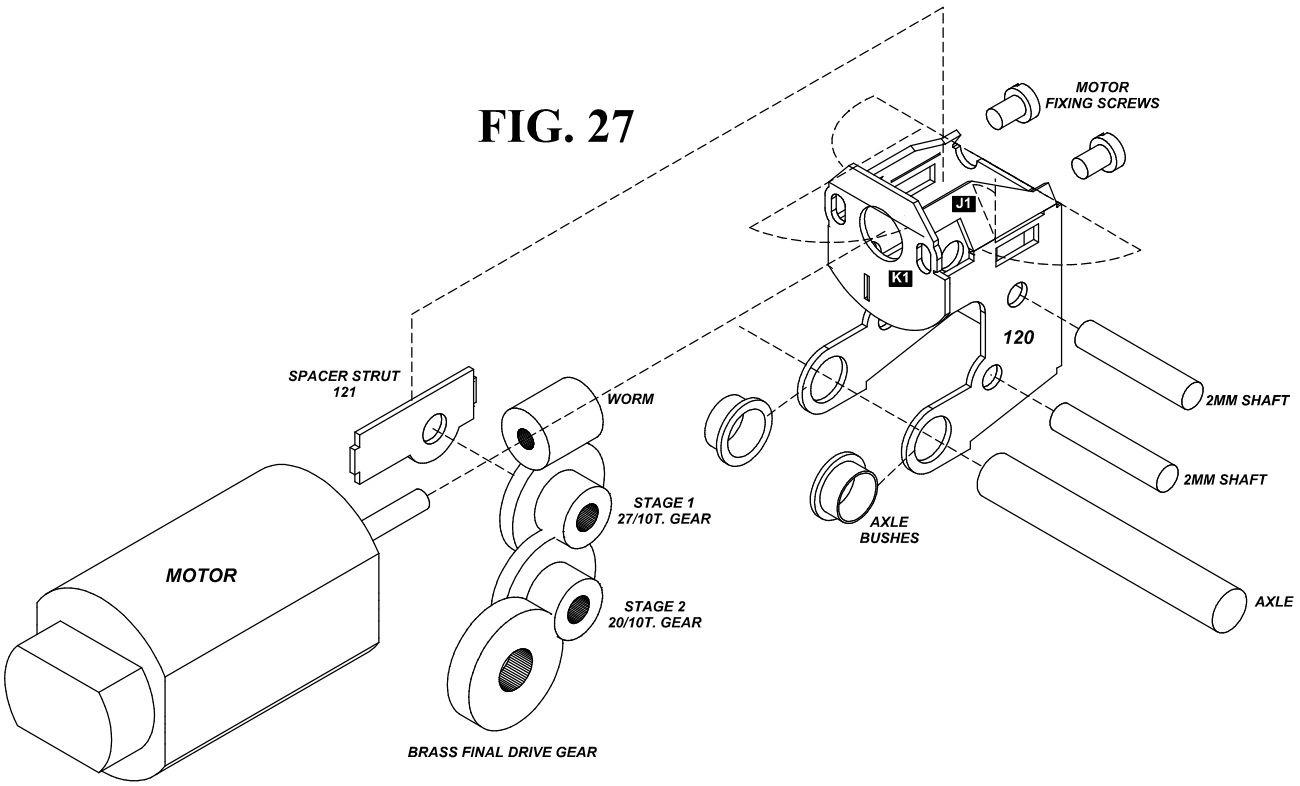


Fig. 26

FINAL ASSEMBLY

FIG. 27



GEARBOX ASSEMBLY

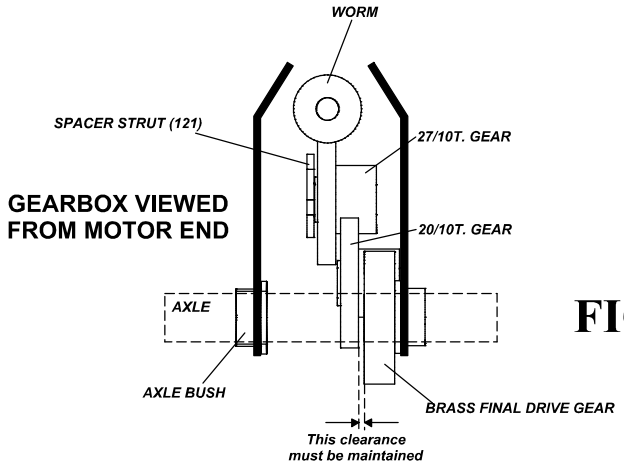


FIG. 28

FIGURE 29