BR Class 03/04 Shunter

(MODIFIED VERSION)

This 4mm scale kit is designed to provide a complete compensated chassis for the BR class 03 and Drewry class 04 0-6-0 diesel shunters. Primarily intended as a replacement for the famously temperamental Mainline/Bachmann split-framed design, with only minor alterations the chassis can also be used with the older Vulcan and Airfix/Dapol kits. The design has been optimised for the 03, so modelers wanting to build a prototypically accurate chassis for a class 04 will need to do a little extra detailing work.

In brief, all class 03s were pretty well alike below the running plate, with deep cutaway front steps, air tanks more or less level with the leading coupled wheels and the unique 'barleytwist' rear steps, formed thus so they could be fabricated from a single metal bar. The later class 04s (from D2274 onwards) had a virtually identical chassis, again with cutaway front steps but with fabricated rear steps minus the twist and air tanks mounted between the leading and centre wheels. This is the version modelled by Bachmann and Airfix/Dapol. Note that 04s from D2215-2340 had 3ft 6ins diameter, 9-spoke wheels that were of a visibly different pattern to those fitted to the 03s; to date no one has produced these commercially in 4mm scale.

D2215-73 of class 04 had a similar chassis to the later engines but the front footsteps were open, of simple bar construction and not recessed into the footplate, which was continuous from front to rear. The air tanks were smaller than those on the later 04s and were mounted behind the front steps. Using a Bachmann or Airfix bodyshell as the basis you can represent one of these engines by using the continuous footplate overlays and alternative footsteps provided in the kit, but we don't include the different air tanks and sandboxes fitted to these locos. The Vulcan whitemetal kit for the class 04 has optional large-window cab sides to allow you to depict an engine from this batch and the High Level bodywork conversion parts are not needed.

The High Level chassis can also be used to model the first batch of 04s, numbered from D2200-D2214, but in many respects these were very different to the later engines and much extra work on the bodyshell is called for. If you can't get hold of the old Vulcan kit, or the Impetus conversion kit to turn an Airfix plastic kit into a Wisbech & Upwell tram engine, scratchbuilding is your only real option. Even more modifications would be required to represent the former Drewry demonstrator that subsequently entered BR departmental stock as DS1173 and for a short while before withdrawal in 1967 was renumbered D2341 in the revenue fleet. Among a host of detail variations compared with the later engines, these early 04s had 3ft 3ins dia. 9-spoke wheels, a different pattern of front sandbox, shallow buffer beams, three-link couplings, low cab roofs with a flatter radius and a single droplight window. The steps (front and rear) had solid backing sheets and the front radiator grille was square cornered – on the later ones it is more obviously radiused. On D2200-3 only, the front cab windows are rectangular; all other 04s have teardrop-shaped front windows, as do the 03s. The paneling forming the top of the bonnet on D2200-29 is in four sections (as are the handrails) but from D2230 onwards on it is in three sections only and the handrails echo this. Buffers vary too – generally speaking, early 04s have big round buffers with the tops and bottoms sliced off; mid-period ones have small round buffers; late ones have oval buffers.

In summary, this chassis kit will cover all the 03s plus the last 67 04s (D2274-2340). With the modified footplate overlays included in the kit – plus a measure of improvisation regarding sandboxes, air tanks etc – you can also use it to represent D2215-73. The simplest adaptation is probably one of the Drewry 'trams' based on an Impetus or Vulcan kit – you can leave off all the brakegear and other below-footplate detail (and even the jackshaft) although we suggest you use 3ft 6ins diameter wheels as this is the dimension for which the ride height of the chassis has been set.

Wheels: Ref 4842DD + OO/EM or P4. Available from Alan Gibson Wheels, PO Box 597, Oldham, Lancashire, OL1 9FQ. Tel. 0161 6781607. Note : 8 long crankpin bushes will be required.

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 . . .

Step Assemblies

To avoid damaging them, carefully prize off the front sandboxes, along with the lights. Before fitting the etched steps, you'll need to remove the heavy, plastic moulded versions from the RTR model. To do this, use your cutters to nibble away at the plastic steps, until most of the material has been taken away. Trim off the remainder with a sharp blade, so the surfaces are absolutely smooth and flat - be careful not to damage any other details (pipes, valves, air tanks etc). For a mid-period 04 loco, with continuos footplate (shown in Figure 24) fill in the footplate cutaway using styrene sheet (Plastikard or Evergreen). Make sure the top surface is level with the existing footplate.

Our kit uses its own method of fixing the body to the chassis so, while you're at it, you can also remove the feeble screw-mounting pillar, situated at the centre of the beams. Finish off behind the beams by using a three-square (triangular) needle file to clean out the inside-upper corners.

If you're planning to replace the buffers, this is a good time to do so. Make sure the mounting pins on the replacement buffers are flush with the backs of the beams - if you're keeping the original buffers, check they are horizontal and tweak as required, using extra adhesive to secure them if necessary.

Front step assemblies
Two variations of front steps can be fitted: The open-frame type (see Figures 2 & 24), as fitted to the mid-period of 04's (engines with a continuos footplate) or the recessed type for the cutaway footplates of the later 04's and all 03's, which is illustrated in Figures 6, 23 & 25.

Open-frame front steps: mid-period 04's
Refer to Figure 1. Remove the front step carrier (1) from the fret and repeatedly bend along line 'A', until the part snaps into two bits, and then file off the corners 'B' and tidy up the edges. Take the front part and make the bend 'C' then try the etch in place under the footplate, making sure it goes right up into the corner between the bufferbeam and footplate,

For a hook and bar coupling, carefully cut through the retaining tabs ('D' in Fig. 1) and bend the coupling anchor through 90 degrees - for 3-link couplings, leave things as they are.

Take the front, open-type step frames (2 x2) and carefully bend up the backs of the bottom footsteps. It's important to get the outside dimension of the step units spot-on, so we recommend bending them up as follows: Hold the thinner side area of the step frame with flat-nosed pliers, positioning the side edge of the jaws right up to the bend line, then bend up the wider bottom area to form the right angle. Do the same at both sides of the steps.

Solder the step frames in place, locating them in the slots in the step carrier etch. Bend up the back edges of the narrow footsteps (3 x4). To make fitting easier, it's recommended that you file the small locator tabs down until they protrude by about 0.2mm, so they are no more than a small pip; it would be impossible to reliably etch them like this. If necessary, use a small drill bit to open out the small footstep location holes in the step frames. Now spring out the sides of the frame, clip the footsteps between them and solder in place, making sure they are level.

Carefully solder or glue the narrow treads (4 x8) onto the steps, and then finish off by soldering an M2 nut directly over the central hole in the step assembly. The assemblies can now be glued in place under the body, using quick-setting epoxy, as illustrated in Figure 24. Make sure they are dead central.

Recessed front steps: Late 04's, all 03's
Although this job looks quite complicated, it's actually no more than a series of 90 degree bends, executed in a specific sequence. Follow the instructions and you should be fine, but be sure to check that all bends are parallel and square before moving on to the next. All bend lines must be on the inside.

Open out the holes, shown in figure 3, until lengths of 0.5mm diametre wire are a tight fit in them, and then remove the front step carrier etch (1) from the fret. Remove areas 'E' by cutting through the tabs 'F' then repeatedly bending along the bend lines until they snap off, before finishing off by filing off any of the tabs that remain.

Carefully bend up the back edges of the bottom footsteps (Fig 4) straighten as necessary, then bend the front and rear top bends ('G ' and 'H') through 90 degrees. Go on to fold up the step sides (bends J and K in Fig. 5), doing both bends simultaneously and overlapping the top sections (K goes over J) as you go. The etch will now be formed into a box shape, although some of the bends may need tweaking to get the whole thing square. To keep everything in place, push lengths of tight-fitting 0.5mm wire through the small holes in the overlapping top sections and then, after making a final check that the box is square when viewed from all sides, solder the tops together so they are sitting flat against each other. Finish off the box by filing the wires flush.

For hook and bar couplings, follow the sequence described above and illustrated in figure 1.

Bend up the wide footsteps (5 & 6) solder their backing pieces (7 x2) to them and then solder these assemblies in place in the step frame, taking note of the above procedure for the open-framed steps. Add the wide treads now (8 x2) using solder, or glue them on later if you prefer. Solder an M2 nut directly over the central hole, and the step assembly is now complete and can be glued in place, centrally, under the footplate (Fig 23).

Rear Steps
With the 03 rear steps, you have two options, one of which includes making the tiny twist at the top of the side supports. This prototypical feature, noticeable under close scrutiny, demands skill and patience from the modeller if it is to be reproduced accurately. Badly executed, however, it will draw attention to itself. The earlier straight-framed steps as fitted to 04s are much easier to build and are included with the kit. As they share the same dimensions, these could be used on an 03 if you don't feel like making the twisted type.

For all types, bend up the rear step carrier (9), as shown in Figure 12. Solder an M2 nut over the central hole, on the top surface of the carrier. Try the step carrier in place under the footplate, to check it fits.

Rear Twisted Frame steps (late 04, + 03)
To do this job, you'll need two pairs of small, flat-nosed pliers. The jaws should be, smooth, with good, clean edges.

With the right (10) and left (11) rear, twisted step frames still in the fret, start off by marking the position of the twists (see the fret diagram). To do this, blacken the metal using a permanent marker, then mark the lines with a scriber and finally remove the step frames from the fret.

Study Figures 7 - 11. With all bends, check each one for squareness as you go: Take the right-hand step frame (10) and bend up the rear edge of the central footstep (Fig. 7) followed by the indicator arrows at each end, making absolutely sure these bend lines are on the inside. Refer to Figure 8 and, working at one side of the frame (it doesn't matter which), position one edge of each pair of pliers along your scribed lines. Gripping the job very firmly, twist your outer wrist (nearest the arrow) through 90 degrees, in the direction shown by the indicator arrow. Use the sides of the jaws, rather than the tips, for a better job. Do the same at the other end of the frame.

Make the bends at the ends of the frame, as shown in Figure 9, this time ignoring the arrows. To do the sides of the footsteps (Fig 10) hold the thinner, side area of the step frame with flat-nosed pliers, positioning the side edge of the jaws right up to the bend line, then bend up the wider bottom area to form the right angle. Finish off with the pair of bends just above the twists, which is shown in Figure 11. Tweak the frame, so it is straight and square, with the two legs running parallel, then repeat the whole process for the left hand side frame.

Locate one of the step frames into the rear step carrier, as shown, whilst manoeuvring the small brace tab (L) into the slot at the back of the carrier making sure you fit it to the correct side (see Fig. 11). Make sure the frame

is sitting fully down on the top surface of the carrier, and that the steps look square from all angles, tweak as necessary, then solder in place, doing a bit at a time so you can make minor adjustments to the position. Do the same for the opposite side.

Rear straight-framed steps (Mid 04's)
Fold up the small lips at the back of the footsteps on the rear straight step frame (14 - see Fig. 13). Go on to bend up the sides, bringing both of them up simultaneously, paying particular attention to how you position the pliers as you make the bend (see the section above). When folded squarely, push the tabs on the frame into the rear step carrier's slots, noting which is the front and back and making sure the small step braces 'L' locate at the rear of the carrier. Ensure the unit is sitting fully down in the slots and solder in place.

All types
Solder the ends of the braces 'L' into the rear of the step carrier and trim off any excess at the back. Bend up and solder the narrow footsteps (3 x4) in place, opening up the location holes as necessary, (see above), and then clean up the step assembly. Very carefully, and using flat-nosed pliers to hold it across the bend on the half without the mesh, fold the jackshaft guard (13 & 14) through 180 degrees - note that the bend lines go on the ***outside*** of the bends, so the markers 'X' face one another. Flatten the two layers together and run a small amount of solder around the frame edges, taking care not to flood the mesh.

Working at one side, tin the back vertical edges of the footsteps and then locate the hole and notch in the mesh assembly, so they locate onto the small pips on the back of the step frame, and then solder it to the rear of the steps. Do the same for the other side and then add the narrow treads (4 x8) to the step assemblies using a very small amount of solder, or, alternatively, they can glued in place later. The step strengthening braces (15 x2) which don't actually exist on the real loco, will make the step unit more robust and are virtually invisible on the model. To fit them, solder them in place, behind the jackshaft guard mesh as shown. The completed steps unit is now ready to be given a final clean-up and then glued under the body, as shown in Figure 23.

If you're fitting 3-link couplings, the bufferbeam cutaways can be filled once the steps are fixed securely in place (see Fig. 24). To do this, cut rectangles of styrene sheet (Plastikard) so they're a good fit in the cutaways - use material which is fractionally thinner than the beams, which can be set onto a bed of epoxy and then pushed back until level with the face of the beams.

ASSEMBLING THE CHASSIS

The chassis, shown in Figure 15, can be built rigid, or with full compensation, which will allow the wheels to follow the undulations of the track.

Remove the frames (16 & 17) from the fret and carefully punch out the rivet detail - some practice rivets are included at the side of the fret - and then straighten the frames as necessary.

For a rigid chassis, ream out all the axle bush locations in the chassis frames and solder the 1/8in axle bush bearings in place.

For a compensated chassis, read all of the following carefully: Solder a 1/8in axle bush into the frames at the rear driving wheel location (N). Now go on to make the hornblock cutaways by carefully making a slot up the centre lines of the front and middle axle locations. Use a cutter in your minidrill, a fine fret saw, or a needle file. 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 slots - this is used to set the hornblocks at the correct height.

For all types of chassis, open out the jackshaft location holes 'P' to accept an 2mm axle bush, and then use the bush to locate the jackshaft details (18 x2) on the chassis, and solder these in place.

Select the spacers (parts 19 - 21) for the gauge in which you model. Bend up and fit the front (19) and rear (20) L-shaped spacers followed by the midway spacer (21)

This kit has been modified to use a different sized idler gear from the original, so you'll need to substitute the original Transmission Sideplates (attached to the main fret) with replacements etches (22 &23) which are supplied separately. To start, cut a piece of 1mm O.D. tube so it's length is exactly equal to the overall width across the outside of the chassis. Having identified the new parts, open out holes 'Z' so a length of 2mm shaft is a tight fit and smaller holes 'S' to suit the 1mm tube.

Identify holes ‘Q’ in the frames (there’s a few around this area so double-check you’ve got the right ones…) and open them out to accept 1mm tube. Locate the new sideplates on the rear spacer, making sure their tabs go fully home in their slots. Push the 1mm tube through holes ‘Q’, in the frames and ‘S’ in the transmission sides – this ensures correct alignment of the sideplates - then, after making sure the plates sit parallel to the frames, solder them to the rear spacer, and the tube into both the plates and the frames. Now cut out the inner section of the tube, netween the plates (see Figure 18) to make way for the idler gear and then finish off the ends of the tubes, so they’re smooth and flush with the etch faces.

Whilst they are still in the fret, tin the backs of the brake hanger brackets (24x 4, 25 & 26). Open out their holes, along with the remaining four brake hanger location holes 'R' in the frames, and in then use a length of lightly oiled 0.5mm wire to locate the brackets on the frames, noting that the rear pair (25 & 26) have handed cutaways. Solder them in place or, alternatively, secure them later using glue.

Finish off the main chassis structure by adding the front and rear webs (27 and 28 - OO, Em or P4) with their recessed edges facing down.

Siderods

Refer to the fret diagram, and to Figure 20. Open out the holes in the rods (29 - 38) to suit the components shown in the diagram. Make the holes a tightish fit - you can always open them out a touch more later. Use the fret diagram to identify the parts and build one rod at a time to avoid confusion.

Starting with the left side, take the central section of the front rods (29) and then add the front inner and outer layers (30 & 31). Put this assembly to one side and then take a left hand side continuous main rod section (32) and add the central (34) and rear (35) layers to the back face of the middle section. Finish off by adding the short central (37) and outer (38) layers to the outer face of the rear section of continuos rod. Use a short length of 1/16in bar to align the rear holes. Solder this in place, trim it flush at the back of the rod, with about 0.1 mm proud at the front, to form the 'dummy' crankpin, which will not actually be connected to the flycrank.

The right hand side rod assembly is a mirror image of the left. Follow the procedure described above.

The rods have an articulated knuckle joint which uses a 0.75mm valve gear rivet as the pivot. For a smooth running chassis, it is essential that these rivets are a good fit in their holes. When the front and rear rod sections are assembled, lightly countersink the holes at the rear of the 'forks'. Put a small amount of oil on the 'tongue' of one of the long rods and slide this into place in the 'fork' on the short, front rod. Slot a rivet through the assembly and, very carefully, secure in place by soldering it to the rear rod sections only and then trimming the rivet almost flush at the back. Alternatively, you can spread the hollow ends of the rivet to form a lip. Do the same for both sides and check the joints pivot freely.

For a compensated chassis, bend up four hornblock etches, using their own separate instructions. When the units are fitted, the horizontal tab, which protrudes from their front face (see Fig. 16) butts up against the top edge of the frame cutaways. With this particular chassis, there's very little clearance above the brake rods, so it's important to ensure that the hornblock units don't sit too low in the frames.

Slot an axle through the rear driver location and position a pair of hornblock assemblies at the middle wheel position. Include the 1/8in brass hornblock bearings, which should be lightly oiled to prevent them from being soldered to the etches, and then use the coupling rods, in conjunction with axle jigs, to set the exact position of the hornblock assemblies. Check they are vertical and then, after having made a final check that everything is as it should be, solder the etches in place. Now slot the axle through the middle wheel location and repeat the procedure for the front.

Slot the small webs (39 & 40) into their notches in the chassis (Fig. 15) then bend the back tabs through 90 degrees, so they nip onto chassis, and solder them in place. Make 60 degree bends in the railguards (at the ends of the frames) and strengthen these with a small amount of solder.

Cut the two M2 bolts, so about 5mm of thread is left, and file a flat on the head of one of them (this is to clear the idler shaft). With the front and rear steps already fixed in place under the body, you can offer up the chassis, and fasten it to the body using the M2 bolts - don't overtighten the bolts or you'll distort the etches. Make sure the chassis sits fully home and then, after having made any necessary adjustments (which should be no more than the removal of the cusp from the ends of the frames) remove the chassis. Finish off the main chassis structure by fixing the rivet strips (41 -44), which can be either glued or soldered in place: Note that the strips slot into small notches at the rear of the webs (see also Fig 25). Finally, add the railguard details (45 x2 and 46 x2) above the railguards, as shown.

Pick-ups
At this stage, it's a good idea to decide which type of pick-up arrangement you're going to use. Plunger pick-ups (Alan Gibson, ref. 4M62) are one option, and these will need to be fitted before wheels go on. For this method, open out the holes 'M' so the plastic, outer sleeve of the pick-up is a tight push-fit, but do not fit the pick-ups.

The second alternative involves running lengths of suitably-shaped, wiper pick-ups - made from phosphor-bronze or 0.33mm hard brass wire - down to the wheel rims from strips of copperclad, concealed under the running plate. For the rear wheels, the strips can be soldered or glued to the extension pieces 'T' which project up from the top of the chassis and are hidden inside the cab. For the middle and rear wheels, the copperclad strips can be attached to L-shaped brackets, situated behind the footplate air tanks. To attach the brackets, file away the notches 'U' (see Fig 15) at the top of the frames, bend up the pick-up mounting brackets (47 x2) and then solder them into the notches, with their vertical face inside the chassis. The pick-ups can be fitted later, during final assembly.

One of our pilot models has 0.33mm brass wire pick-ups, running from short strips of copperclad glued to the inside faces of the frame and acting on the wheel rims below the chassis. The pick-ups need to be very carefully shaped to avoid shorting on the brake hangers and pull rods and we therefor we do not recommended it.
Compensation

If you're building a compensated chassis, you can fit the compensation beam. Cut a length of 1.6mm O.D. tube, so it fits between the frames without being tight. Layer up the two compensation beam halves (48 x2) then fold up and fit the stabilising plate (49) to the end. Ream out the central hole until a length of 1.6mm O.D. tube is a good fit, then open out the central beam pivot hole in the frames 'V' to 0.8mm diameter. Position the compensation beam centrally on the tube, then offer this assembly up between the frames, slotting the rear of the beam through the spacer as you go. Push a length of 0.8mm wire through the holes 'V' in the chassis, and through the tube in the beam. Solder the beam in place on the tube, making sure it is parallel to the frame and central in the slot. Do not fix the wire in place for the time being. The cutaway view in Figure 18 shows the beam in place in the chassis.

Brakegear assembly
This method of assembly creates a set of brakegear that is fully removable, as well as prototypical in appearance. Do not solder anything until the instructions specifically say so. Figures 18 -20 shows how the completed brakegear assembly integrates with the chassis.

Open out the holes in the actuators (50 x2) to suit the wire sizes shown in Figure 15. and do the same for the holes 'W' in the frames. Make sure these holes are a good fit on the wires, as this will effect the position of the brakes.

Now cut a length of 1mm wire to about 20mm long, to represent the crosshaft. Locate the tabs on one of the actuators in the spacer '25' then push the 1mm wire through the frames at location 'W'. Use this to position and support the lever as you solder the lever into the spacer only. Remove the wire and repeat this process for the second actuator, then solder the crosshaft wire centrally in the frames, and into the levers. Check both actuators sit at the same angle by slotting a length of 0.5mm wire through the small holes and adjust if necessary.

Add the brakeshaft details (51 x2 - you have a choice of a casting or an etch) to the outsides, up against the frames, and then trim the ends of the shaft very slightly proud of the details. If you haven't already done so, fix the tiny brake hanger brackets (19x 4, 20 & 21) over the holes 'R' using solder or glue to hold them in place.

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, make the amount of sideplay as small as possible and be sure not to exceed 0.3mm (either side) - excessive sideways movement of the middle driver will be transferred to the rear end of the conn rod, causing it to snag on the fragile mesh behind the rear steps. The plan view in Figure 17 helps to make this clear. If the chassis still won't go around your curves, allow a small amount of sideplay at the front axle.

For a rigid chassis, the ride height and levels shouldn't really need adjusting. If you're building a compensated chassis, sit the loco on a flat, level surface and check the stabilising pad sits flat onto the front axle. If necessary, adjust the angle of the pad by applying heat to the solder joint with your iron. You can make fine adjustments to

the ride height by adding shimming under the pad or by filing a small amount from the rear end of the compensation beam. When the chassis sits level, trim the 0.8mm diametre beam pivot wire (shown in Figure 15) to length, which should be 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.

The brake hangers have small folding tabs at the tops of the front layers (parts 52 x3 & 53 x3) which will space them at the correct distance from the frames. For P4 wheels, which are narrower than OO/EM, the small half-etched areas ('X' in Fig. 15) 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 0.7mm wire, pushed through the middle holes, to locate it onto a brake hanger rear layer (54 x6) then solder them together. Trim the wire flush at the back, leaving it very slightly proud at the front. Repeat this process for all the hangers, so you have three handed pairs, and then check the top and bottom holes are free from solder.

For all models, detail the brake rods (55 x2) with the details (56 x2) to make a handed pair. Invert the chassis, slot a 20mm length of 0.5mm diametre wire thought the actuators and then locate the small holes at the front end of the brake pull rods on the wire, so the rods sit on the outside of the actuators (50). Swing the rods down so they run along the bottom of the frames - for P4 locos, the rods run along the insides of the hornblocks, as illustrated in the cutaway view in Figure18. For EM and OO gauges, they should run just behind the front faces of the hornblocks as shown in Figure 19.

Slot a 25mm length of 0.7mm wire through the bottom hole in one of the brake hanger assemblies, making sure it is at right angles to the hanger, then solder it in place so one end is about 1mm beyond the hanger's outer face. Push the long end of the wire through the pullrods at the rear of the chassis. Slot an opposite hanger on the other end of this wire. Slide it along the wire, so both hangers move up to the chassis sides. Now push a length of 0.5mm wire thought the top hole, and right through the chassis at holes 'R'. Position the hangers so they are parallel, vertical and lying at the same angle, and then carefully solder the loose hanger to the bottom wire, - do not solder anything at the top. Check the pull rods run parallel to the chassis sides and then solder the bottom wire into the brake pull rods. Repeat this process for the other two pairs of hangers then trim all the bottom wires so the ends are about 0.5mm proud of the hanger faces.

Now remove the top wires from the chassis and pull out the wire at the actuators, and the brake gear should be free. With the brakegear removed, slot a continuous length of 0.5mm wire through the top of the rear hangers, so it bridges between the two sides, and solder or glue it in plac. Trim this wire so it sits slightly proud of the outside face of the rear hangers then cut away the middle section to leave the inside so they protrude by about 0.3mm from beyond the innermost edge of the spacer tab. Remove any burrs from the ends of the wires - these short wires will now locate in the rear hanger holes in the chassis but the other hangers will still use continuos wires.

Slide a length of wire into the actuators, solder it in place, then trim out the middle section. File the inner ends almost flush, leaving about 0.7mm protruding at the outsides. When you come to refit the brakegear, slot the long 0.5mm wires (trimmed so they are flush with the sides of the hangers) through the hangers and the chassis, at the front and middle wheels - as you do this, locate the rear hanger pins into their locations and spring the front ends of the pull rods over the pins on the actuators.

When the brakegear is off, remove the wheels and paint the various sub-assemblies, ready for the final assembly sequence.

Gearbox assembly

Before cutting the gearbox etch (57 - in Fig. 22) from the fret, progressively drill out or ream each of the holes to accommodate the shafts, bushes shown in the diagram. 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 in place with the larger-diameter shoulders on the same side of the etch as bend lines. File the non-shouldered face of the bushes flush with the etch, then cut the etch from the fret with a heavy blade and trim off the tabs.

Bend the gearbox to shape, as indicated - a three-sided box with all bend lines on the inside of the gearbox - and then strengthen the inside corners with fillets of solder. Now attach the centralising plate (58) to the gearbox - this will also brace the sides.

Solder the stage one spacer (59) into its location, using a length of gearshaft to position it, and file off the protruding tab flush at the rear, so the motor mounting plate is smooth.

Using a carborundum disc in a mini-drill, cut the 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 they 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. Insulate the terminals with tape. For testing, connect the other ends to the output leads of your controller.

The stage 1 double gear will be one of three types - 15/10T (60:1), 20/10T (80:1) or 27/10T (108:1) - depending on the overall reduction ratio of the gearbox. Fit the stage 1 gearshaft and the double gear (according to ratio) followed by the stage 2 double gear (these are all 20/10T) then turn the geartrain using your finger - the gears should run without resistance. The side faces of the stage 1 and 2 gears should run quite happily against one other, and so a small amount of sideplay is necessary to avoid friction. If you wish, you can 'fine tune' this clearance to a minimum (but make sure there is still some sideplay there) by adding one of the 2mm spacer washers, (60 or 61) of suitable thickness. The washer should be slotted onto the shaft between the stage 2 gear and gearbox side (see Figures 21 & 22).

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 up against the side of the gearbox, away from the side face of the stage 2 gear - this clearance, shown in Figure 22, ***must*** be maintained at all times. With the gears positioned correctly, test the gearbox under power

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 - when you come to fit it you can, 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 6mm from the motor face (i.e. - so the worm lines up with the stage 1 gearshaft when the motor is fitted into the gearbox). 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 test the gearbox under power and then, when all is well, remove the driven axle and brass gear.

Depending on the length of the motor, you may have room for a flywheel. A 24mm long motor, with 10mm of shaft protruding from it's rear face, should just clear the front spacer. Any increase in the length of the motor, will mean trimming an amount equal to this increase from the motor shaft.

Jackshaft and idler

Refer to figures 15, 17, 21 & 22. To fit the jackshaft components, cut a piece of 2mm shaft, so its length is equal to the width over the outside transmission sideplates (22 & 23). Check the loose-fit, 20T idler gear runs freely on the shaft and then spring the sides of the transmission sideplates slightly, which will allow you to fit the shaft – include the idler gear, washers and collar. Don't fix the shaft in place just yet as you may need to adjust the washering arrangement but, for the time being, try one full and one half-etched washer, as shown.

Carefully open out the holes in the flycrank castings (62 x2) until they are a tight fit on a 2mm axle. Cut the jackshaft to length - this should be 23mm for P4, 21.5 for EM and 19.5 for OO gauge - then check the shaft rotates freely in its location and ease the bearings with a reamer if necessary.

Fit one of the flycranks to the axle, flush with the end and secure it in position with 'Loctite' or a suitable adhesive. Push the jackshaft axle through the rear bearings ('P' in Fig. 15) locating the tight 20-tooth gear as go. This gear, which is an interference fit, may profitably be eased slightly with a reamer before fitting, but be very careful not to ream it too slack as it is difficult to secure this gear with adhesive. Use the fixed flycrank to wind the gearshaft through the 20T gear, moving it along the shaft until it meshes and lines up about halfway along the idler shaft gear - if the flycrank slips, grip the shaft with your pliers as you do this. Test for smoothness by turning the gears and then fit the second flycrank, taking up all the sideplay, but also making sure the shaft is still

free to rotate. When all is well, trim off any excess shaft, so both ends are flush with the flycrank faces, but don't fix the loose flycrank just yet.

Temporarily fit the gearbox and final drive gear into the frames - the box should centralise itself because of the plate - and slot an axle through to locate the unit, making sure the final drive gear is correctly meshed with the idler. Check all the gears line up as shown in Figure 17, altering the idler shaft washering arrangements if necessary. Using a tiny amount of glue, secure idler shaft into the transmission sides and then the collar to the shaft, making sure there is no sideplay on the gear. Give the complete geartrain a thorough test under power - when it's running smoothly, remove the gearbox, but leave the idler and jackshaft components in place.

The plastic 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 or brass gears) should be lubricated with a tiny amount of ultra-adhesive oil.

Footplate overlays
The High Level kit includes delicately-etched footplate overlays, for both cutaway and continuos types (see Figures 23 - 25) These will greatly enhance the model but, as they are very fragile, we recommend that any super-detailing of the body structure (handrails, catches, etc) be done prior to fitting the overlays.

Prepare the footplate for the overlays by using a sharp scalpel to pare off the rivet detail from the front of the bonnet, just under the radiator. Try and preserve as much of the wasp-striped paintwork as possible.

Carefully remove the thin footplate overlays (63 - 66) from the etched fret. It's likely they will be slightly curved due to the etching process, so you'll need to use your fingers to straighten them. Before gluing the cutaway overlays (63 & 64: late 04 and 03) in place, it's a good idea to check their position in relation to the steps. Do this by passing a length of 0.5mm wire, down thought the handrail holes in the footplate, and into the steps. Make any necessary adjustments, so the wire is vertical.

For cutaway footplates, hold the overlay in place and bend the small areas 'Y' down over the front corners of the footplate, then remove the etches and tweak the bend with pliers, as required. You'll also need to trim a small amount of the footplate away, at the rearmost side of the front step wells. Use the overlays as a guide to scribe the line, then remove the overlay and trim the footplate. You can cut along your scribed line, so the plastic footplate will be level with the edge of the overlay. Alternatively, you can make the cut about 1.2mm behind the line, so the overlay will protrude beyond the supporting footplate. The latter, more realistic option, leaves only the thin, top surface visible, but the unsupported edge of the overlay will be prone to catching and lifting, so the model will need extra care when handling.

In order to obtain a good bond, it's advisable to 'rough up' the surface of the footplate. A medium grade paper (about 400 grit) is ideal. When they're perfectly flat, carefully glue the footplate overlays in place, with the detail facing up. Use an adhesive which will allow you time to manoeuvre the etches into position, such as a thin layer of quick-setting epoxy. They should be butted squarely and firmly up to the bonnet sides, and pushed backwards towards front faces of the cab. For a cutaway footplate, as you manoeuvre them into place, double-check their position using a handrail wire, as described above.

When the overlays are in position, use a suitably-shaped piece of wood - a lolly stick with a squared-off end is ideal - to press them down, so they sit perfectly flat on the footplate, then allow them to set. Use cramps if you have them, and a packing piece. Invert the model and check that the overhang along the edge of the footplate is constant - the narrow section, which runs along the cab side, tends to wander - and correct as necessary.

If you've made the footplate at the rearmost side of the stairwell cutaway flush with the overlay edge, do the same for the front side by gluing a strip of styrene sheet in place.

For all variants, glue the valances (67 x2 or 68 x2) in place, just under the protruding edges of the overlays. Add the rear footplate section (69 x2) just behind the cab and if necessary, very carefully trim the etches flush with the rear edge of the existing footplate. The cutaway footplate will also require short valances (70 x2 - cut to length) to be fitted into the backs of the cutaways, as shown.

Using a very sharp blade, carefully scrape back the edges of the footplate overlays until they blend into the valances - hold the blade at an angle, to avoid removing any of the surface detail from the footplate. If you feel confident, you can use a small carborundum grindstone on low revs for this, but be careful it doesn't dig in.
If you wish you can add the optional radiator rivet strip (71) to the front of the bonnet, at the base of the radiator. Use the indicator etched on the fret to mark the centre of the strip then, after forming it to shape, use tiny

amounts of cyano applied on the end of a pin to secure the strip. Avoid flooding footplate surface detail - if in any doubt about your ability to do this, leave it off.

For 04 variants, drill out the holes for the footplate stanchions, using the drill-starts provided (see Figure 24). The stanchions can be represented using short lengths of 0.4mm wire, protruding by about 1.7mm above the footplate. Alternatively, long handrail knobs (not supplied) can be used.

To fit the rear sandboxes (72 x2) mark a line on the underside of the footplate, 3.5mm back from the cab's front inner face, and then fit the loco body to the chassis. Position the leading edge of the sandbox on the scribed line, with the outer vertical face of the extension pillar butted up against the inside face of the cab side - for twisted-type rear steps you may need to file a small amount from the sandbox to clear the step frame. Glue the sandboxes in place with epoxy and then check their position in relation to the chassis - the small holes 'S' (see Fig. 20) should be just visible in front of the sandboxes.

When the sandboxes are secure, drill out the holes in their bottoms using the drill-starts in the castings, and then, fit lengths of annealed 0.4mm wire (bent to shape) to represent the sandpipes. For P4 models, you may need to position the sandpipes slightly off-centre, in order to clear the brake hangers.Take the front sandboxes that were originally attached to the body, and trim the mounting pegs so they are almost flush (to avoid pushing the overlays up) and then glue the boxes back in place, under the footplate.

Final assembly.
If you're using plunger pick-ups, which sit behind the wheels, then these should be fitted now.

Study Figures 17 & 20, then go on to fit and quarter the wheelsets - the right hand cranks lead by 90 degrees - complete with crankpins. Be sure to include the gearbox and final drive gear on the rear axle. 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 22).

Now add the bushes to the crankpins, followed by the coupling rods. Note that because of the overall thickness of the rods, you may need to use two crankpin bushes for the rear driver - this will depend on the type used. Check for free running before fitting the securing nuts.

Fix the body in place and rotate the wheels as you push the axles from side to side - this is to check that the conn rods do not catch the mesh behind the rear steps. The components should more or less line themselves up but, if they do catch, then it's probably due to excessive axle, either at the crankpins, or on the wheelsets themselves. As an absolute last resort, bend the rods away from the steps.

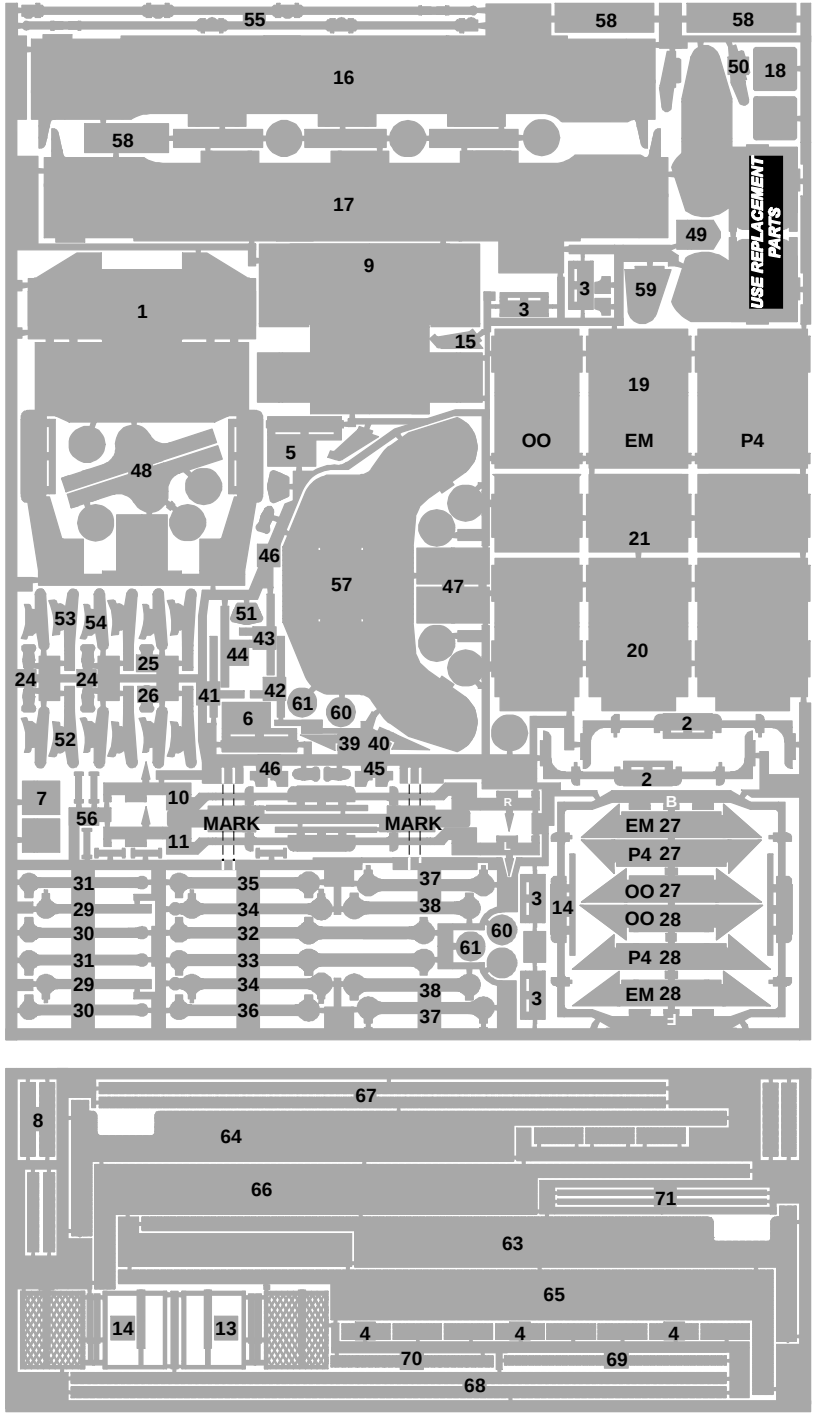
Push the chassis along your track, to check for free running, and then secure the final drive gear to the axle using a small amount of Loctite - make sure none of the adhesive gets onto the stage 2 gear, which runs very close to the final drive axle. The jackshaft will now turn in synchronisation with the wheels, but you'll need to adjust the position of the flycranks, so they match the quartering of the driving wheels. When you've done this, make sure there is no sideplay on the jackshaft ,and then secure the loose flycrank in place with a drop of Loctite.

For wiper pick-ups, attach short lengths of copperclad strip to the pick-up mounting points, using epoxy to secure them, and then solder the pick-up wires to the strips, so they make light contact with the wheel treads. For plungers, wire up feeds from the plungers to the motor

Wire up the Pick-ups, fit the body and then give the model a good run on the track. If there's a tight spot, whatever you do, don't try winding up the controller in an attempt to blast through it - with a powerful can motor and 108;1 reduction, that would be asking for trouble! Better to investigate and, if necessary, dismantle the mechanism, working backwards through the assembly sequence, until you find the cause.

When you're satisfied all is well, remove the body and refit the brakegear, as described previously, and then refit the body, securing it with the M2 fixing bolts. Before doing this, it's a good idea to fit a some packing (perhaps a blob of bath sealant, some foam or Blue-tack) above the foremost end of the motor, which will prevent the unit from lifting when power is applied.

BR CLASS 03/04 0-6-0 SHUNTER



PARTS LIST

1. Front step carrier
2. Front, open-type step frames x2
3. Narrow footstep x4
4. Narrow treads x8
5. Wide footstep - LHS
6. Wide footstep - RHS
7. Wide footstep backing piece x2
8. Wide treads x2
9. Rear step carrier
10. Rear, twisted step frames - RHS
11. Rear, twisted step frames - LHS
12. Rear, straight step frame
13. Jackshaft guard mesh - LHS
14. Jackshaft guard mesh - RHS
15. Step strengthening brace x2
16. Frame - LHS
17. Frame - RHS
18. Jackshaft detail x2
19. Chassis spacer - front
20. Chassis spacer - rear
21. Chassis spacer - midway
22. Modified Transmission side plate - LHS
23. Modified Transmission side plate – RHS
24. Brake hanger bracket - front & middle
25. Brake hanger bracket, rear - LHS
26. Brake hanger bracket, rear – RHS
27. Chassis web/spacer, front - OO/ EM/P4
28. Chassis web/spacer rear - OO/ EM/P4
29. Siderod, front, middle layer x2
30. Siderod, front, Left, outer layer & right, inner layer x2
31. Siderod, front, Left, inner layer & right, outer layer x2
32. Siderod, continuos - LHS
33. Siderod, continuos - RHS
34. Siderod, middle section, central layer x2
35. Siderod, middle section, rear layer - LHS
36. Siderod, middle section, rear layer - RHS
37. Siderod, rear section, central layer x2
38. Siderod, rear section, outer layer x2
39. Small web - LHS
40. Small web - RHS
41. Rivet strip, front- LHS
42. Rivet strip, front - RHS
43. Rivet strip, rear - LHS
44. Rivet strip, rear - RHS
45. Railguard detail - front, left & rear, right
46. Railgaurd detail - front, right & rear, left
47. Pick-up mounting bracket x2
48. Compensation beam halve x 2
49. Stabilising plate
50. Actuator x2
51. Brakeshaft detail x2
52. Brake hanger, front layer - LHS x3
53. Brake hanger, front layer - RHS x3
54. Brake hanger, rear layer x6
55. Brake rod x2
56. Brake rod detail x2
57. Gearbox
58. Gearbox centralising plate, OO/EM/P4
59. Stage one spacer
60. 2mm spacer washer - 0.2mm thick
61. 2mm spacer washer - 0.4mm thick
62. Flycrank x2
63. Footplate overlay, cutaway type - LHS
64. Footplate overlay, cutaway type - RHS
65. Footplate overlay, continuos type - LHS
66. Footplate overlay, continuos type - RHS
67. Valance for cutaway footplate x2
68. Valance for continuos footplate x2
69. Rear footplate section
70. Short valances x2
71. Radiator rivet strip
72. Rear sandboxes

FRONT STEP ASSEMBLIES

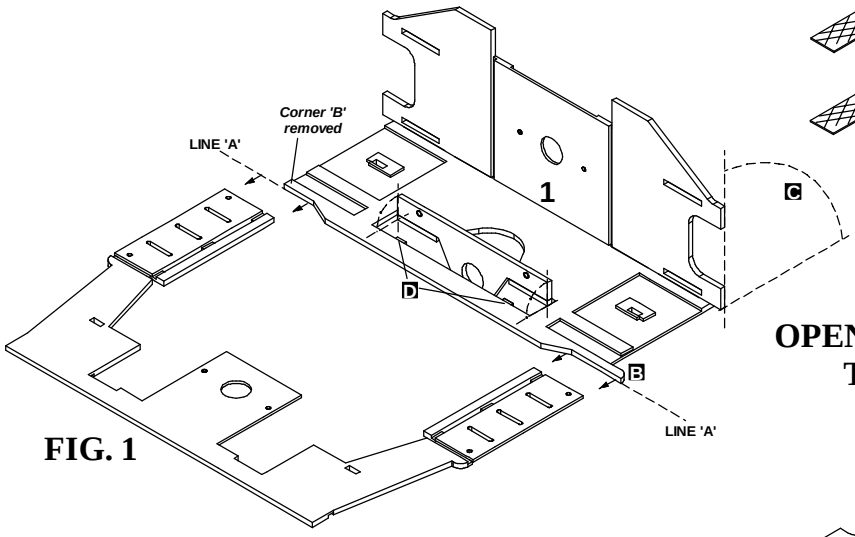
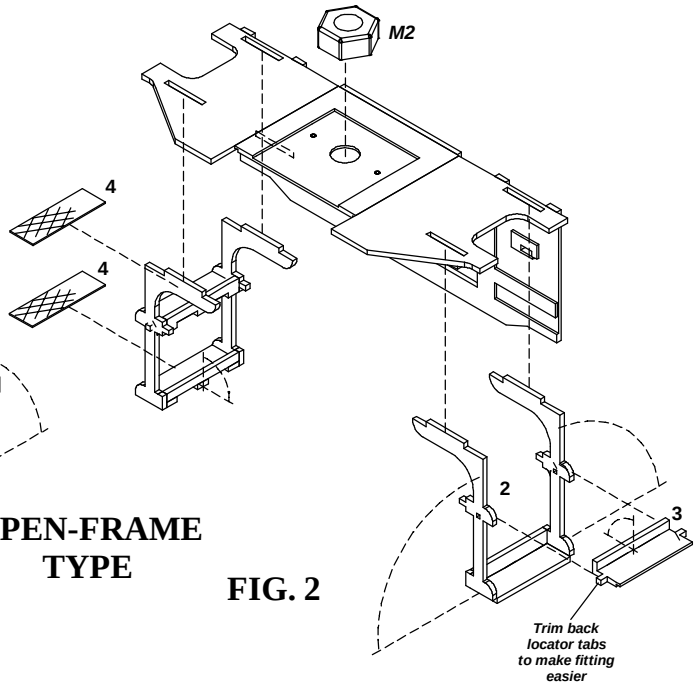


FIG. 1



OPEN-FRAME TYPE

FIG. 2

RECESSED TYPE

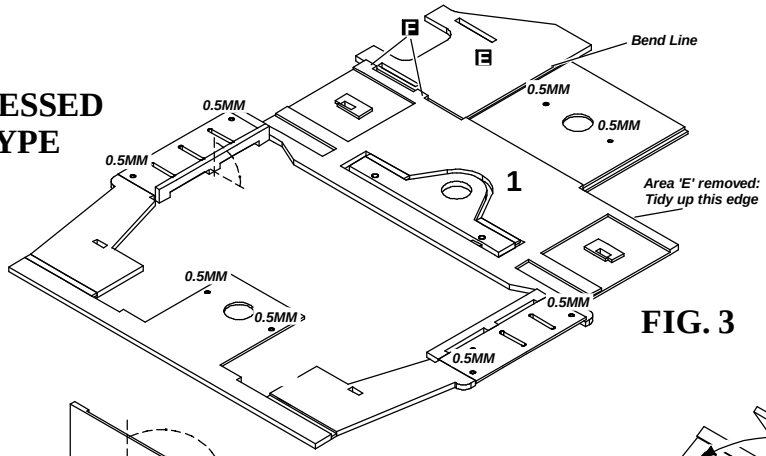
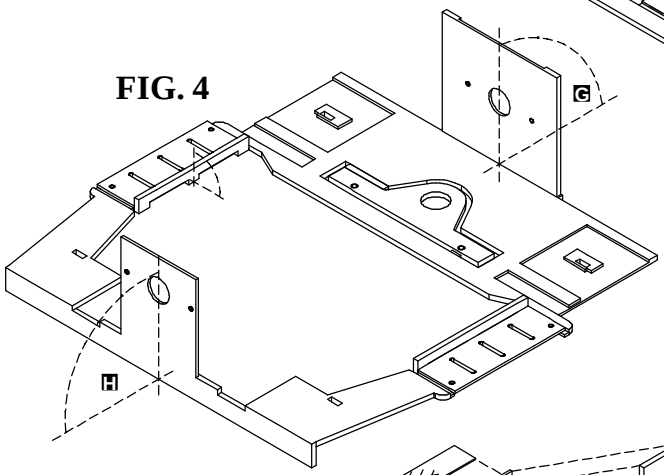


FIG. 3

FIG. 4



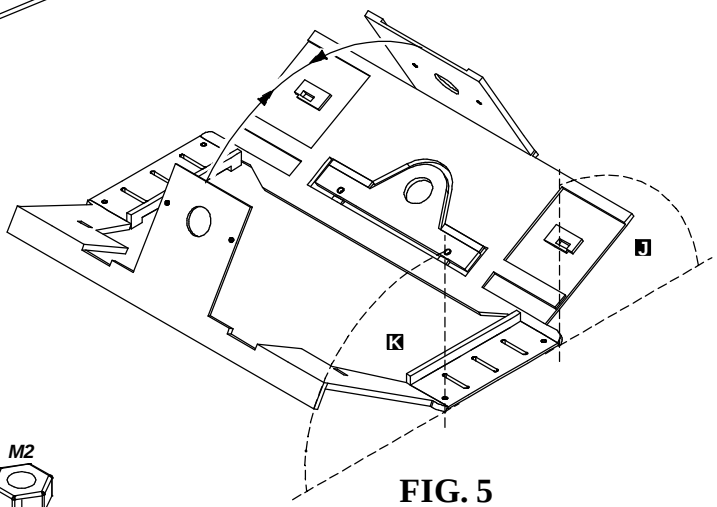


FIG. 5

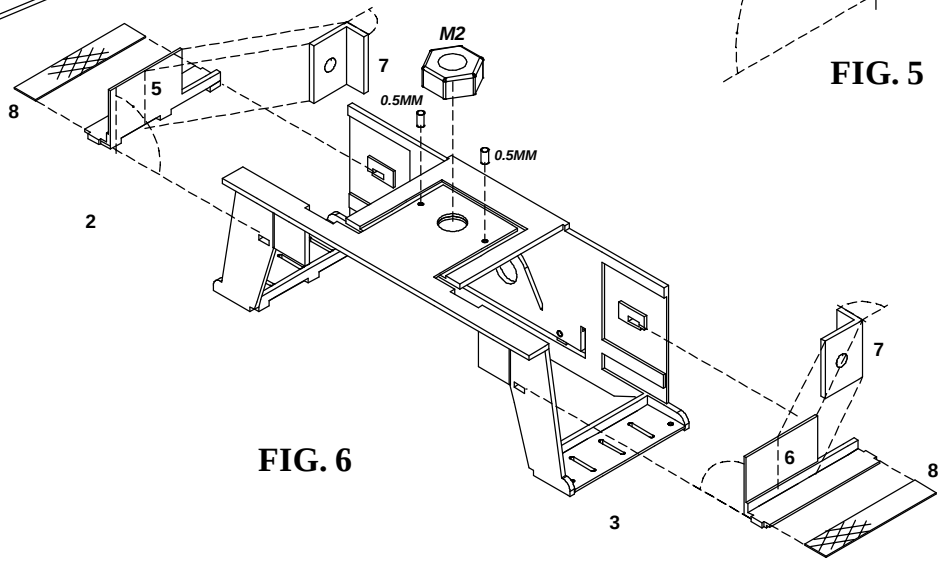


FIG. 6

REAR STEP ASSEMBLIES

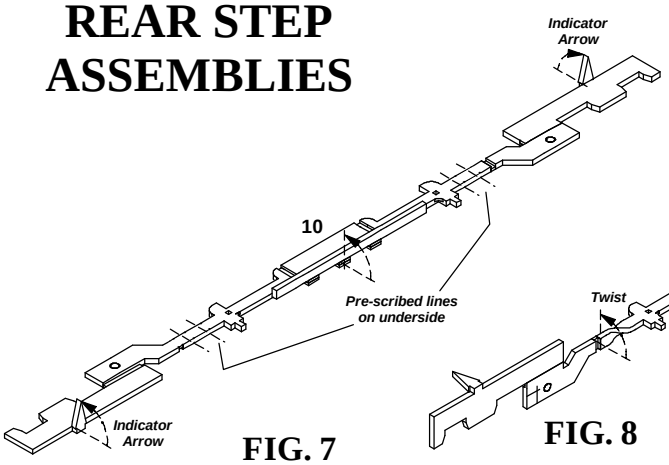


FIG. 7

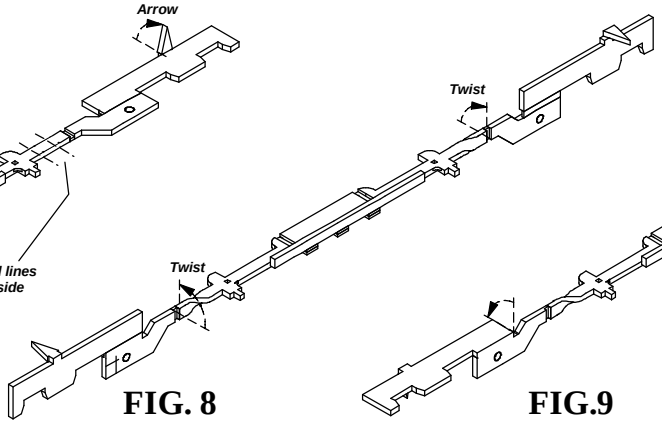
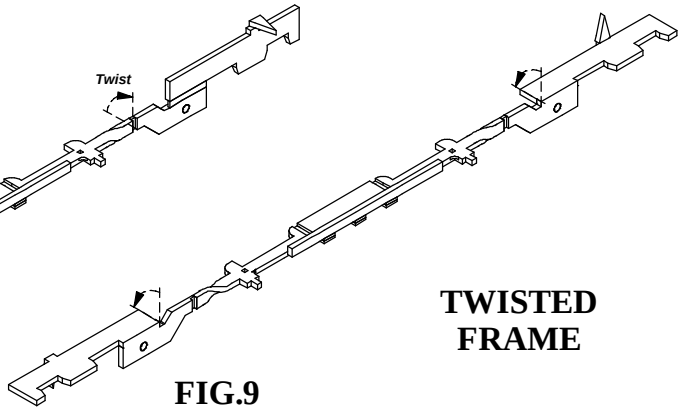


FIG. 8



TWISTED FRAME

FIG.9

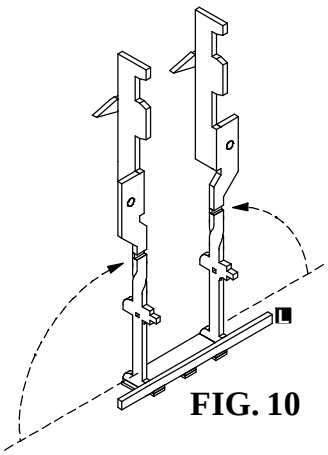


FIG. 10

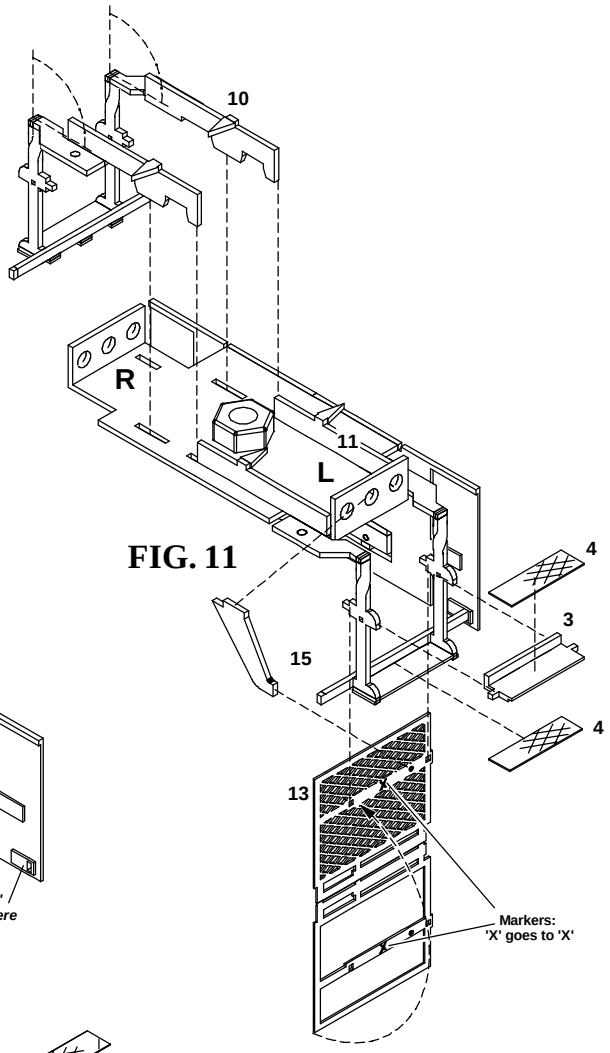


FIG. 11

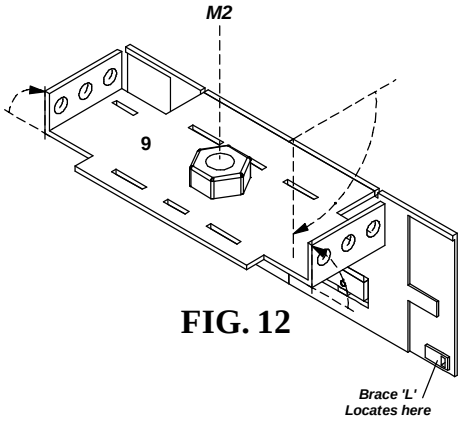


FIG. 12

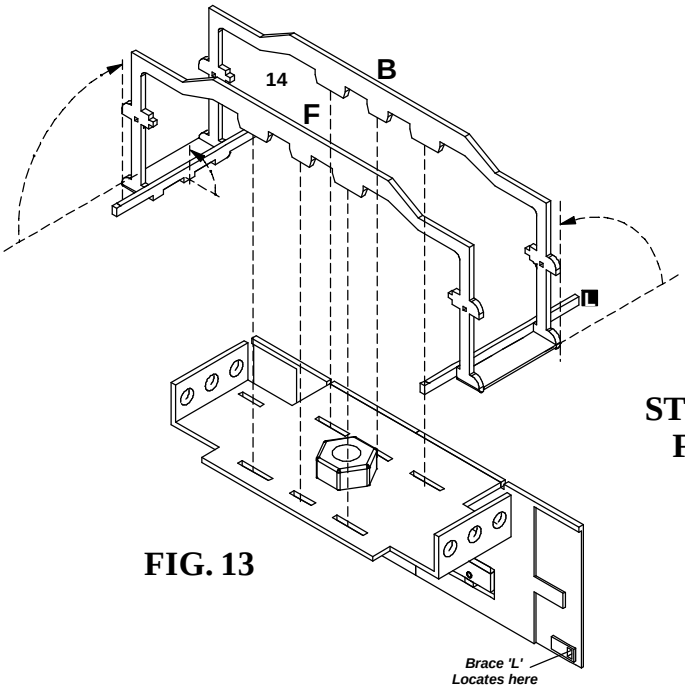


FIG. 13

STRAIGHT FRAME

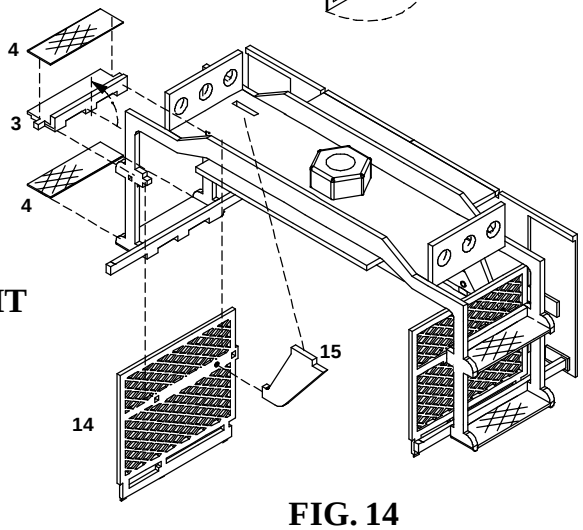


FIG. 14

CHASSIS ASSEMBLY

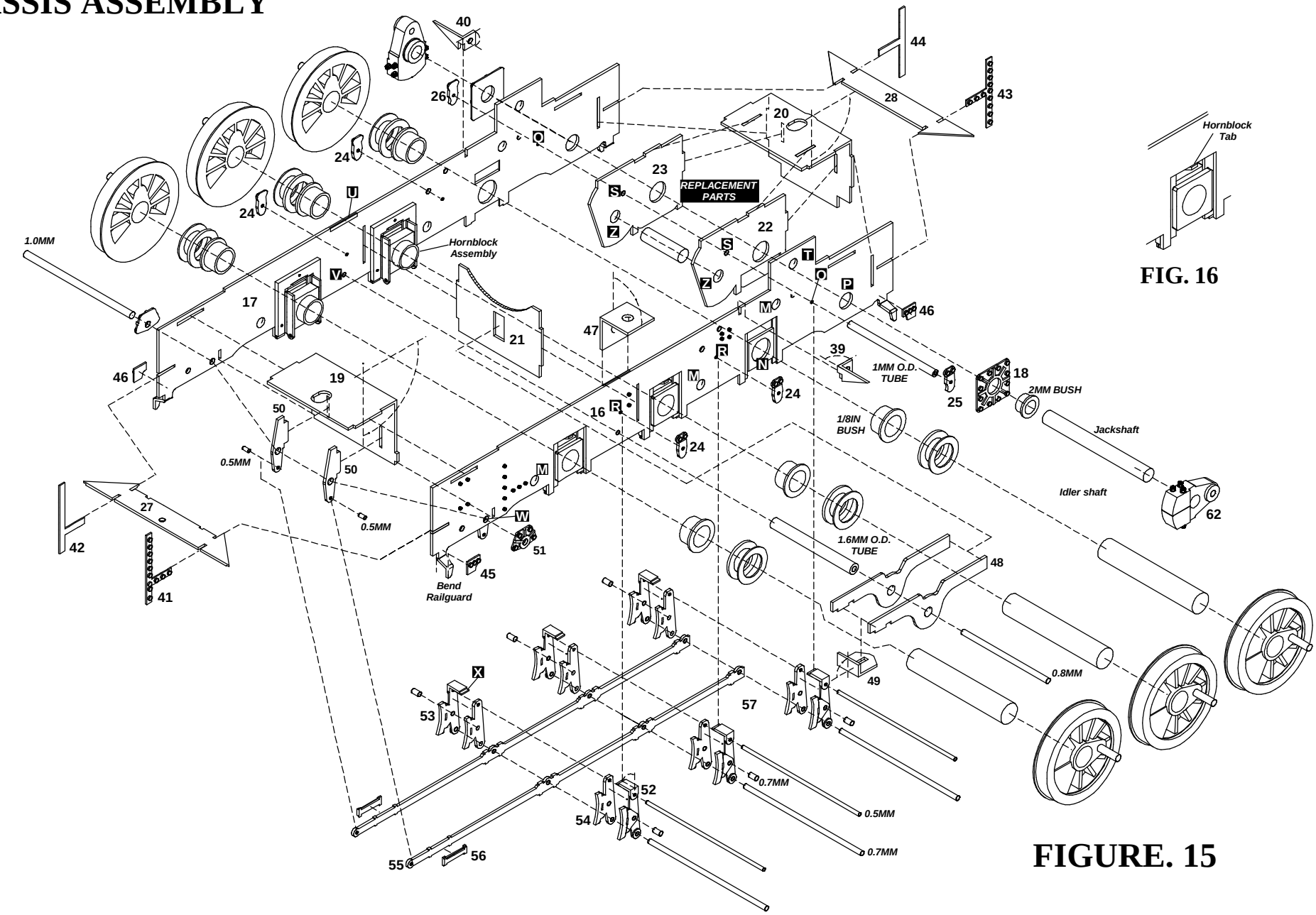


FIG. 16

FIGURE. 15

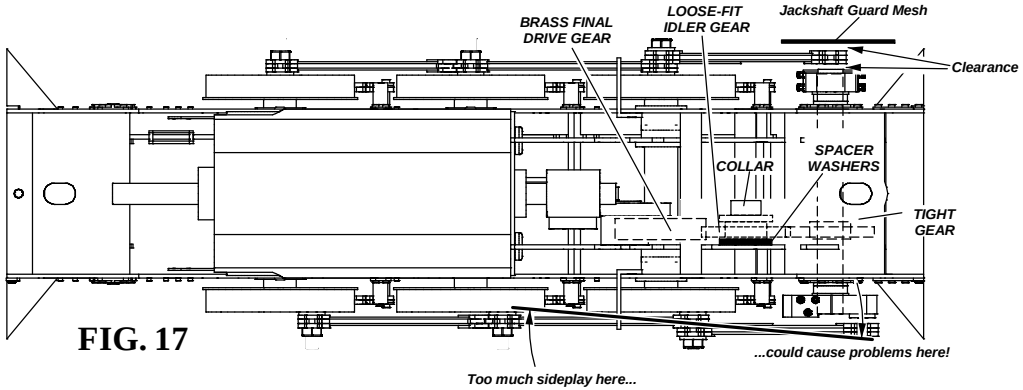


FIG. 17

FIG. 19

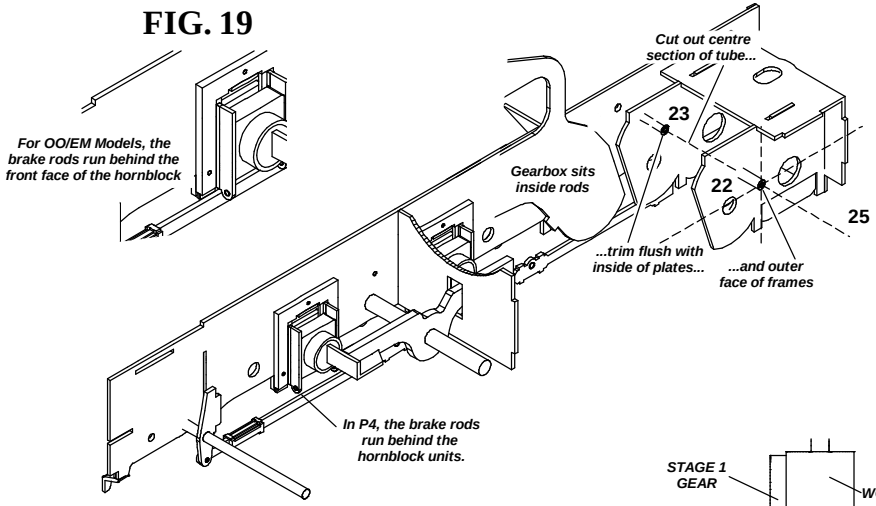


FIG. 18

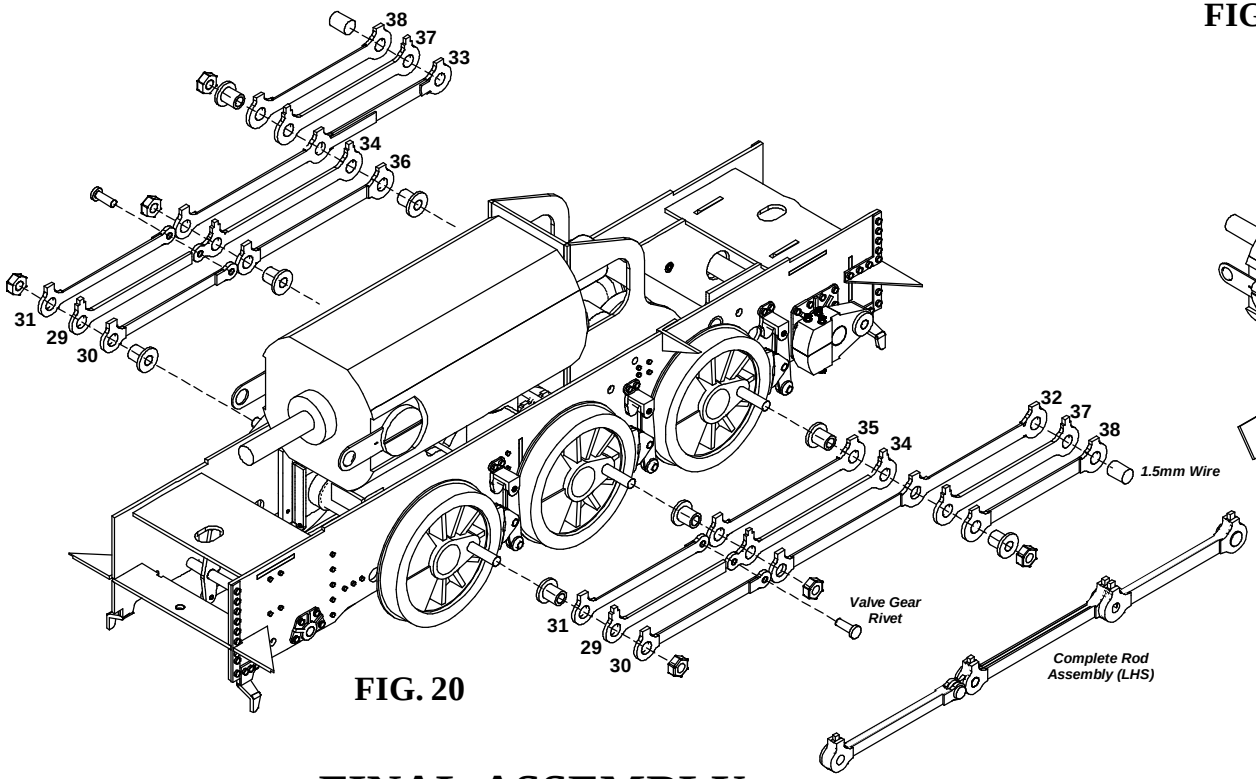


FIG. 20

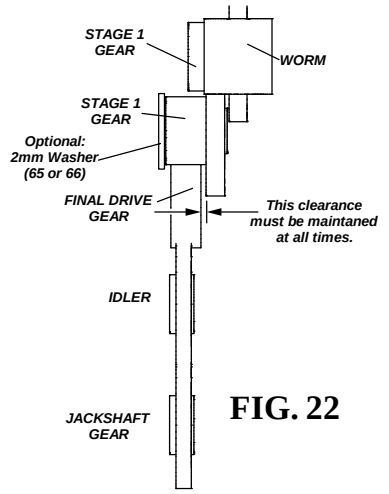


FIG. 22

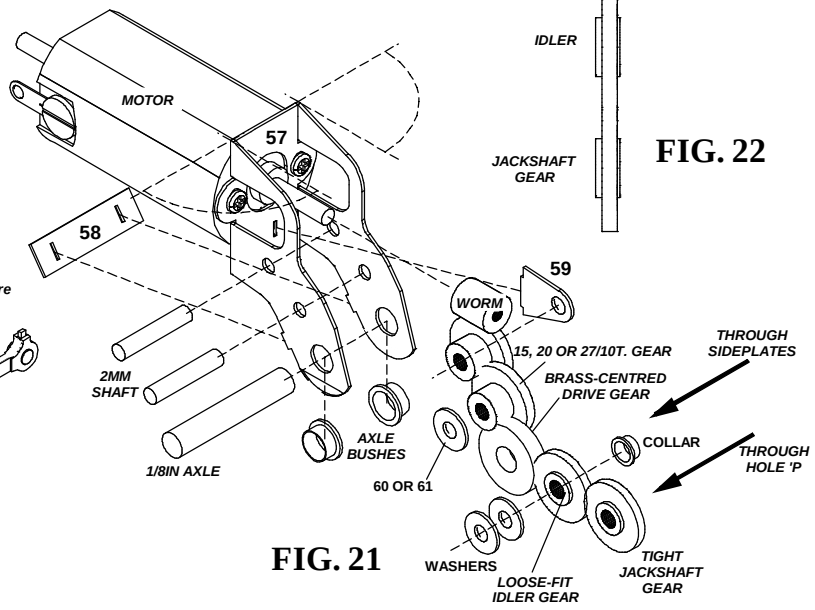
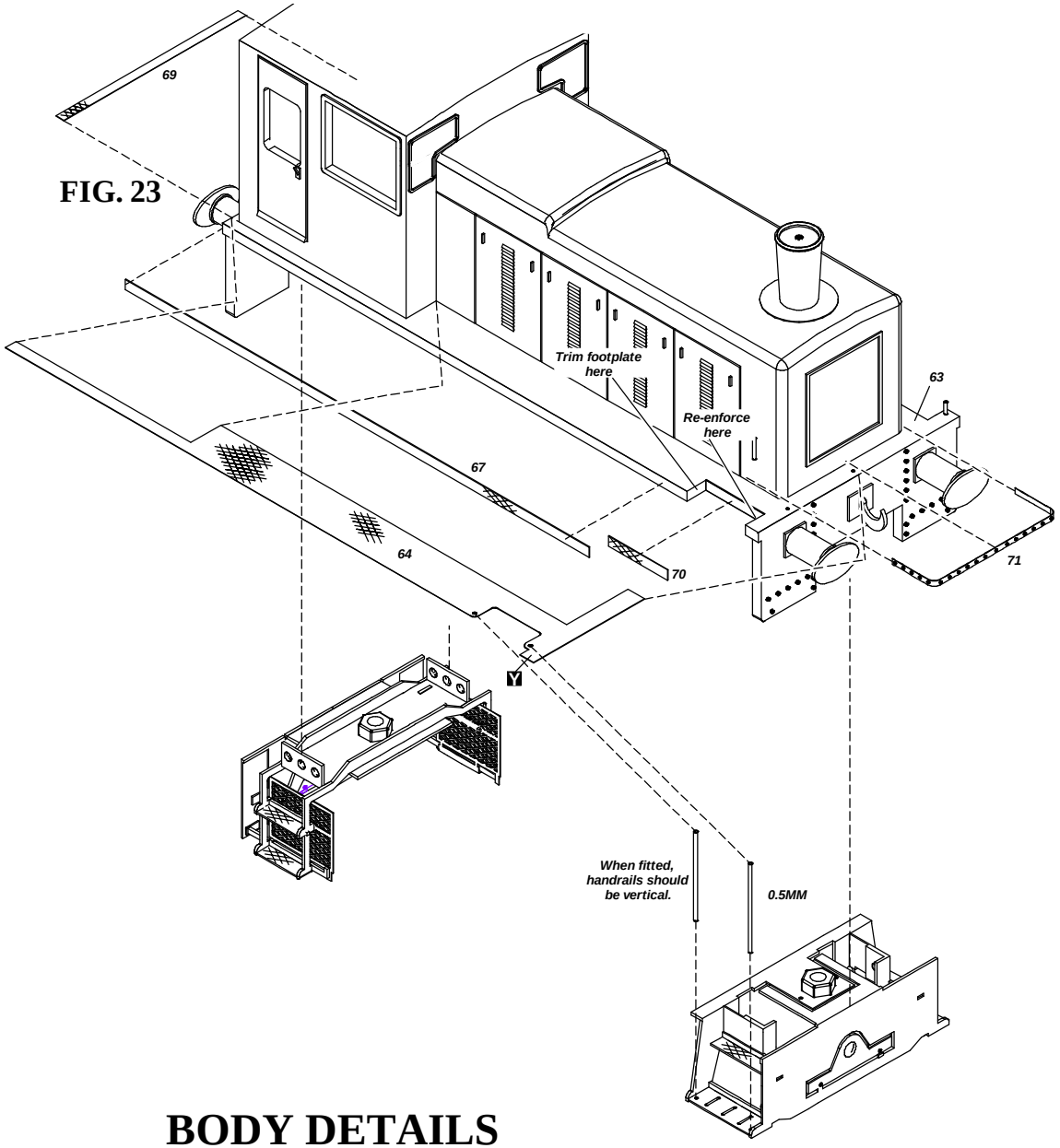


FIG. 21

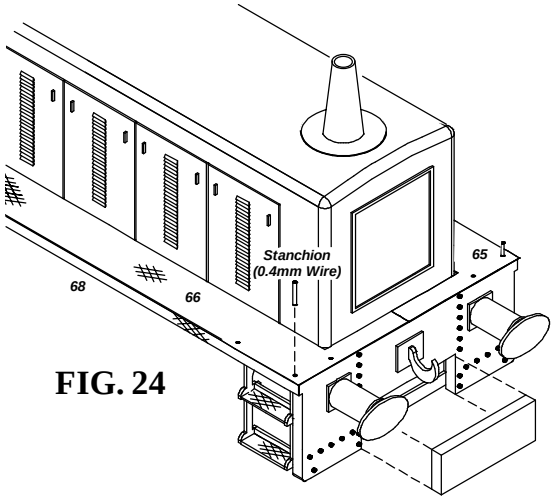
FINAL ASSEMBLY

FIG. 23



BODY DETAILS

FIG. 24



Styrene sheet, cut to size, set onto a layer of Epoxy and pushed back until level

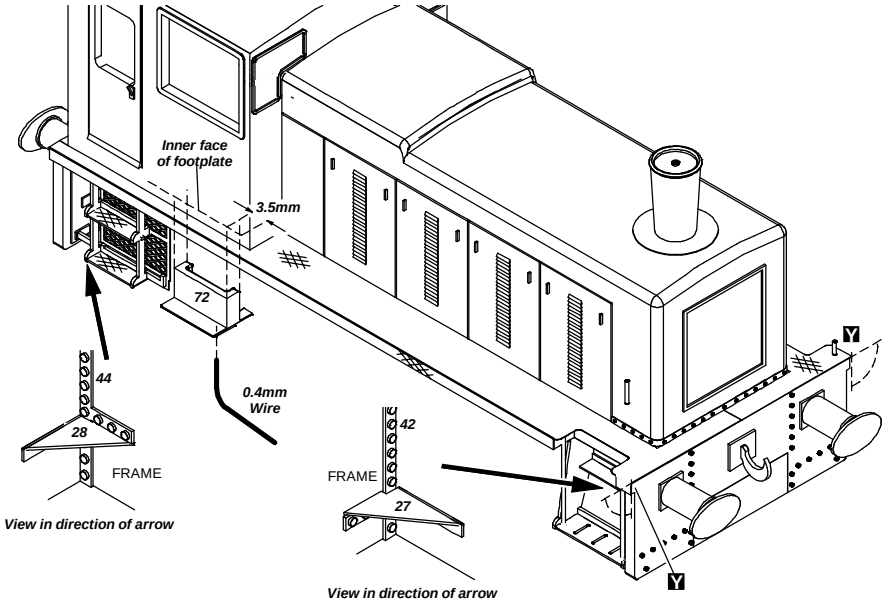


FIG. 25