Chassis Kit for GWR 14xx

Basic 4mm scale kits of this popular class have been available for more than 50 years. The legendary Sayer-Chaplin etched brass kit of the immediate post-war era, was quickly followed by the K's version in whitemetal. But in the absence of a true finescale kit, designed to modern specifications, most modellers of recent years have preferred to use the plastic Airfix/Dapol/Hornby body as their starting point. While far from perfect – the smokebox door and chimney look nothing like the prototype, and there are no cab fittings – it is reasonably accurate in dimensional terms and does a good job in capturing the character of these diminutive locomotives. The chassis, though, is very poor and fails to meet the criteria of today's ready-to-run models.

The High Level kit builds up into a true finescale chassis for the 14xx, complete with bespoke gearbox and many other refinements. Assembled as per the instructions, it will give you smooth, reliable operation at prototypical speeds. The large can motor and gearbox have been shoehorned into the relatively small boiler space, leaving the cab area completely clear for detailing.

The body can be much improved using the excellent (and reasonably priced) 14xx detailing kit, designed by Iain Rice, and available from Mainly Trains (www.mainlytrains.com). This includes correct smokebox door, chimney, backhead, screw reverse, safety valve, bufferbeam fittings, push-pull bracket and brake standard. Iain's seminal article on upgrading the Airfix 14xx appeared in the now-scarce first issue of *Model Railway Journal* back in 1985 and it is hoped that a completely new account of how he combined a High Level chassis with his own detail parts to build a state-of-the-art model locomotive will be published very shortly.

The driving wheels (G4862E) carrying wheels (G4844) and (optional) plunger pick-ups (4M62) are required to complete the chassis and these are available from Alan Gibson.

GENERAL NOTES ON CONSTRUCTION

Read the instructions carefully - preferably more than once - before starting work. Study the diagrams until you become familiar with all the parts and the assembly sequence. We have tried to make these instructions as comprehensive as possible, which may make some assembly sequences appear more complex than they actually are.

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 specified, holes are etched undersized so they can be drilled or reamed out to the correct diameter.

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 CHASSIS

The chassis can be built rigid, or with full compensation, so the wheels follow the undulations of the track. This will improve electrical pick-up, roadholding and haulage capability.

Carefully remove the frames (1 & 2) from the fret and, if you have a rivet press, punch out the rivet detail 'A' at the front. Some engines had a crescent-shaped row of proud-standing rivets at the spring anchors ('B' in Figure1). If you decide to model this feature, carefully punch out the rivets using a rivet press - Note: they are quite tricky, so a set of practice rivets is included along the side of the fret. This process can cause the frames to distort so you may need to straighten them afterwards.

For a OO model, remove the half-etched areas ('C' in Figure 1) behind the rear driver location, to provide clearance for the motor.

Using flat-nosed pliers, fold over the spring backing pieces (3 x4) to make them double thickness (see Figure 1.) noting that, unlike most bending operations, the fold lines should be on the outside of the bend. When these parts are absolutely flat (this can be done by gently tapping them between two flat pieces of hardwood) they can be soldered in place on the chassis, behind the springs, before cleaning off any excess solder.

For a rigid chassis, ream out all four of the axle bush locations in the chassis frames and solder the circular 1/8in axle bush bearings in place. Modellers building to 16.5mm gauge should file the rear driver's axle bushes flush with the inside of the frames to allow clearance for the gearbox. If you're going to fit plunger pick-ups (Alan Gibson, ref. 4M62) open out the holes 'D' so the plastic outer sleeve of the pick-up is a tight push-fit.

For a compensated chassis, read all of the following carefully: To make the hornblock cutaways, carefully make a slot up the centre lines of the leading and middle axle locations, taking care not to damage the springs. Use a cutter in your minidrill, a fine fret saw, or a needle file. Now bend the sides of these cuts back and forth, until the metal snaps off to form the rough cutaway shape. Dress up the sides with a file using the remainder of the half-etched marks as a guide. Don't file anything from the top horizontal edge of the slot - this is used to set the hornblocks at the correct height.

For all types of chassis, select the spacers (parts 4 - 8) for the gauge in which you model. Note: P4 modellers have two options for spacers 7 (for OO/EM there is a replacement for part 7 - see Fig 11) and 8. The parts marked P4 will space the rear outside frames (parts 17 & 18) at scale width, which allows no room for sideplay on the rear axle. Spacers marked P4W will position the frames 1mm further apart, thus allowing 0.5mm clearance at each side of the rear wheels.

Open out the holes in the front spacer (4) to suit the wires, as shown in the Figure 4. Punch out the rivet detail in the motion bracket (5) and then straighten the part as necessary. EM and P4 modellers should now open out the large holes ('E' in Fig.1) in the motion bracket, so a length of 1.6mm OD tube is a tightish fit. For OO gauge these tubes will not be visible, so you can simplify things by fitting the valve gear carrier (9 in Fig. 4) which should be bent through 90 degrees and then soldered into the slot in the motion bracket.

Start the chassis structure by bending up and fitting the front L-shaped spacer (4) to the frames sides, followed by the rear spacer (8) and then the motion bracket (5) with the detailed side facing forwards (Fig. 1).

Select the correct midway spacer (6) and outside frame spacer (7) and punch out the rivet detail at the ends of the midway spacer. For a rigid chassis, solder both spacers into the frames and then add the strengthening webs (10 x2) at the junctions, as shown.

For a compensated chassis, solder only the outside frame spacer (7) in place, along with the strengthening webs (10) and slot the front midway spacer into it's location, but do not solder in place. Now select the correct midway spacer retainer (part 11 for P4/OO or 12 for EM) make the 45 degree bends and then solder the part into the frames - when fitted, the central flat section sits up against the midway spacer. When the spacer retainer is fixed in place, remove the midway spacer from the frames and strengthen the bends on the retainer with solder.

For all types of chassis, ream out the hole in the brake cylinder mount (13) to suit a length of 2mm tube and then solder the mount in place, between the frames, so an equal amount protrudes at either side.

Now you can assemble and fit the etched rear wheel carriers. These are necessary for both compensated and rigid chassis, as they allow the wheels to be slotted into the chassis when the outside frames are in place. A standard hornblock, although easier to assemble, is much larger and would show behind the frames.

Take the central layers of the rear wheel carrier (14 x2) and remove the cusp from the sides. Do the same for the cutaways in the frames, so the etches are a good sliding fit. Open up the holes in the front (15 x2), central and rear (16 x2) layers of the wheel carriers, to suit a 2mm axle bush. Make the first bend (F) in the tab which is part of the front layer, push an axle bush into the central hole, slot the middle and rear layers over the tab, using the axle bush and tab to locate them together, Sweat all the layers together using the minimum amount of solder then try the assemblies in the frames to ensure they are a smooth sliding fit - if they're tight, try cleaning out any excess solder from the slots. When you've got them working freely, remove the assemblies from the frames, make the final bend in the tab at the rear ('G' in Figure 1) and put them to one side.

Now finish off the basic chassis structure by soldering the outside frames (17 & 18) in place, so they run between spacers 7 and 8, with the circular wheel clearances facing inwards.

Refer to the fret diagram, and to Figure 7. Open out the holes in the coupling rods (19 x2 & 20 x2) to suit the crankpins. Make the holes a tightish fit as you can always open them out a touch more later. Solder the front and back layers together to make a pair.

For a compensated chassis, bend up four hornblock etches, using the separate instructions supplied with them. When the units are fitted, the tab which protrudes from their front face (see Fig. 2) butts up against the top edge of the frame cutaways. For the driven axle, you'll need to file the circular boss from the rear of the

brass hornblock bearings to allow clearance for the gearbox - the front bearings can be left as they are.

Position a hornblock assembly at the rear driver location, making sure you include a 1/8in brass hornblock bearing, which should be lightly oiled to prevent it from being soldered to the etch. Use a short length of 0.4mm wire, slotted through the axlebox datum holes ('H' in Figures 1 and 2) to locate it, check it sits vertically and then solder the etch in place. Position an etch and bearing at the opposite side, slot an axle through the bearings, adjust the etch so the axle it is at right angles to the frames and then solder the etch in place.

You'll need to trim a small amount from the leading edge of the front hornblock etches (see Fig. 2) so they clear the front spacer. Although the hornblock units can be assembled without any solder, it may make the job easier if you run a small amount between the layers of the hornblock etches. When you've trimmed the etches, use the coupling rods in conjunction with axle jigs, to position the remaining pair of hornblock assemblies (complete with lightly oiled bearings, as above) in the chassis and, after having made a final check that everything is as it should be, solder them in place.

Inside motion

The inside motion (shown in Figure 4) is highly detailed and greatly enhances the model. If you wish, you can simplify things by using only the radius arms and slidebars (parts 21 to 25 & 30 to 31) and ignoring the other smaller parts. This may be the most sensible option for OO models, as it's difficult to see between the narrower frames.

To fit the bottom slidebars (21 & 22 - marked left and right) hold them at an angle, so you can slot the rear ends of the bars into their locations in the motion bracket. Push them as far back as they will go, then bring the front ends of the bars down, locate them in the front spacer, slide them right forward and then solder them in place at both ends. Now do the same for the top slidebars (23 & 24) and then slot in the slidebar spacer pieces (25 x2), as shown, and solder these in place.

Whilst still in the fret, drill out all the holes in the droplinks (26 - 29), the radius arms (30 & 31) and connecting rod, crosshead and reverser components (32 - 37) to suit the wires, shown in Figure 4. Make the 0.7mm holes a fairly loose fit, so a wire can pass easily through them.

Noting that the two sides are different, use short lengths of 0.5mm wire to locate the droplink and radius arm parts together, and then solder them up to make a pair of valve gear assemblies. This can be done more easily by locating the parts together on short L-shaped lengths of wire, which can be trimmed to length (just proud of the etches to represent the pivots) once the bits are soldered together.

Refer to Figures 1 and 4. Slot a length of 1mm wire through the reverser shaft holes 'J' in the frames, and use this, along with a short length or 0.5mm wire, to locate the reverser lever (32). Solder the lever to the inside of the right hand frame, but do not solder the shaft in place. To represent the top pivot, trim the wire flush at the outside, leaving a small amount proud at the inside.

For OO engines, remove the shaft and locate the ends of the valve gear assemblies in the small holes in the valve gear carrier (9). Slot the reverser shaft back through the frames and valve gear assemblies, then solder only the shaft in place in the frames - the valve gear assemblies must be free at this stage - and trim the ends of the shaft very slightly proud of the frames.

For EM and P4 Gauges, slot the reverser shaft through holes 'J' in the frames, and use this to locate the valve gear assemblies. Solder only the shaft in place in the frames - the valve gear assemblies must be free at this stage - and trim the ends of the shaft very slightly proud of the frames. Now swing the valve gear assemblies up into position and slot a length of 0.7mm wire through holes 'K', and through the assemblies - don't solder anything in place at this stage. Cut two 4.5mm lengths of 1.6mm OD tube to represent the valve guides. Slot the tubes into holes 'E' in the motion bracket, pushing them through from the front, until they locate over the small pins at the front of the valve gear assemblies. Push lengths of lightly oiled 0.8mm wire through the front spacer and into the tubes, to set the tubes at the correct angle, and then solder the tubes in place in the motion bracket. When the tubes are secured, remove the 0.8mm wire.

For all gauges, make any necessary adjustments to the valve gear assemblies, so the they lie vertically and run parallel to the chassis, and then solder them to the reverser shaft and, for OO engines, solder the ends of the valve gear assemblies into the valve gear carrier. For EM/P4, carefully slide the 0.7mm wire from the rear of the valve gear assemblies - these assemblies should still be supported by the reverser shaft.

Take the connecting rods (33 & 34) and solder the layers of crosshead detail (35 & 36) to them, along with their packing pieces (37 x2), using a length of 0.5mm wire to locate all the parts, then trim the wire almost flush to represent the pin. Working from under the chassis, manoeuvre the rear ends of the rods through the

motion bracket. Now push the length of 0.7mm support wire back through the frames (holes 'K') and valve gear assemblies, this time locating the rear of the rods as you do so. Swing the front ends of the rods up to the slidebars, locate the tabs in their slots and solder in place.

When both rods are in place, solder the ends of the support wire into the chassis and then trim the ends flush with the outside of the frames. Make a final check that all the components on the support wire are correctly positioned and then solder them all in place on the wire.

For the valve spindles, slot lengths of 0.8mm wire through the front spacer, into the tubes or holes in the motion bracket, and solder in place. Once you've done this you can solder the front ends of the valve gear assemblies in place.

Finnish off the valve gear by pushing 2 lengths of the same wire through the front spacer, to represent the piston rods, locating the ends in the notches in the crossheads. Use longish lengths of wire, so you can hold the ends to position them as you solder them in place and then, when they're secured, use a burr to cut off the excess length, so the ends are more or less flush with the front face of the spacer.

Detailing

Now you can add the final details to the chassis structure. On the left hand side of the ashpan, fit a short length of 0.4mm wire into small hole ('L' in Fig. 1) to represent the washout plug bolt. Use an annealed length of the same wire for the feed pipe, shown in Figure 10, which runs from hole 'M' at the opposite side. Make a sharp bend in the wire, solder the end into the circular etched disc, then run it down the side of the ashpan and curve it around the bottom edge where it can be tack-soldered in place.

Solder the front (38 x2) and rear (39 x2) beam braces, plus the front footplate supports (40 x2) and the step braces (41 x2) in place, then add the various rivet strip details (42 - 47). Figure 1 shows the left hand side of the chassis - the rivets on the right hand side should be an exact mirror image of the left.

If your model has scale width frames, (spacers 7 & 8 marked P4) then you have the option of fitting the angle strips (48 & 49) at the junctions between the spacer (7) and the outside frames (17 & 18). You'll need to carefully file the tabs from one of their side edges, and then fit them with this edge butted right into the corner, up against the rivet strips (44 & 45). Figure 9 shows this arrangement at the left hand side of the chassis, as viewed from the rear corner.

Refer to Figure 12 and carefully remove the axleboxes (50 x2) from their sprues. Locate them, as show, solder them in place, then fit the etched hornstays (x2) which are part of the supplementary fret (Fig 11) .

If you have a rivet press, carefully punch out the rivet detail in the railguards (51 - 54). Make the 45 degree bends, solder the guards in place at the ends of the frames, as shown in the diagram, and then strengthen the bends with a small amount of solder.

Pre-drill the holes at the bottom of the sandboxes (55 - 58) secure the front sandboxes to the frames and then attach the rear sandboxes to the midway spacer (6), as shown in Figure 3. For a compensated chassis, you can do this with the spacer removed from the frames, and then the whole assembly should be fixed in place using a 14BA nut and bolt, slotted through the retainer (11 or 12).

Preparing the body

Before you offer the chassis up to the body, remove a small amount of material from the vertical faces below the smokebox, as shown in Figure 8 - the boiler/smokebox assembly should unclip to allow you to do this. The length along the bottom edge should be 11.5mm, with the slope on the back edge corresponding with the inclination of the front spacer - when the chassis is in place this spacer extends upwards and sits between the footplate inner edges to represent the rear face of the smokebox. If you wish, you can add material to the underside of the boiler, to fill the cutaway which is no longer required. Suitably shaped Plasticard will do for this.

When you've sorted the body, try the chassis in place. For P4 locos, it'll be necessary to file small flats at the ends of the beam braces (38 & 39) so they fit between the valances. Secure the chassis to the body, by locating the horizontal slot in the rear spacer over the rectangular plastic lug which protrudes from the inside of the bunker, then swing the front of the chassis up into position. Fasten it in place using the original fixing screw, through the front spacer and then, after having made any necessary adjustments, remove the chassis.

Rear axle set up

There are three options available for the rear axle set up: Rigid construction locks the wheelsets solid, so they can't move vertically in their slots. Alternatively, the semi-rigid arrangement allows the rear axle to rock on a

central pivot, but the driving wheels are still rigid - this will improve performance and involves very little extra effort. The third option - a fully compensated chassis - also allows the rear wheelsets to move vertically and to distribute the movement through the compensation beams.

For a fully rigid chassis, carefully open up the holes 'N' (Fig. 1) in the frames, and in the wheel carriers, until a length of 0.5mm wire is a tight fit.

For all types of chassis, slide the rear wheel carrier assemblies onto your rear axle, fit the wheels to the axle, set them to the correct gauge and include washers to control sideplay, then refit this assembly into the frames.

For a fully rigid chassis, slot short keeper wires through holes 'N' to lock the wheel carriers solid, and to set their height. The wires should not be fixed permanently and care should be taken to prevent them from poking too far through the frames and fouling in the spokes of the wheels.

If you decide to try a semi-rigid set up, bend up the sides of the rear axle pivot carrier (59) solder an M2 nut over the central hole and then solder the assembly in place, as shown. Screw an M2 bolt into the nut, so it bears on the centre of the axle - when the drivers are fitted you can adjust the bolt so all the wheels sit on the track. A suitably shaped wire, slotted through holes 'P' will prevent the wheelsets from dropping out, as illustrated in Figure 5.

For a fully-compensated chassis, fit the pivot carrier (59) and wheelset retaining wire, as above, but ignore the M2 nut and pivot bolt.

Compensation

If you're building a compensated chassis, bend the small cantilever tab 'Q' in the front spacer (4) up through 90 degrees. Slot a 9mm length of 1mm diameter silver steel rod through the holes in the tab and spacer, so the end of the rod stops about 1mm beyond the centreline of the front hornblock - this will be the pivot for the front wheels.

To fit the compensation beams, cut 2 lengths of 1.6mm O.D. tube, so they fit snugly between the frames, but without being tight. Ream out the central hole in the compensation beams (60 x2) so the tube is a good fit, and then open out the beam pivot wire hole 'R' in the frames to 0.8mm diameter (you'll need to remove the spacer/sandbox assembly to gain access).

Position the beams 1mm from the edge of the tubes, and solder them in place to make a handed pair. Try the assemblies in place between the frames - this is illustrated in the cutaway view in Figure 5 - and then slot a length of 0.8mm wire through the holes 'R' (see Fig 1) in the chassis, and through the tubes. Check the beams pivot freely - if they don't, look for obstructions: tabs, wires etc. which may be protruding inside the frames - and ensure they run parallel to the frames. The rear ends of the beams should locate on the small ledges at the backs of the rear wheel carriers, with the front sitting on top of the square hornblock bearings at the rear driver locations. It's essential that the beams and hornblocks work correctly together, in a smooth see-saw motion with no tight spots.

Brakegear assembly

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. Figure 5 shows how the completed brakegear assembly integrates with the chassis.

Drill out the small holes in the steambrake and handbrake lever components (61 - 65) to the sizes shown in Figure 1. Use a short length of 0.5mm wire through the holes on the longer part of the levers, to locate the steambrake halves together - the hole in the shorter lever must be left clear. Trim the outsides of the wire almost flush with the etch faces and then, with the assembly completed, go on to ream out the larger central hole to suit a length of 1.6mm O.D. bar. Do the same for the handbrake parts, this time including the small detail (65) and then bend the locator at the top of the assembly through 90 degrees.

Now drill or ream out the rest of the brakegear components (66 - 70) to accommodate the various wires shown in Figure 1. making absolutely sure these wires will pass through their holes without being forced.

Remove, or spring, the retaining wires (see above) so you can drop the rear wheelsets, which will allow you to fit the crosshaft. Cut a length of 1.6 mm bar, so its length is about 0.3mm greater than the width across the outside of the chassis, then thread this through the frames, including the handbrake and steambrake lever assemblies as you do so. Make sure the shaft is central in the chassis and then solder it in place, ensuring that the two lever assemblies are still free to move.

To represent the brake cylinder, cut a length of 2mm O.D. tube to about 6mm long. Slide the steambrake lever assembly to the middle of the crosshaft, slot the brake cylinder tube into the hole in the brake cylinder mount and then swing the end of the lever up into the tube. Adjust the tube until about 4mm protrudes down below the mount, locating the end of the lever assembly as you do so, then solder the tube in place. Now solder the steambrake lever assembly to the shaft, making sure that the part of it which extends up into the tube is absolutely vertical - don't solder this into the tube in case you need to adjust the angle of the lever on the shaft. Slide the handbrake lever assembly along to the left of the shaft until the small tab at the top can be located in the slot in the frames, then solder the tab into the frames and the lever in place on the shaft.

Setting up the chassis

Temporarily fit the driving wheels, including any washers that may be necessary to eliminate sideplay. Try pushing the chassis around your curves, to see how much sideplay you actually need - this applies to both rigid and compensated chassis. In OO and EM gauges, we've allowed for up to 0.5mm sideplay (total 1mm) on the middle axle. For P4, the sideplay should be no more than 0.3mm either side. Don't worry about the sideplay effecting the gear mesh, because the gearbox is designed to move laterally with the axle. If the chassis still won't go around your curves, allow a small amount of sideplay at the outer axles.

For a rigid chassis the ride height and levels shouldn't need any adjustment. For a semi-rigid set up, you'll need to place the loco on a flat length of track, and then screw the M2 pivot bolt down onto the rear axle, until the loco sits level with all wheels in contact with the rails.

If you're building a compensated chassis, then you may need to make some very fine adjustments, so the chassis sits level on the track. You can alter the height at the back of the loco, either by filing the ends of the compensation beam, or by fixing a small amount of packing onto the ledges of the rear wheel carriers. The front end of the loco can be raised or lowered, simply by tweaking the end of the silver steel pivot rod. It may be wise to fit the body at this stage, so you can check the buffer height. When the chassis sits level on your track, and at the correct height, trim the compensation beam pivot wire to length (about 1mm longer than the overall width of the chassis) and then fix it into the frame with a small amount of glue at one end only. Make sure the glue doesn’t penetrate into the tube. Finally, fit the spacer/sandbox assembly back into the frames and secure it using a 14BA nut and bolt.

The brake hanger front layers (66 x2 & 67 x2) have tabs at the tops which space them the correct distance from the frames. For P4 wheels, which are narrower the OO/EM, the small pieces ('S' in Fig 1) will need to be filed off.

Take one of the brake hanger front layers and carefully make the bend at the top. Use a short length of 0.5mm wire, pushed through the middle holes, to locate the rear layer (68 x4) onto the front, solder them together and then trim the wire flush at both sides. Repeat this process for all the hangers, so you have two handed pairs, and then check the top and bottom holes are free from solder.

If you wish, add the very small (and optional) hanger pivot details (69 x2 & 70 x2) to the tops of the hangers. If you do decide to fit these details (and depending on the amount of sideplay you have on the wheels) you may need to add crankpin spacer washers (71 x 4) so the siderods don't catch the brakes. We recommend that you try the hangers and siderods in place (see below) along with the details, so you can check the clearances, before deciding whether to fit the details not.

Select the correct brake stretchers (72 & 73 - OO, EM, or P4) and solder lengths of 0.5mm wire into them, making sure the wire sits right down in the grooves. Trim the wires so that about 2mm protrudes at the sides.

Whilst they are still in the fret, mark the forward end of the front brake rods (74 x2) as indicated on the fret (and Fret Diagram). Open out the small locations holes 'T' in the rear brake rod (75) and in the brake rod fork (76 x2) then use a short length of 0.4mm wire to locate the parts and solder them together to form a forked end. Check the fork will slip over the bottom of the steam brake lever assembly, and that a 0.5mm wire will slot through the holes 'U' but do not secure it in place.

Hold the rear brake stretcher with the wire facing downwards and slide the front end of the rear brake rod assembly along the stretcher, so it locates in the notch at the centre, and then solder in place. Do the same for the front brake rods, this time locating them in outer notches in the front and rear stretchers and noting that the front slots are very slightly smaller (which is why you marked them previously). Adjust all the parts as necessary, so the whole assembly is straight and square and then solder the rods in place on the stretchers. If you wish, you can strengthen the rods using wire.

Fit the forked end of the pull rod assembly onto the steam brake lever, slotting a length of 0.5mm wire through the holes 'U' to keep it in place. Push a 25mm length 0.5mm diameter wire though the chassis, at the front

brake hanger pivot 'V' and then locate a handed pair of hangers onto these wires. Swing the whole pull rod assembly up and slip the bottoms of the hangers over the wires on the brake front brake stretcher, with the top locating on the wire at the hanger pivot 'V'. Now, push the hangers hard up against the frames and then, as you hold them in place, carefully solder the bottoms to the stretchers. Trim the wire at the top and bottom of the hangers, so it is very slightly proud at both sides.

Fit the rear hangers, as above, and solder them to the rear stretchers. Now set the loco down and view the brakegear, paying particular attention to the clearances between the shoes and the wheels - the length of the brake rods should set the hangers at more or less the correct distance from the wheels, but you can make minor adjustments by applying heat at individual joints whilst carefully nudging the parts. When all is well, remove the brakegear by pulling out the loose wires from the tops of the hangers, and from the rear of the brake rod.

When the brakegear is off, remove the wheels and use epoxy to attach the balance weights (77 x2 & 78 x2) in position, noting that they are different on the front and rear drivers (see Fig. 7). Make sure they lie flat and don't foul the rods.

Invert the loco and slot lengths of annealed 0.4mm wire into the pre-drilled holes in the sandboxes. Shape the wire so it runs down to the wheels , as illustrated in Figure 7. Check the brakegear can be removed without the pipes getting in the way.

Now clean up all the parts and paint the sub assemblies, ready for the final assembly sequence.

Gearbox assembly

Study Figures 6 & 7. Before cutting the gearbox etch (79) 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 are 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 as the bend lines. Now cut the etch from the fret with a heavy blade and trim off the tabs.

Carefully bend the gearbox to shape, so you end up with a three-sided box, as indicated in Fig 6 - all bend lines are on the inside of the gearbox. Now solder the stage one spacer (80) into its location, using a length of gearshaft to position it. Locate the slots in the motor mounting plate (part 81 for 1224 & 1424 motors or part 82 for 1624) on the gearbox tabs and, noting which is the top of the plate, use a piece of wood to hold the parts hard up against one another as you solder the plate in place. File off the excess tabs, so the mounting plate is absolutely smooth and then finish off the shell by attaching the gear protector (83) to the front of the gearbox, making sure the gear clearance recess is correctly positioned.

Using a carborundum disc in a mini-drill, cut a 1.5 and 2mm gearshaft, 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 a length of insulated wire into two equal lengths and solder to the motor brush tags. 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. Hold the motor by the rear of the shaft and 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 5.5mm from the motor face (i.e. - so the worm lines up with the stage 1 gearshaft when the motor is fitted into the gearbox). Grind off the excess motor shaft at the back of the motor and screw the motor onto the mounting plate.

Refer to Fig. 6. The stage 1 double gear will be one of three types - 15/10T (30:1), 20/10T (40:1) or 27/10T (54:1) - depending on the overall reduction ratio of the gearbox. Fit the stage 1 gearshaft, and the double gear (according to ratio). Sight through the opening in the gearbox sides to check the mesh with the worm - there

should be daylight between the gear and the worm, but avoid having too much backlash. If necessary, loosen the motor fixing screws, adjust the mesh and then lightly glue the shaft in place at both ends.

Now fit the Idler shaft ,complete with thin 16T single gear and the spacer washer (84), into the gearbox - the larger boss on the gear should run against the washer. Fix the shaft as above. Temporarily fit the axle, along with the brass 20T. gear into the gearbox. Tighten the grubscrew on the gear and then. if the motor is not fitted, check that all the gears revolve smoothly. Now test the gearbox under power by fitting the motor and worm assembly, as described above. Remove the drive axle and brass gear.

The gears are effectively self-lubricating but a little plastics-compatible 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 ultra-adhesive oil.

Pick-ups
Most modellers have their own preferred method of fitting pick-ups. Plunger pick-ups are one option for the driving wheels and these will need to be fitted before the wheels go on. An alternative would be suitably shaped wiper pick-ups made from phosphor-bronze or 0.33mm hard brass wire. These can be run to the wheel rims from strips of gapped copperclad and are best fitted after the wheels. Make sure you allow adequate clearance around the chassis components to prevent shorting. The loco will also benefit from extra wiper pick-ups on the rear carrying wheels.

Final assembly.
When the gearbox is completed and you are ready for the final assembly sequence. Offer up the motor/gearbox unit. As you fit the driven axle, slip on the final drive gear, but do not tighten the grubscrew yet.

The kit includes axle washers of varying thicknesses, which can be used to limit axle sideplay. Fit and quarter the wheels, complete with crankpins - the right hand cranks lead by 90 degrees. Now add the bushes to the crankpins, followed by the coupling rods, and check for free running before fitting the securing nuts. Optional crankpin spacer washers (71 x4) are provided, but these only need to be fitted if the siderods catch the brake hangers.

With the chassis inverted, centralise the middle axle in the frames, so there is equal sideplay at either side. Move the gearbox to the centre of the axle and then carefully tighten the grubscrew on the final drive gear. For OO engines pay particular attention to the position of the gearbox on the axle as there is minimal clearance (although still enough) between the sides of the motor and the tops of the wheels.

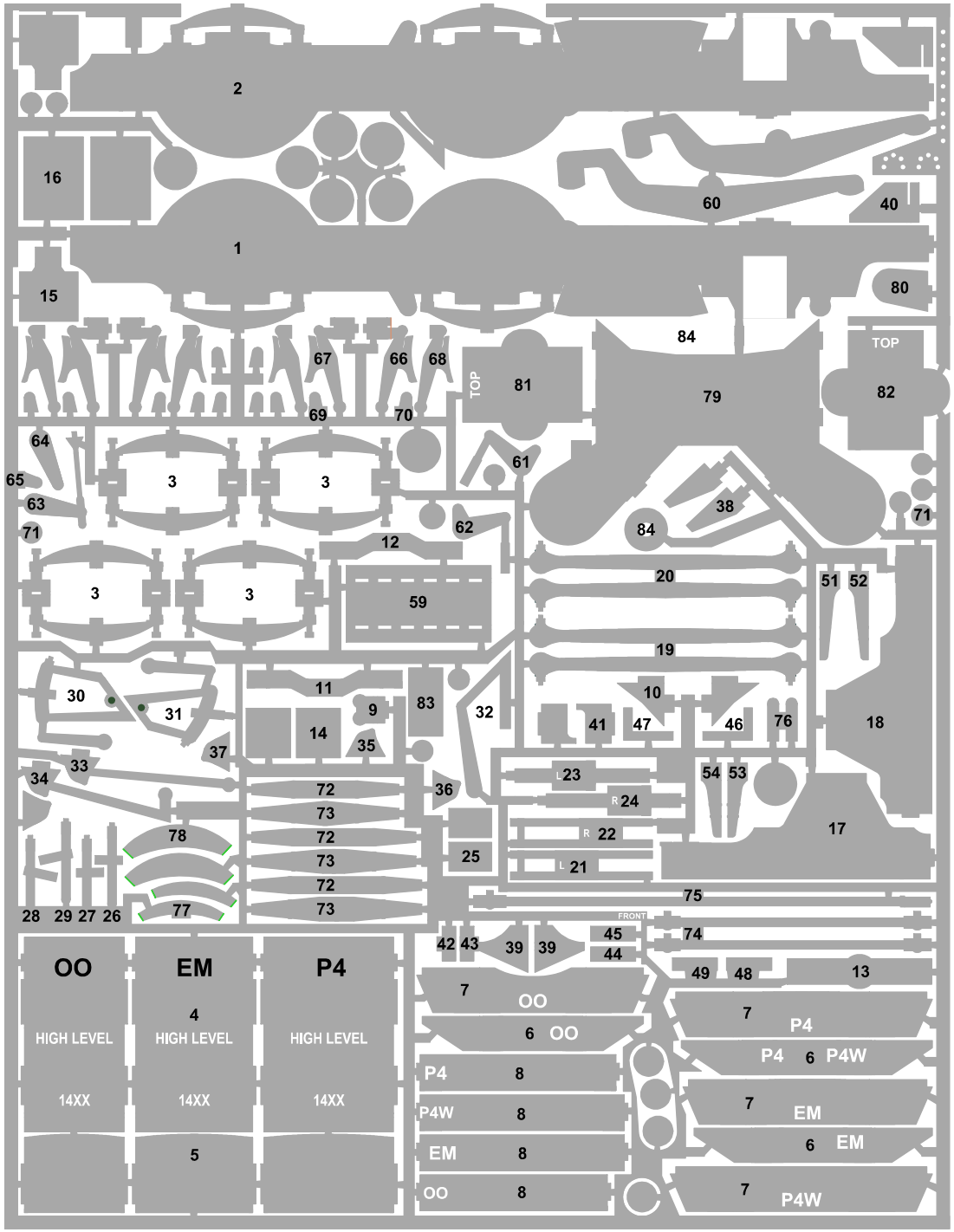
Try moving the axle sideways - the gearbox will move with it - then test the mechanism under power. You should be able to push the axle from side to side with the motor running and without anything binding or catching.

To complete the chassis, refit the brakegear, as described previously and trim the ends of the top wires so they protrude slightly beyond the brake hangers at either side. Test again under power, as above, to check the clearances.

Fit the body to the chassis, as described previously, and give it a test run on your track. For P4 models, check the siderods don't catch on the underside of the footplate. If this happens, carefully grind away a small amount of material from the footplate, and/or remove the cork details from the rods.

Once the body is fitted, there's very little room for the motor to move about. You can, if you wish, fit a small amount of packing (perhaps a blob of bath sealant or Blue-tack) to the inside of the firebox, near the back, to prevent the motor/gearbox from lifting when power is applied. You'll need to get the thickness of this material just right - if it's too tight the movement at the front of the box will be restricted and, on a compensated chassis, will prevent the unit from floating with the axle.

CHASSIS KIT FOR GWR 14XX



PARTS LIST

1. Frame - LHS
2. Frame - RHS
3. Spring Backing Pieces (x4)
4. Front Spacer
5. Motion Bracket Spacer
6. Midway Spacer
7. Outside Frame Spacer
8. Rear Spacer
9. Valve Gear Carrier
10. Strengthening Webs (X2)
11. Midway Spacer Retainer - P4/OO
12. Midway Spacer Retainer - EM
13. Brake Cylinder Mount
14. Rear Wheel Carrier - centre layer (x2)
15. Rear Wheel Carrier - front layer (x2)
16. Rear Wheel Carrier - rear layer (x2)
17. Outside Frame - LHS
18. Outside Frame - RHS
19. Coupling Rod - outer layer (x 2)
20. Coupling Rod - inner layer (x2)
21. Bottom Slidebars - LHS
22. Bottom Slidebars - RHS
23. Top Slidebars - LHS
24. Top Slidebars - RHS
25. Slidebar Spacers (X2)
26. Droplink, outer - LHS
27. Droplink, inner - LHS
28. Droplink, outer - RHS
29. Droplink, inner - RHS
30. Radius Arm - LHS
31. Radius Arm - RHS
32. Reverser Lever
33. Connecting Rod - LHS
34. Connecting Rod - RHS
35. Crosshead Detail - LHS
36. Crosshead Detail - RHS
37. Crosshead Packing (x2)
38. Front Beam Brace (x2)
39. Rear Beam Brace (x2)
40. Front Footplate Support (x2)
41. Step Brace (x2)
42. Midway Brace Rivet Strip - LHS
43. Midway Brace Rivet Strip - RHS
44. Outside Frame Rivet Strip - LHS
45. Outside Frame Rivet Strip - RHS
46. Rear Beam Brace Rivet Strip - LHS
47. Rear Beam Brace Rivet Strip - LHS
48. Angle Strip - LHS
49. Angle Strip - RHS
50. Axlebox Castings (x2)
51. Front Railguard - LHS
52. Front Railguard - RHS
53. Rear Railguard - LHS
54. Rear Railguard - RHS
55. Front Sandbox - LHS
56. Front Sandbox - RHS
57. Rear Sandbox - LHS
58. Rear Sandbox - RHS
59. Pivot Carrier
60. Compensation Beam (x2)
61. Steambrake Lever Halve - LHS
62. Steambrake Lever Halve - RHS
63. Handbrake Lever Halve - LHS
64. Handbrake Lever Halve - RHS
65. Handbrake Lever Detail
66. Brake Hanger Front - LHS (x2)
67. Brake Hanger Front - RHS (x2)
68. Brake Hanger Rear (x4)
69. Hanger Pivot Detail - LHS (x2)
70. Hanger Pivot Detail - RHS (x2)
71. Crankpin Spacer Washers (x4)
72. Brake Stretcher, Front
73. Brake Stretcher, Rear
74. Front Brake Rods (x2)
75. Rear Brake Rod
76. Brake Rod Fork (x2)
77. Balance Weights, front (x2)
78. Balance Weights, front (x2)
79. Gearbox Etch
80. Stage 1 Spacer
81. Motor Mounting Plate - 1224/1424
82. Motor Mounting Plate - 1624
83. Gear Protector
84. Idler Shaft Spacer.

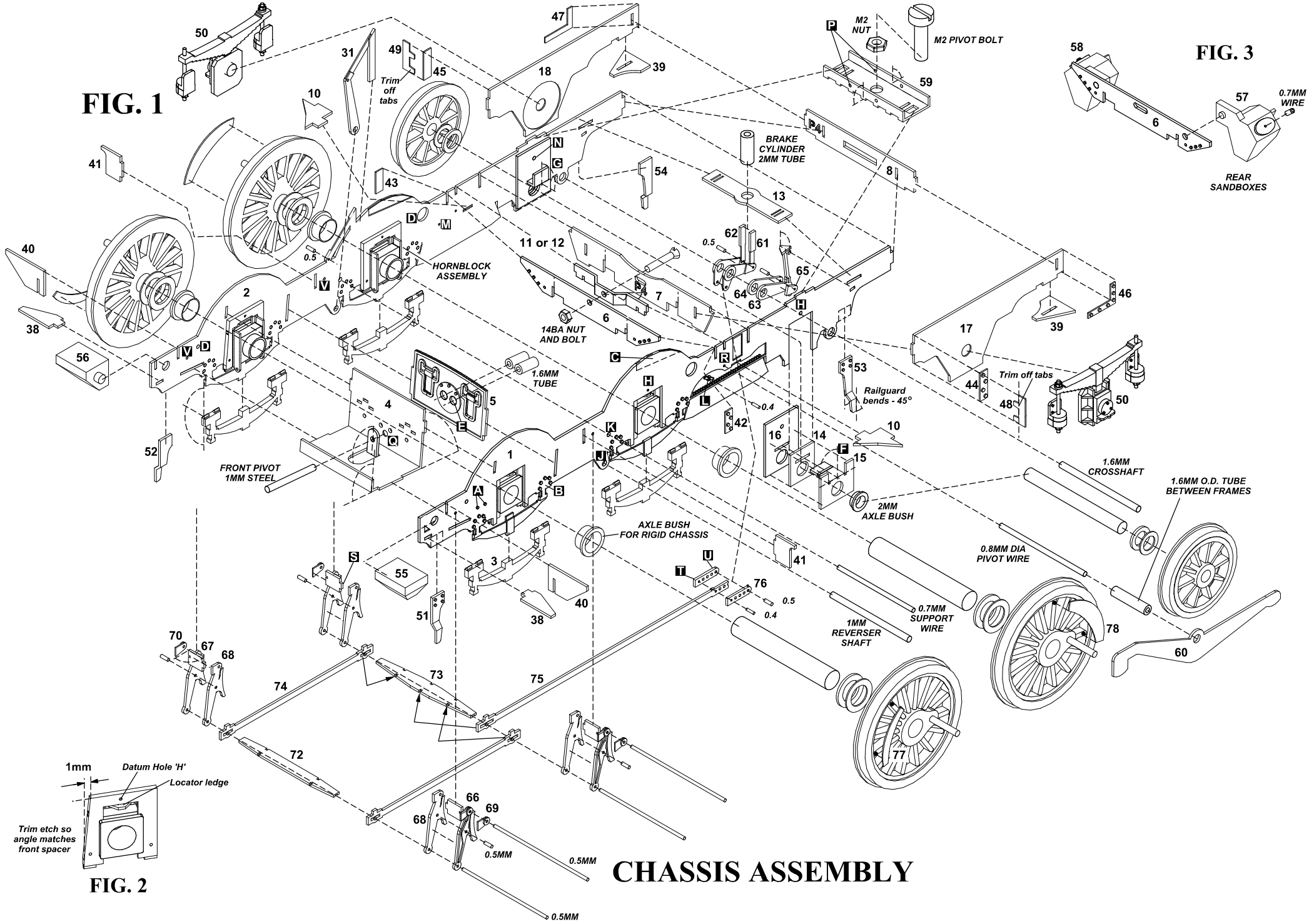


FIG. 1
FIG. 3
FIG. 2
CHASSIS ASSEMBLY
M2 NUT
M2 PIVOT BOLT
BRAKE CYLINDER 2MM TUBE
REAR SANDBOXES
0.7MM WIRE
Trim off tabs
HORNBLOCK ASSEMBLY
14BA NUT AND BOLT
1.6MM TUBE
FRONT PIVOT 1MM STEEL
Railguard bends - 45°
Trim off tabs
1.6MM CROSSHAFT
1.6MM O.D. TUBE BETWEEN FRAMES
2MM AXLE BUSH
AXLE BUSH FOR RIGID CHASSIS
0.8MM DIA PIVOT WIRE
0.7MM SUPPORT WIRE
1MM REVERSER SHAFT
0.5MM
0.5MM
0.5MM
1mm
Datum Hole 'H'
Locator ledge
Trim etch so angle matches front spacer

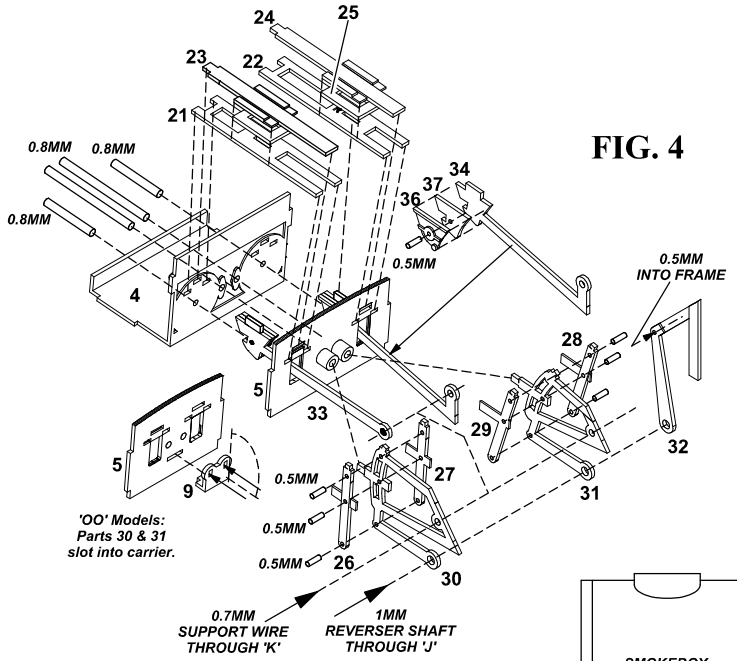
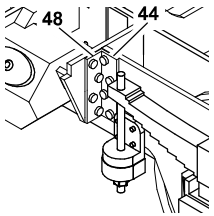


FIG. 4

FIG. 9



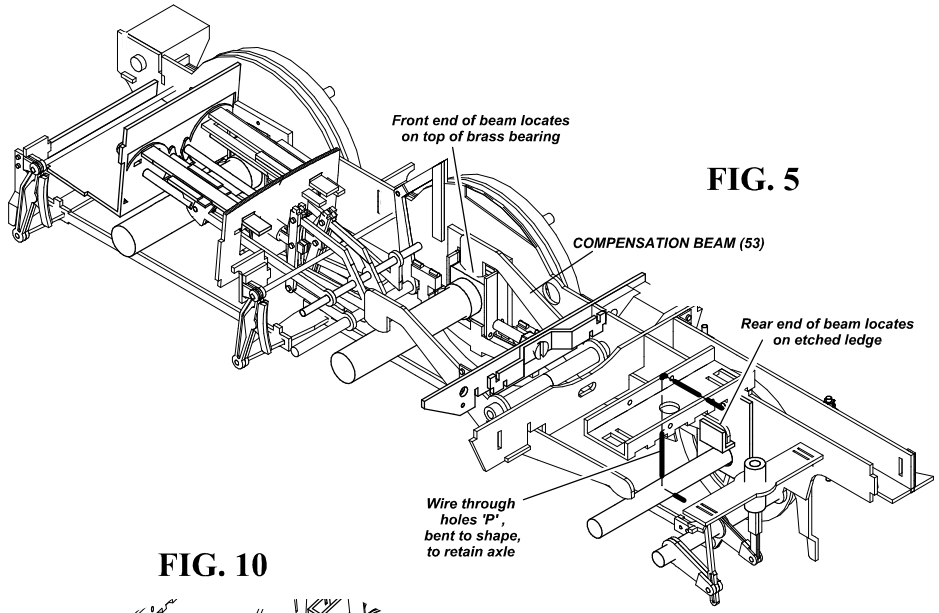


FIG. 5

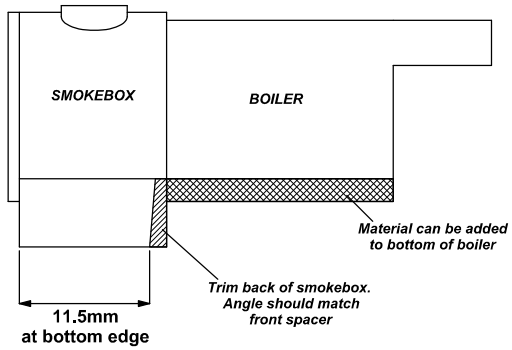
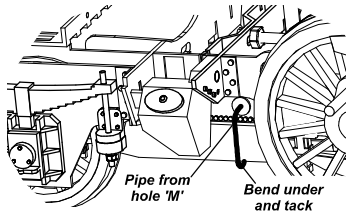


FIG. 8

FIG. 10



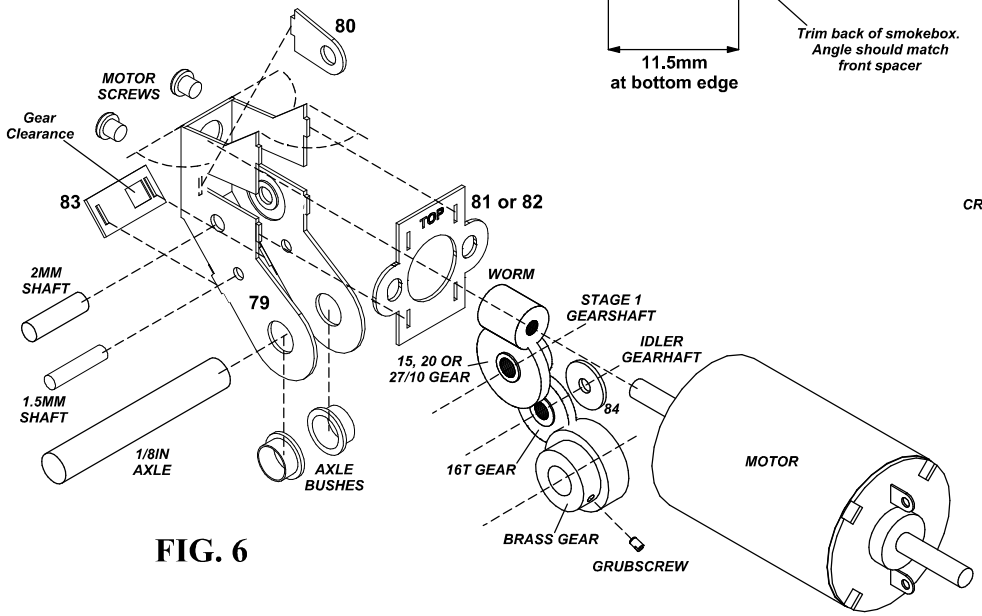


FIG. 6

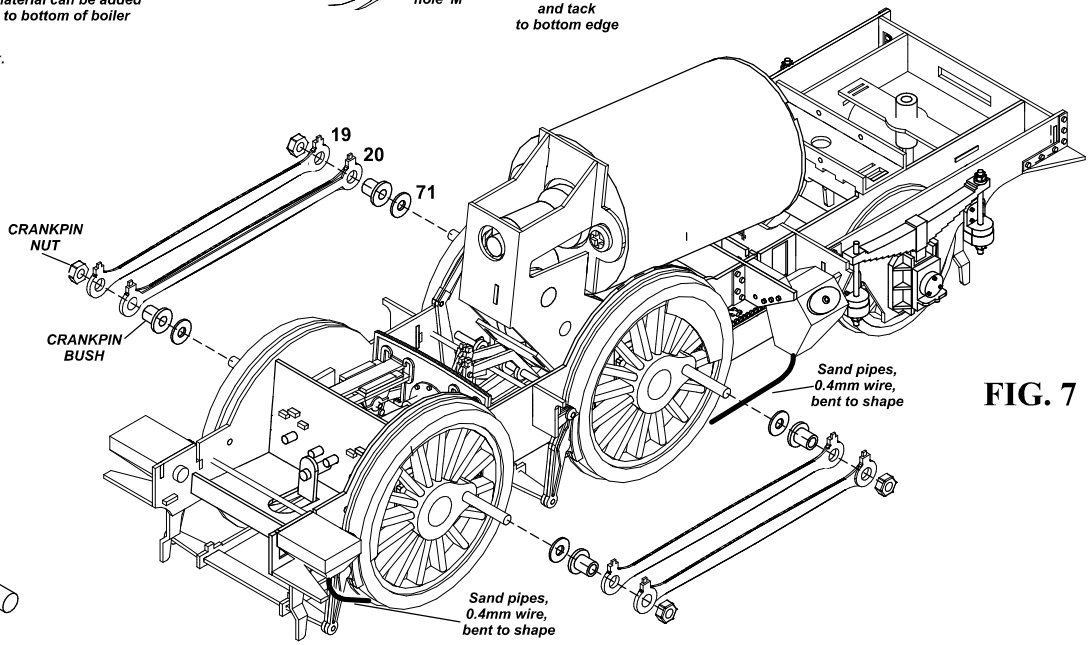


FIG. 7

REPLACEMENT PARTS

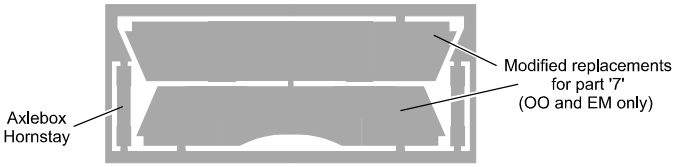


FIG. 11

LOST WAX AXLEBOXES

Follow the instructions in the order stated below.
The castings are fragile until they are in place.

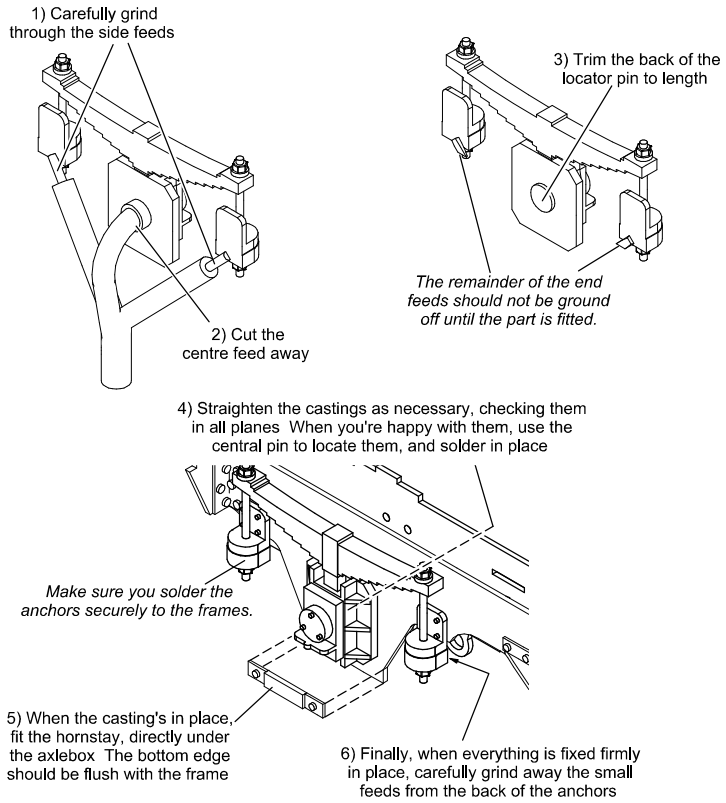


FIG. 12

HIGH LEVEL

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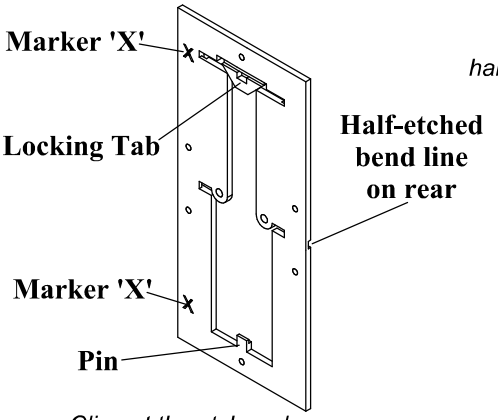
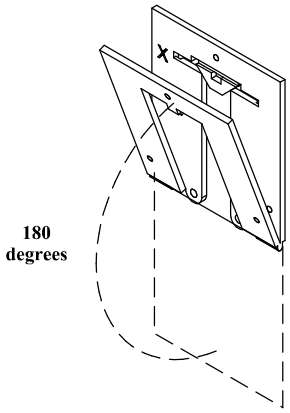


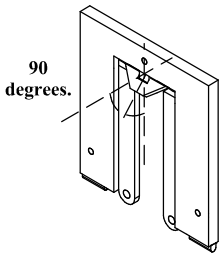
Clip out the etch and clean off any mounting tabs.

Fold the etch through 180 degrees, so the markers 'X' face each other. The half-etched line is on the outside of the fold.

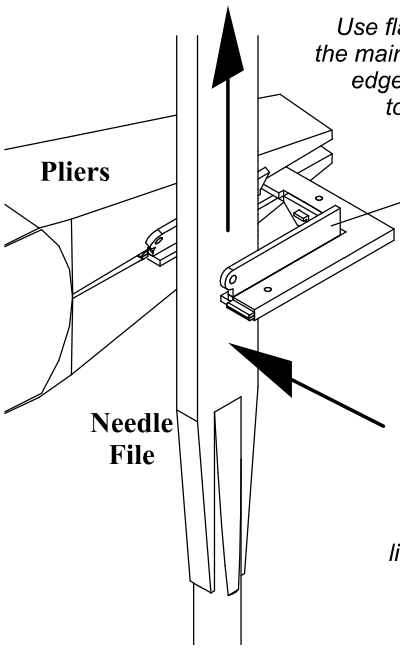


When it's folded, tap the layers between two pieces of hardwood, so they sit absolutely flat.

Hold the layers tightly together and fold the locking tab through 90 degrees, so it locates on the small pin.

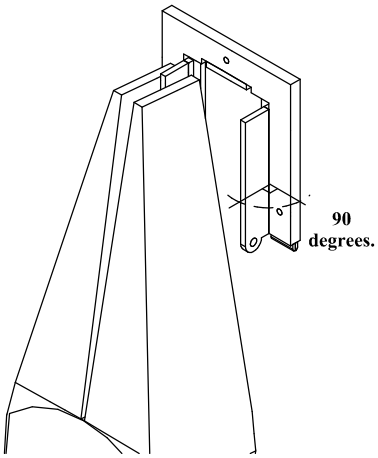


The end of a flat, pointed needle file is a good tool for this job. The tab locks the layers together, eliminating the need for solder.



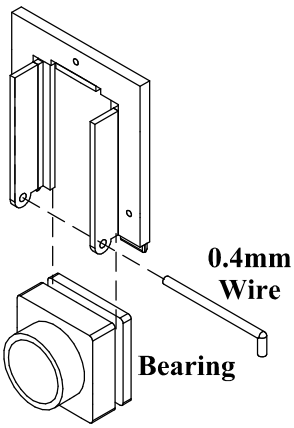
Use flat nose pliers to grip the main etch,with the straight edge of the pliers close to the bend line.

Bend the horncheeks up through about 80 degrees, using a flat needle file to apply upward and sideways pressure simultaneously. In this case, the half-etched line is on the inside of the fold



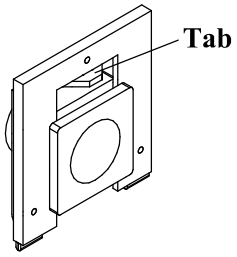
Finish off the horncheek bends so they are at 90 degrees. Check this through a magnifying glass and adjust as necessary.

Use fine emery to clean up the bearing, remove any burrs and then try it in place - the groove on the block locates on the front layer of the etches.



When the bearing is fitted, slot a length of 0.4mm wire through the bottom holes to keep it in place.

The completed assembly can now be soldered to the inside face of the chassis, using axle jigs. If you fit it with the bearing in place,make sure the sliding surfaces are lightly oiled, to prevent the bearing being soldered to the etch.



The tab is designed to sit exactly 4mm above the axle centre line, with the loco on level track. The top edge of the cut-outs on most chassis is also 4mm above the axle centre, so the tab can be butted against the top of the cut-out to set the unit at the correct height.

HIGH LEVEL, 14 TUDOR ROAD, CHESTER-LE-STREET, CO. DURHAM, DH3 3RY.
TEL. 0191 3882112.