# HAWTHORN LESLIE
# 14in 0-6-0ST

**In 1817 Robert Hawthorn began building marine engines in Newcastle. By 1831 the company had expanded into locomotive production and in 1885 amalgamated with the Tyneside shipbuilding firm of A. Leslie & Company, based in Hebburn. From this point onwards the business was known as R. & W. Hawthorn Leslie & Co Ltd. In 1937 they merged with Robert Stephenson & Co to create Robert Stephenson & Hawthorns Ltd.**

**Throughout its career, the Hawthorn company was a prolific manufacturer of industrial locomotives, and enjoyed a reputation for reliability and outstanding build quality. A number of standard designs were developed, some of which remained in production for many years without significant alteration. A classic instance was the 14in 0-6-0ST, the first of which was produced in 1905. The last one came out exactly fifty years later, in 1954, and between those dates a total of 26 were produced. There were some minor differences in detail - chimney, smokebox front, position of handrails, pattern of sandbox - and a few had 3ft 4ins wheels instead of the normal 3ft 6in. The last two built were to 3ft 6in gauge, one for the Westfield Freezing Company in New Zealand and the other for Orlando power station in Johannesburg. The standard-gauge engines found a variety of customers - collieries, contractors, steelworks, quarry operations. One went to a WD depot in Hampshire, another was used on construction work at Peterhead prison.**

**One member of the class with a most unusual history was No 3513 of 1927. There have been many cases of steam locomotives being converted to internal combustion but the reverse is considerably rarer. No 3513 began life in 1923 as a standard Hawthorn Leslie 14in chassis driven by an experimental Paragon-Cristiani compressed-steam system. The objective was to match the starting power of steam with the efficiency and ready availability of an i/c locomotive. It was, in effect, a kind of self-contained fireless locomotive capable of generating its own steam. A small oil-fired boiler was used to produce the initial supply of steam and then a pair of 160hp marine-type petrol engines came into operation, powering a V-type, six-cylinder compressor. Steam, now at a much higher pressure, passed into a reservoir and was admitted to the cylinders, much as in a conventional locomotive. The engine had a full-length, carriage-like superstructure with driving positions at either end; there were large, externally mounted radiators above the buffers. This curious hybrid was tested for a while at Hawthorn Leslie's Forth Banks workshops, latterly towing an auxiliary reservoir mounted on a four-wheel tender. It enjoyed modest success but in 1927 was rebuilt as a standard 0-6-0ST named 'Stagshaw'.**

**'Stagshaw' was delivered to the Brancepeth Colliery of Strakers & Love Ltd, a few miles south of Durham. It had a long, if somewhat less eventful life in the Durham coalfield and ended its career in 1972 as spare engine at Shotton Colliery, painted bright yellow with warning stripes. Now preserved in more sober guise at the Tanfield Railway, this is the prototype on which the High Level kit is based. Alternative parts are, however, included to allow a number of variants to be modelled - for instance the post-war RSH version. These parts are identified in the instructions although we advise referring to photographs to check specific detail differences.**

**AddItional parts required**
Mashima 1220 or 1224 motor, with flywheel to choice - the 1220 gives a higher maximum speed, the 1224 is more powerful. With 108:1 gearing, the effect of a flywheel is minimal.
Couplings, pick-ups and hornblocks.

**Wheels** - one of two types, depending on prototype.
Sharman 3ft 6in, 10-spoke wheels - crankpin between spokes (ref. S62).
Alan Gibson 3ft 6in, 10 spoke wheels – crankpin in line with spoke (ref. 4842E)

# 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.

Except where you have a visible outside edge, such as on a cab side, it is advisable not to file off the cusp around the edges of components, especially with dimensionally-critical parts such as formers and spacers. The slight alteration to their dimensions could be enough to affect the way they integrate with other parts.

AII fold lines are etched on the inside of the bends. Check all right angles with a square. When soldering parts in place, tack-solder first in one spot only and then check that everything is as it should be before final soldering along the joint. Moving a part that isn't aligned correctly can be difficult if it has been tack-soldered at more than one point.

The model is built as a sequence of sub-assemblies, which only come together at the very last. They fit together in a very particular way - and come apart again. These sub-assemblies clip-fit or are screwed together to allow the model to be dismantled for painting and during routine maintenance. They should not be fixed permanently.

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

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

The kit uses the same castings as our 4-coupled RSH. which means there will be a few bits left over at the end of construction.

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

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

# ASSEMBLING THE BODY

Remove the axle washers from the footplate (1) and store them. Sit the M2 brass nuts into their circular locations in the top of the footplate and solder them in place, directly over the holes. Bend the firebox sides 'A' up through 90 degrees, as shown in Figure 1.

Use a 0.4mm drill bit to open out the hole in the small tab 'B' which protrudes inwards from the right hand side of the footplate and then bend the tab up through 90 degrees. Strengthen the bend with solder and then solder a short length of wire into the hole. Use a strip of masking tape to protect the footplate and trim the wire so it is flush on the inside and protrudes by about 0.6mm on the outside. Remove any burrs from the wire and then check that the end of the reverser rod (37) will slot easily onto it before removing the masking tape.

Using flat nosed pliers, carefully bend the four narrow door sections 'C' of the cab frame (2) inwards through 45 degrees. Now bend the frame corners through 90 degrees making sure you use pliers to grip the cab side window area to prevent it from buckling. Now manoeuvre the frame into its locations in the footplate – the small locator lugs on the top corners of the firebox sides (A) should 'snap' into place as you do so. Solder the frame in place on the footplate - tack only, making sure the solder does not go along the joint where the bottom edges of the cab sides and front will sit. Work from the front, doing one tab at a time, constantly checking that the sides are running parallel to the footplate edge – although it has numerous location tabs, it's still possible for the cab frame to 'run out', especially at the rear. If necessary, clean the solder out of the area along the bottom edge of the frame using a blade or square file. Bend up the cab floor platforms (3 & 4) fit these in place in the slots in the cab floor and frame, and then grind the tabs flush at the outside of the cab frame.

Remove the firebox wrapper (5) from the fret, but be careful not to accidentally remove the small locator pip 'D' on the front edge of the wrapper. Anneal it until it looks like beaten silver. You can do this on the hotplate of your cooker, over a gas flame or even with a resistance soldering unit (but don't crank it up too far or you will punch a hole clean through the brass). Bend it to shape around a suitable rod so that it clips neatly around the firebox former (6) - the slot 'E' at the rear of the wrapper locates on the tab at top of the former – and then solder in place on the former.

The small locator 'D' at the front edge of the firebox wrapper locates in the central notch in the cab frame. Clip the firebox assembly in place on the footplate so the bottom edges of the wrapper sit just below the level of the footplate. Solder the firebox in place, not forgetting to do the bottom edges (at the footplate joint) and the front edge where the wrapper touches the cab frame. (This wrapper is structural, being a brace for the cab front as well as part of the 'backbone' of the monocoque bodywork).

The cab sides (7 & 8) have braces across the doorways which must be left in place until the cab handrails are fitted.

Fit the cab sides. When soldering these in place, make sure they are pushed right up against the cab frame and that there are no gaps along the bottom edges - i.e. the tabs are fully home. When the sides are soldered in place, clean out the location slots for the bunker front (in the cab frame) making sure they are free of solder.

Now fit the cab front (9). It should sit between the protruding front edges of the sides. When in place, open up the holes for the whistle bracket ('F' – 0.5mm) and whistle pipe hole ('G' – 0.4mm) in the cab front, drilling right through the cab frame as well. Working from inside the cab, use a 1mm bit to drill the injector pipe holes (H) straight out through the cab front. It's important that you do this now – once the back is fitted you won't be able to get the drill in.

Layer up the reverser assembly (10 & 11) using a length of 0.4mm wire to locate the components, and then trim the wire so it protrudes by about 0.7mm at the left and is almost flush at the right. Remove any burrs from the wire end and check that the end of the reverser rod (37) will slot easily onto the wire, but do not fit the rod yet. Fit a bent piece of 0.4mm wire to represent the catch at the top of the rod and then solder the reverser assembly into the footplate.

Refer to figure 7. Make a central 180? bend in the double rod assembly (12), slot the rod up through footplate, solder in place and then bend the top of the front rod through 90 degrees Push the damper lever (13) and draincock lever (14) up through the footplate, into their locations and solder them in place.

Fit the cab rear (15) in place - the slots in the footplate allow some 'fore and aft' movement so the part can be positioned exactly. The cab rear should sit in the recess formed by the back edges of the cab frame. If it won't sit fully home, clean out these areas with a blade.

Detail the bunker front (16 – Figs 1 & 9) using a bent piece of 0.4mm wire to represent the handle on the bunker hatch (17) - this will also locate the hatch in the correct (open) position. Manoeuvre the bunker front assembly into its locations in the cab floor and cab frame and solder in place. Fit the bunker lids (18 x 2) and then grind the protruding tabs flush at the back. Shape the bunker back (19) and fit it between the rear edges of the cab sides. It should also locate into recesses formed by the cab frame (see above).

**Saddle tank assembly**

Study Figs 2-6 before beginning work. Before removing the wrapper (20) from the fret, score two grooves (to represent the tank's plate sections) across the back of the tank wrapper, using the markers on the fret as a guide - make these reasonably deep to allow for dressing up of the completed tank with emery paper. An alternative way to represent the plates is to use a strip of tape for the raised middle section. This can be applied just before painting.

Remove the saddle tank frame (21) from the fret and place it face down on a flat surface, with the bend lines facing upwards. Hold down area 'J' with a piece of wood held up against the bend line and gently bend area 'K' up through 90 degrees. Repeat this process for both inside faces and then bend up the ends 'L'. Check that everything is square. Use your piece of wood to hold the ends in position while you solder the small pips on 'K' to the outer ends of the frame. Trim off flush.

Along the edges of the wrapper are two narrow outer strips (shown shaded on the fret diagram) which are used to position the bends. Without cutting these off, remove the wrapper and strips from the fret in one piece. Do not anneal the wrapper at this stage.

Place the wrapper assembly in a vice as in Fig 5 & 6, clamped up with two packing pieces of hardwood (lolly sticks are fine) to prevent the jaws of the vice marking the metal. Align the outer strips so that the forward edge is barely visible above the top of the jaws and the hardwood packing pieces. After checking everything is level, take another piece of wood and use it to bend the whole lot over at once, exerting equal pressure along the length of the wrapper. Hold the piece of wood you are using to apply pressure approximately 1mm above the packing pieces, opposite the fully etched area. If it is too close to the packing pieces, the radius of the curve will be too sharp. Remove the wrapper from the vice and then, using flat-nosed pliers, gently tweak the bends so that they are just over 90 degrees. Do the same for both bends and then remove the alignment strips.

Now you can anneal the saddle tank wrapper before bending the main radius. After annealing, the large top radius can be formed by placing the wrapper on an open phone book (or a mouse mat) and rolling a bar of about 8mm diameter over it while exerting constant downward pressure. Use smaller diameter bars to get in near the corners - The metal can be re-annealed if work hardening occurs. Try to get the wrapper as near as possible to its final shape before fitting, rather than relying on the frame to pull it into shape. Before fitting it to the frame, run a straight edge along the length of the wrapper to check for bowing. Finger pressure should be enough to correct any kinks.

Clean up the inner edges of the wrapper, where it will be soldered to the frame ends. When you are happy with the shape of the wrapper, spring it on over the top of the frame. It should be a tight fit, but not so tight that you need to use excessive force. Try springing the wrapper out slightly if you have trouble. Make sure the wrapper is the right way round (chimney at the front). If the wrapper is too tight - i.e. the sharp corner bends won't line up with the frame - you can ease the fit by carefully removing a tiny amount of the cusp from around the circumference of the tank frame ends.

For RSH versions, curve the very ends of the wrapper so they blend into the small inside radii (M) next to the smokebox - this gives the illusion of a separate saddle tank sitting on top of the (largely imaginary) boiler.

When the wrapper is in position, check that everything is centred correctly and then solder it to the frame, one end at a time. Work on a flat, smooth surface - the thin metal will be comparatively soft after the annealing process and if you can wait a couple of days for it to harden off, you will be less likely to induce any accidental dents or buckles. Use a piece of wood to hold it as you tack-solder it in place, first in the centre and then at the outer edges. Make sure the flats on the undersides are soldered tight up against the ends of the frame. Do not put any pressure on the centre of the tank as this may cause distortion. For extra strength you can pack lengths of brass (not supplied - the thickness of this will depend on the fit of the wrapper) into the gap between the underside of the wrapper and frame bottom, and then solder this in place.

Carefully file off any excess material along the ends and dress the curves on the saddle tank with emery paper.

Check the prototype you are modelling - some engines had their domes and tank fillers in different positions. If necessary, reposition the tank step location holes. Drill or ream out the holes for the various tank fittings (see fret diagram). Push a length of 1.6mm OD tube as far as it will go into each of the balance pipe holes and solder in place (Fig. 4). Use the filing/drilling guide (22) to trim the protruding sections to length and deburr by finger-twisting a drill bit of around 1/8in diameter in the ends. These tubes will act as locators when the time comes for the balance pipe to be fitted.

Bend up the smokebox (23) and solder it to the saddle tank underside, making sure it is square and absolutely flush with the front of the tank – if it protrudes by even the smallest amount, then you'll have difficulty fitting the smokebox front. Check that the smokebox tabs will locate comfortably in the footplate slots.

Solder in place the injectors (24 x2, pre-drilled 0.5mm) and the tank footsteps (25 x2). Curve the safety valve cover plate (26 – Fig. 1) and solder it in place on the saddle tank.

**Fitting the saddle tank**

Refer back to Figure 1. Although they will not be fitted until later, check that the front sandboxes (57 or 58) sit nice and flat in their holes on the footplate and open up and deburr the latter if necessary - it will be difficult to get at the holes when the tank is in position.

Remove all protrusions from the underside of the footplate and then, placing it on a flat surface, set up the saddle tank/footplate assembly. A good way of keeping the footplate flat while you add structural parts is to build the loco on a flat piece of wood. It can be held in place using long M2 bolts through the body mounting holes.

Push a 14BA-countersunk bolt through the hole in the cab frame (N) and through the hole in the rear of the saddle tank and tighten the nut up to the inner face. Make sure the smokebox is sitting fully down on the footplate (you can use an elastic band for this). The tank should sit level, although minor adjustments can be made by enlarging the bolt hole in the tank slightly to allow some movement at the back.

When you are satisfied that it is sitting square and level with the footplate, tack the saddle tank in position. Make a final check that everything is as it should be and solder the tank to the cab front, being careful not to de-solder the tank wrapper. Remove the 14BA nut and grind the bolt flush inside the tank. Now solder the smokebox frame into the footplate.

For a Hawthorn Leslie loco, fit the tank mounting spacer (27) in place, making sure it is exactly central. Noting that the right hand side overlay has a drill start, solder the smokebox side overlays (28 & 29) in place with their front edges flush with the mounting spacer's front face. If the overlays will not sit flat, check for excess solder along the bottom edges.

For an R.S.H, do as above, but omit the spacer (27) and fit the smokebox side overlays flush with the front face of the saddle tank and smokebox frame.

Choose either the Hawthorn Leslie (30) or RSH (31) pattern smokebox front overlay, punch out the row of rivets along the bottom edge and then fit in place.

For an RSH loco, add the front tank mounting brackets (32 x2) - the plate with six rivets goes on the smokebox side. Engines with the Hawthorn Leslie-pattern smokebox did not have these brackets.

**Completing the bodywork**

To represent the cab handrails, slot lengths of 0.4mm wire up through the footplate, solder them to the cross-brace in the cab sides and then into the footplate floor (Fig. 10). Check the wires run vertically, adjust if necessary and then carefully grind away the excess wire so it is flush with the top of the brace. Grind away the middle of the brace itself, finishing off with a fine file to produce a neat vertical edge, which is just proud of the wire.

Refer to figures 7,8 & 9. Remove handbrake stanchion (33) from the sprue, cutting as close to the sprue as possible so the stanchion has sufficient length. Fit the stanchion into the floor and up against the bunker. Drill out the cab door location holes ('P'– Fig.7) to 0.4mm – the doors can be modelled open or closed, depending on which holes are used. Solder the cab doors (34 & 35) into their holes and also at their edges where they touch the cab frame (for extra strength).

Working from the inside the cab, carefully manoeuvre the injector linkages (36 x2) through their slots in the cab front. Start off by holding the rod vertically and pushing the front end through the hole in the cab front. Now swing the back down and push the remainder of the rod through the hole. Finally, locate the front of the rods in their notches on the underside of the saddle tank and solder them into the tank only (see Fig. 11).

Slot the reverser rod (37, also Fig. 1) through the cab front (outside the R.H. injector linkage) and locate it on the pins, which protrude from the reverser assembly, and the small reverser rod ('B' on the footplate). Solder the rod in place.

Drill out the holes in the rear tank mounts (38 & 39 – Fig 1) to 0.7mm diameter and then bend the mounts through 90 degrees. Fit them under the rear corners of the saddle tank, making sure they are positioned so a length of 0.5mm wire will pass through them and into the cab through the holes 'H' in the cab front (see Fig. 11). The outside edges of the mounts should be flush with the cab corners with the top ledge as near to the underside of the saddle tank as possible. Don't worry if it isn't actually touching – the prototype has wooden packing pieces on top of the mounts.

Note that the rivet patterns on the front (40) and rear bufferbeams (41) are different. Punch out the rivets and then tack-solder them in place as shown in Figure 1, using the half-etched ledge on the underside of the footplate for location. The footplate edge should be almost, but not quite, flush with the face of the beam – protruding no more than a hair's breadth. When satisfied that the bufferbeams are square and correctly aligned, run a good fillet of solder along the join. Some of this solder may subsequently need to be ground away to allow clearance for the chassis sideframes.

Offer up the valances (42 x2). The half-etched areas on the valances should line up with the cab side location tabs, which protrude from the underside of the footplate. You may need to trim a small amount of length from the valances so they fit snugly between the bufferbeams – take equal amounts of material from each end of the valance or the half etched areas may not line up with the tabs.

Attach the valances to the footplate, making sure the footplate is flat while you are doing this. Tack -solder at one end first, check for distortion and then do the same at the other end. Now tack-solder at regular intervals along the valance. Check that the footplate is still level, that the valances are straight and that there are no gaps between valances and footplate. When satisfied, work on a short length at a time and run the tacks of solder into one another – heat only short lengths of the valance at any one time to prevent buckling.

Choose either Hawthorn Leslie (43 x4) or RSH pattern (44 x4) buffers – Hawthorn Leslie buffers have a tapered body and RSH buffers have a straight body. Fit the buffers and grind the locators flush with the backs of the bufferbeams. Coupling hooks of your choice can be added at this stage but the links (not supplied) are best left until the model has been painted.

Bend up the rear steps (45 x2) locate them on the half-etched circular marks under the footplate and solder in place. Fit the footsteps (46 x2) and rivet strips (47 X2) to the steps.

Choose either the taller Hawthorn Leslie chimney (48) or the shorter RSH type (49) and solder it in place, along with the detail castings for the tank filler (50) and safety valve (51). Drill the smokebox door (52) and fit the smokebox door handles (53). Leave the front of the handle-mounting pin very slightly proud of the door face. Now fit the smokebox door, making sure you position it centrally on the etched flange. Using epoxy instead of solder allows subtle adjustment.

If you've decided to use tape to represent the raised middle plate section of the saddle tank, then the dome (54) should be glued in place after the tape is applied, just before painting. If you've chosen to use scribed marks to represent the plates, as described above, you can solder or glue the dome in place now.

Drill out the clack valves (55) while they are still on the sprue. To represent feedwater pipes, solder 0.5mm wire to the clacks as shown in Figs 11. Remove the clacks from the sprue, trim the mounting pegs flush and bend the wire to shape. The feedwater pipes touch the top of the footplate and the rear face of each clack should be in line with the inner vertical face of the saddle tank frame. This allows clearance for the boiler to be fitted into the body at a later stage - the clacks only appear to be touching. Now solder the feedwater pipes into the front of the injectors and also at the point where they touch the footplate.

Carefully drill out the two holes in the steam turret (56) to the sizes shown in figure 7 and then solder it in place on top of the firebox. Take a length of annealed 0.5mm wire and, working from inside the cab, slot this through the cab front (hole 'H'), through the hole in the rear tank mount (38 and 39) and then solder the end into the back of the injector.

Back inside the cab, bend the wire so it runs up the cab front and then cut it to length, so it butts against the back of the side extension on the steam turret, as shown. The pipe can also be soldered to the cab front and/or firebox for extra strength. Repeat the whole operation for the other side.

Using the drill starts on the underside of the footplate, drill out the holes for the injector overflow pipes. Finally, run the pipes through the footplate, solder into the footplate and the injectors and then trim the ends so about 1mm protrudes below the valances.

Drill out the handrail holes in the saddle tank and then fit eight short handrail knobs along the sides, plus four more at the tank filler (Fig. 10). There is also a central knob on the front of the tank. If you use one continuous length of wire to represent the handrails, then this knob must be slotted onto the wire and fitted at the same time as the handrail. Alternatively, you can fit the knob first, and then add the handrail as two separate sections, which can be joined inside the handrail knob.

Use the drill start provided to make a 0.4mm hole in the footplate at the right hand side of the smokebox. Bend a short length of wire to shape to represent the smokebox pipe and solder the wire in place (see Figure 10).

Fit the front sandboxes - choose either Hawthorn Leslie type (57 x2), as shown in Figure 1, or RSH pattern (58 x2) with the angled rectangular fillers.

Use 0.4mm wire to locate the lamp irons (59) on the smokebox and bunker back. Carefully solder them in place and then trim the wires almost flush to represent fixing bolts. Drill the two small holes in the top of the safety valve out to 0.4mm, locate the etched safety valve lever (60) in the holes and solder or glue in place.

Carefully cut the whistle (61) from its sprue and solder it in place on the whistle mounting bracket (62). Trim the excess peg from the bottom of the whistle and push the bracket assembly through the top hole in the cab

front ‘F’ until the whistle butts up against the cab face. Solder the bracket in place and trim off the surplus bracket inside the cab.

Pre-drill the gauges (63), fit them in place inside the cab and then add lengths of fuse wire, as shown in Figures 7 & 8. The pipe from the left-hand-side gauge loops around the top of the gauge and then continues straight down the centre of the cab front, where it can be anchored by pushing it through a small hole drilled in the top of the firebox. The right-hand gauge pipe runs directly from the gauge, down the cab front and into the firebox, alongside the other gauge pipe. To complete the cab pipework, run a short length of fuse wire from the pre-drilled hole in the top of the steam turret through hole ‘G’ and solder it to the bottom of the whistle. Attach the whistle lever (64) to the steam turret.

Bend up the cab seats (65 x2) and glue them in place, 2mm below the bottom of the cab side openings, just ahead of the doorways.

Open up the holes in the backhead casting (66) to accommodate the various detail fittings illustrated in Figure 7. Make the firebox door handles and regulator pivot from 0.4mm wire. Fit the backhead shelf (67) and bend and fit regulator (68). Fit the gauge glasses (69 x2) and the wheel valves (70 x2) to the backhead.

Glue the backhead onto the firebox and then fit the maker’s plates (71 x2) in position on the cab sides (Figure 10). Both these jobs can be done now, or after painting.

Form the cab roof (72 – Fig. 1) shape the roof hatch (73) to match the roof curve and then fix the hatch in place – it can be either open or closed (or anywhere in between). When painted, use epoxy adhesive to attach the roof assembly, making sure the overhangs are equal. Glue the lubricator (74) to the smokebox.

# ASSEMBLING THE CHASSIS

The chassis can be built either rigid or with rocking-beam compensation on the leading and middle axles. This is easy to effect and will greatly improve the running quality of the model. Study Fig 12 before starting.

A row of practice rivets is included along the top of the fret. Form the line of three rivets in the centre of the sideframes (75 & 76), but ignore the single half-etched mark 'Q' above this. Punch out the rivet detail at the ends of the frames.

Ream out the axle holes in the frames so that the 1/8in top hat bearings are a push fit. For a rigid chassis, solder all the bearings in place. For a compensated chassis, solder only the rear axle bearings in place. Modellers building to 16.5mm gauge should file the rear axle bushes flush with the inside of the frames to allow clearance for the gearbox. Punch out the row of rivets in the detail parts (77 & 78). Line their bottom edges up with the etched lines on the inside of the frames (so the lines are almost covered) and solder in place.

Drill out the brake hanger pivot holes in the frames to accept 1.6mm OD tube. Bend the strengtheners on the front spacer (79) through 90 degrees and then assemble the frames using the appropriate spacers (79 - 82) according to gauge, as in Fig 12.

If you're building a compensated chassis you can fit the compensation beam and set the ride height at the same time. First, drill out the beam pivot hole in the frames 'R' to 0.8mm diameter. Cut a length of 1.6mm O.D. tube, so it fits between the frames without being tight. Position the two halves of the compensation beam (83 x2 – Figure 12)) centrally on the tube and then solder the halves together and to the tube. Hold this beam assembly between the frames and slot a length of 0.8mm wire through the holes 'R'. Do not fix the wire in place for the time being.

Push top hat bearings into the front and middle axle holes, but do not solder them in place. Now fit the front axles – they probably won't go right through until you've trimmed some material from the bottom of the beam ends, where they touch the axle. Try to file these edges into a slight radius and remove roughly the same amount of material from both ends of the beam. When both axles will just go through, the ride height should be set. Remove the pivot wire, beam, axles and bearings from the chassis. Then, following the half-etched marks, carefully saw away the hornblock cut-outs at the front and middle axles and clean up.

Turning now to the brake hangers, solder short lengths of tube firmly into the brake pivot holes and then, using the appropriate brake assembly guide (84) (dimension A equates to the chassis width), file the outer faces of the tubes flush with the guide faces (dimension B). Cut away the excess tube inside the chassis and file flush. Solder the valve tail rods (0.7mm wire) between the spacers (80 & 81) and trim to length. Make sure the front ends of the wires are flush with the spacer or the cylinders won't fit.

Cut a piece of 1mm wire to be a tight fit between the frames. Use a short piece of 1mm wire to layer up the counterweight assembly (85 & 86 x2) and trim the wire slightly proud on either side. Check the dummy inside motion (87 x2) will fit into its location holes in the spacer (81). Drill out the 1mm holes in the dummy inside motion along with the counterweight assembly - take great care or the drill may snatch and twist the etches – and then thread them onto the wire. Solder the motion into the adjacent spacer (81) so the wire sits over the half-etched marker holes 'Q'. The bottom edges of the inside motion should be high enough to clear the compensation beam pivot tube (see above). Now solder the wire to the frames and motion. The counterweight assembly must be free to rotate at this stage.

Fit the webs (88 x4, 89 x4) to the chassis. Crank the railguards (90 x2, 91 x2) and form the rivets as shown in Figure 20. Now solder them in position, so the top 1mm of the guard is against the chassis (see Figure 12). Note - some engines had these guards removed.

The clearance between the crosshead and leading crankpin is limited in P4. To prevent them touching, the rods should be cut as shown in Figure 16 (best done before layering the rods) and the top hat bush reversed after having been filed to length. If this is done, the top hats on the other crankpins should also be reversed in P4 so the connecting rods are parallel to the frames. The rods will run close to the wheels so make sure the axle ends are the correct lengths and don't stick out beyond the wheel centres.

Open out the holes in the rods to the sizes shown in Figure 16. Layer up the connecting rods (92 - 95) and coupling rods (96 -103) so you have front and rear rods for both sides (the model's rods are articulated at the middle crankpin). To avoid confusion, they are arranged on the fret in pairs - this enables you to remove and build one rod at a time. To represent the forked pivot of the prototype, solder a short piece of 1mm wire into the leading rod assembly, trim it flush at the back and very slightly proud at the front.

For a compensated chassis, assemble your chosen hornblocks (not supplied) according to the manufacturer's instructions. Use the coupling rods in conjunction with axle jigs to position the hornblocks. You may find it necessary to trim the bottom part of the hornguide and possibly the hornblock itself, so they don't show on either side of the wheels. Refit the compensation beam and pivot wire, trim the wire to length (to 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.

Refer to Figures 13-16. Open up the holes in the cylinder saddle (104). Before bending it to shape, modellers in EM and P4 will need to file away an appropriate amount of the half-etched areas to allow for the different frame width. Now slide it into position in the chassis, check that it sits correctly and then secure it in place with 14BA nuts and bolts. The cylinders will be assembled in-situ on the chassis, but are fully removable at any stage, even when the model is complete.

**Boiler assembly**

The boiler is also removable and simply clips into place on the chassis (Fig 16). Only the bottom half of the boiler is modelled. Having it as part of the chassis rather than built into the bodywork enables you to fit a comparatively large can motor and a high-reduction gearbox into a small locomotive, without any of the mechanism being visible.

Form the rivets on the appropriate firebox/rear boiler mounting (105, 106 or 107) for the gauge to which you are building the loco. Bend the sides of the firebox through 90 degrees. Carefully bend the boiler (108) to shape so that it exactly matches the large outer radius of the front boiler mounting (109) - it is worth spending some time doing this, as the fit of the boiler is vital when the various sub-assemblies come together. The motor and the rear part of the gearbox fit inside the boiler and there is very little clearance at the rear end. Solder the boiler to the mountings. File off the surplus lug at the rear.

Try the assembly in position, with the front mounting locating in the rear slot in the cylinder saddle and the lugs on the rear mounting in their slots on top of the chassis. Now remove the boiler and offer it up to the body. The boiler should fit fairly snugly between the inner edges of the firebox sides ('A' – Fig. 1).

The accuracy of the fit depends on the accurate forming and positioning of a number of components that are already in place. Do not try and force the boiler home. Instead, check that it is not fouling on something that may be slightly awry. A gentle tweak of the boiler (especially along the top edges) will remedy any slight misalignments. There should be no need to file anything to get the boiler to fit.

Once everything fits comfortably, try the boiler on the chassis again and offer the complete assembly up to the body. Do not proceed further until you are satisfied that the various components can readily be fitted and separated.

At this stage, you might like to think ahead to where the pick-ups will located and how they will be wired to the motor. The most straightforward and unobtrusive way of routing the leads is to have them passing inside the boiler and down through the firebox, which will allow the cylinders to be removed if necessary.

Boiler bands, represented by Sellotape, can be added now or later, as you prefer. Stick a few inches down on a sheet of glass and cut strips 0.8mm wide. These can be lifted up on the point of a scalpel and manoeuvred into position as shown in Figure 23. The front band goes right up against the front boiler mount.

**Brakegear assembly**

This method of assembly creates a set of brakegear that is fully removable as well as totally prototypical in appearance. If it seems over-elaborate - some of the parts are very small - you can always simplify the arrangements - Do not solder anything until the instructions specifically say so.

The first step is to drill out all brakegear components (110-119) to accommodate the various wires shown in figure 12. Make absolutely sure these wires will pass through their holes without being forced. Use a piece of 0.5mm wire to locate the handbrake die block halves (110 x2) on the handbrake lever (111). Solder the sides to the rod so they form a right angle and trim the wire slightly proud at either side (also see Figure 19).

To represent the cross-shaft, thread a length of 1mm wire approximately 20mm long through the chassis, the two actuating levers (112 x2), the handbrake lever assembly and the steam brake lever (113) (notch facing upwards). Fit the brakeshaft details (114 x2) over the ends of this wire, outside the frames, and then solder them in place along with the cross-shaft, making sure the levers are well out of the way. Trim the faces of the shaft slightly proud.

Solder a piece of 0.5mm wire into the brake cylinder (115) and trim so it protrudes by about 5mm. Solder the brake cylinder into the rear spacer (82). Line up the steam brake lever with the cylinder, so the wire sits in the notch, and solder the lever to the cross-shaft and wire. The lever sits more or less horizontally.

Push a piece of 0.4mm wire through the hole in the spacer (82) so it is vertical and protrudes about 6mm below it. Position the handbrake lever on the cross-shaft so that the die block assembly sandwiches the 0.4mm wire - again, the lever should be roughly horizontal. Solder the lever to the cross-shaft and the wire into the die block and spacer.

Use 0.5mm wire to locate the brake shoes (116 x6) on their hangers (117 x6) - noting which is the top and which is the bottom of each (see drawing) - and solder up three left and three right-handed hanger assemblies. Trim the wires slightly proud of the brake shoe faces to represent the fixings.

Solder the brake rod details (118 x2) (they represent the hexagonal adjusters) to the brake pull rods (119 x2). The pull rods are quite fragile at this stage although they can be strengthened later by soldering wire along the inside faces.

Push a length of 0.7mm wire through the rear and middle brake hangers and tubes, at their top pivots. Two separate shorter lengths must be used for the front. Position the brake assembly guide (84) on the chassis, just ahead of the front wheels. Sit the brake pull rods in the slots in the guide and push a length of 0.7mm wire through the bottom of the hangers and the front holes in the brake pull rods. Don't solder anything yet.

In 00 gauge the pull rods have to be run on the outside of the actuating levers as shown in Figure 19 – you may need to file a small flat on the bottom of the cross shaft pivot point so the hole in the pull rod lines up with the hole in the actuating lever.

Slot a length of 0.5mm wire through the rear of the pull rods thus attaching them to actuating levers. Move the actuating levers on the cross shaft so they pull the brake gear up near to the wheels, making sure the shoes are not so close that they cause a short. When you are happy with the position of the brake shoes in relation to the wheels, solder the actuating levers to the cross shaft. Solder the piece of 0.5mm wire that runs between the actuating levers, into the levers, but not the brake rods. For EM/P4, trim this almost flush on the outside and 1mm protruding inwards. In 00, trim it flush on the inside and with 1mm protruding outwards (see Figure 19).

Push the front hangers up against the guide so they hang vertically and then, with the guide still in place, solder the front brake hangers to the bottom wire. Solder the wire into the front pull rod holes. Reposition the guide just ahead of the middle and rear wheels and repeat the assembly sequence.

Pulling the wires out of the hanger tubes and springing the rods at the actuating levers will release the brake gear. With the brakegear guide removed, solder short lengths of 0.7mm wire into the pivot holes on the hangers and trim so the wire protrudes slightly at the front faces and by about 0.5mm at the rear.

To refit the brake gear, simply spring the hanger pins into the tubes and the rear of the brake pull rods on to the actuating levers. Finally, rotate the counterweight on the inside motion until it is horizontal and central and then solder in position. Remove the brake gear.

Whilst the wheels are still in place, you may as well fit the sandpipes. Bend up the rear sandboxes (120 &121) - do the sides first, then the top and bottom – and fit them to the chassis. Now fit the rear sandpipes into their holes using annealed 0.5mm wire, bent to shape. For the front sandpipes, run a length of 0.5mm wire down the outer faces of the brake hangers (see Fig 16). Remove the wheels, cleaning up as necessary.

**Cylinders and motion.**

The whole of the cylinder assembly is removable and must not be soldered into the chassis (see Figs 13-16). Before cutting them from the fret, drill out the holes in the discs, which are, located at the ends of the slidebar/motion bracket halves (122 &123) to 1mm. Drill the 0.5mm holes in the slidebars and locate the slidebar outer layers (124 x2) using wire. Solder the layers together, taking care not to run solder into the bend lines at the motion bracket end. When cleaning up do not accidentally file off the small details on the rear layers.

Check that the turned brass gland (125 x2) fits into its location (see Figures 15 & 21), and that it is central between the bars, but do not solder the gland just yet. Remove the stretchers 'S' and clean up the slidebars.

Bend up the slidebars at the motion bracket end and bend back the discs at the other end. The slidebars should be lightly clamped while you are doing this to avoid distortion. Add little fillets of solder to strengthen

the bends. Pin the two halves of the motion bracket together with wire, solder them up and file the wire flush. Using 14BA bolts, fix the cylinder saddle in position on the chassis. With the slidebars at 90 degrees to them, locate the slidebars in the slots in the cylinder rear face. Swing the motion bracket/slidebar assembly down through 90 degrees so the slidebars fit snugly in their slots, and the top of the motion bracket is level with the top of its own slots in the chassis. Don't force anything - if necessary, relieve the slots in the cylinder saddle with a blade. When the whole assembly is set up, there may be a slight gap between the slidebar disc and the front cylinder face. This will not affect the running.

Lightly oil a length of 1mm wire and push it through the various holes in the cylinder/motion assembly. Making sure all the parts are fully home in their respective slots, line the wire up with the centre axle as shown in Fig 15. Check that the motion bracket and the cylinder faces are correctly inclined and that the wire runs centrally between the slidebars. Slide the turned brass gland (125) along the wire and set it in position in the notch in the slidebars. Now solder the slidebars to the cylinder saddle at each point of contact. Solder the disc to the front cylinder face and the gland to the slidebars. Remove the wire.

Anneal, bend and fit the cylinder wrappers (126 x2). - The wrapper is fitted so it is flush at the front and overhangs at the rear. Make sure the half-etched lines are on the inside - the wider ones go to the rear of the cylinders. Form the wrappers to shape as exactly as possible - If you solder the straight sections only to the formers, you will avoid dislodging the slidebars. Now punch out the rivets on the front cylinder covers (127 x2) and tin the faces of the front and rear covers (128 x2). Fit the rear covers over the slidebars and solder them in place. Very carefully drill out the etched gland flanges (129 x2) while they are still in the fret until the 1mm wire is a smooth sliding fit. Use oiled 1mm wire to locate the gland flange centrally on the gland body. The gland flanges lie about 15° from the vertical, the top innermost, as shown in Figure 21. It's probably best to fix them in position with glue to avoid disturbing the alignments.

Working up through the drill sizes, carefully open out the cylinder front faces and slidebar disc until you have a 2.5mm clearance hole. This will allow for any displacement of the piston rod. Although the front cylinder covers can be fitted now, we suggest you do this after the loco has been test run. This will enable you to check the movement of the piston rod, just in case it catches anything inside the cylinder.

Remove the cylinder assembly from the chassis and draw a line on the bottom of the cylinder wrappers, about 1mm inwards of the slidebar centre line. Place the filing/drilling guide (22) on the line and drill two 0.4mm holes in each cylinder. Solder four L-shaped pieces of wire into the outer holes on the draincock linkage (130 & 131) and trim almost flush at the front. Solder the wires into the cylinders. Run a piece of wire into the central hole in the linkage and solder the other end to the edge of the wrapper. Trim neatly to length. The small end tap on the front cover can be represented by a piece of 0.4mm wire bent to shape – make sure the wire doesn't protrude past the inner face of the cylinder cover or it may impede the travel of the piston rod.

**Crossheads and connecting rods**

Remove the crossheads (132 x2) from the sprues and trim them to length, straightening the piston rods as necessary. Lay masking tape over the rear of the slidebars. Lay the crosshead (front face outwards) on the slidebars and file the rear face until it is flush with the tape on the back of the slidebars. This creates clearance for a smooth sliding fit of the crossheads on the slidebars. Repeat with the other crosshead. Remove the tape and clean up if necessary with white spirit or lighter fuel.

Solder a piece of 0.5mm wire into the crosshead to act as the pivot. Trim it almost flush at the front (to represent the nut) and leave about 1mm proud at the rear. Offer up the crossheads to the slidebars. They should slide smoothly but without any slop. Fit the small end of the connecting rod over the pivot on the rear of the crosshead, making sure the rod is correctly oriented and checking that the rod pivots freely - Put a tiny drop of oil on the pivot and on the slidebars and then, using the smallest possible quantity of solder, fit the crosshead backing plates (133 x2) over the protruding pivot. When soldered in position, trim the pivots flush. Check again that everything runs smoothly.

**Fitting the gearbox/boiler and cylinder/slidebar assemblies**

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

At this preliminary stage, you can try out the assembly sequence (Fig 16) using just the folded up gearbox shell and motor (the motor shaft must be trimmed to length - see the gearbox section overleaf) before the gears themselves are fitted. Temporarily screw the mount to the motor, holding it inside the boiler so the gearbox butts up against the rear edge of the boiler. Still holding the motor and boiler together, locate the

lugs on the rear boiler mounting in the slots in the chassis. Make sure the boiler is not twisted in any way. Push an axle through the bearings. If the gearbox shell is square and the chassis bearings are correctly aligned, it should be free to revolve. If it is still tight, then the boiler is probably off centre on its mounting lugs. To fit the cylinders, tilt the gearbox back slightly without forcing and at the same time lift up the front of the boiler sufficiently to slip the cylinder/slidebar assembly into place. The tab on the front boiler mounting locates in the slot in the cylinder saddle rear face. If you get stuck, do not force anything. Remove the assembly and check for any excess solder or for slots that are not fully opened up.

Offer up the chassis to the body, secure using M2 bolts and then when satisfied that all is well dismantle the assembly.

Refer to Figure 12 and fit the rivet strips (134 x4, 135 x4) to the chassis. The motion bracket rivet strips (136 x2) should be tilted back slightly so they match the angle of the motion bracket. If you have not already done so, add the boiler bands. Solder the small firebox stay (137- according to gauge) into it's locations in the frames (the small notches just ahead of the firebox front's locations) The major assemblies - body, chassis, cylinder assembly, brake gear, backhead and boiler - can be painted at this stage, but you may prefer to leave this until the loco has been test run.

**108:1 Gearbox assembly**
Study Figs 17 & 18. Before cutting the gearbox etch (138) from the fret, progressively drill out or ream each of the holes to accommodate the shafts or bushes shown in the diagrams. Components should be offered up until they a tight push-fit in their holes. Once the gearbox is assembled, the shafts are fixed but the gears are free to revolve.

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

The gearbox can now be folded up as indicated in Fig 17. AII bend lines are on the inside of the gearbox. Now solder the ashpan (139) to the rear of the gearbox.

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

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

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

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

Fit the first-stage gearshaft with the 27/10T. gear and the 2mm collar. Use the collar to position the gear under the worm, as shown, and then test under power. To adjust the mesh, loosen the motor fixing screws slightly and move the gearbox relative to the motor until you have a good mesh - neither too tight nor too loose. When satisfied, tighten the motor screws and glue the collar in place. Lightly glue the shaft on one side only - this will make it easier to remove.

Fit the second stage gearshaft into the gearbox along with the 20/10T. gear. Test under power and then glue the shaft in place. Fit the idler shaft along, with the single thin 18T. gear and 2mm collar. The boss on this gear goes up against the gearbox shell. Glue the idler shaft in place and then carefully secure the collar so the gear is right up against the gearbox side but is able to rotate freely.

Temporarily fit a 1/8in axle along with the final brass 20T. (making sure the latter is correctly meshed with the idler gear) and then tighten the grubscrew and test the gearbox under power.

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 Seuthe ultra-adhesive oil.

**Fitting the wheels**

When the gearbox is completed and you are ready for the final assembly sequence (Fig 16), offer up the motor/gearbox/boiler sub-assembly as before but this time with the leads from the motor brush tags passing down through the firebox. As you fit the rear axle, slip on the final drive gear but do not mesh it yet. Fit and quarter the wheels - the right hand cranks lead by 90 degrees. The kit includes axle washers of varying thicknesses, which should be used to eliminate sideplay. Aim for running clearance only at the front and rear axles, and anything up to 1.5mm total sideplay at the centre axle. Fit the bushes to the crankpins, add the coupling rods and check for free running. Fit the securing nuts to the front and rear crankpins and cut these crankpins off flush. Leave the middle crankpins at full length for the time being.

Fit the balance weights (140 x6) to the wheels, directly opposite the crankpins - epoxy is best for this. Make sure they lie flat and don't foul the rods.

Secure the cylinder assembly to the chassis using 14BA nuts and bolts. Attach the connecting rods to the middle crankpins and make sure the chassis runs smoothly without any tight spots. Once satisfied, cut off the surplus crankpins and secure the nuts with a tiny drop of Loctite 601 retainer. Mesh the final drive gear, tighten the grubscrew and test under power once more.

**Pick-ups**

Most modellers have their own preferred method of fitting pick-ups. Suitably shaped wiper pick-ups (phosphor-bronze or 0.33 hard brass wire) can be run to the wheel rims from a strip of gapped copperclad fixed across the chassis, behind the middle wheels. Make sure you allow adequate clearance around the chassis components to prevent shorting. The motor leads can be fed down through the firebox and, after being cut to length (allowing a reasonable amount of slack), they can be soldered to the copperclad strip.

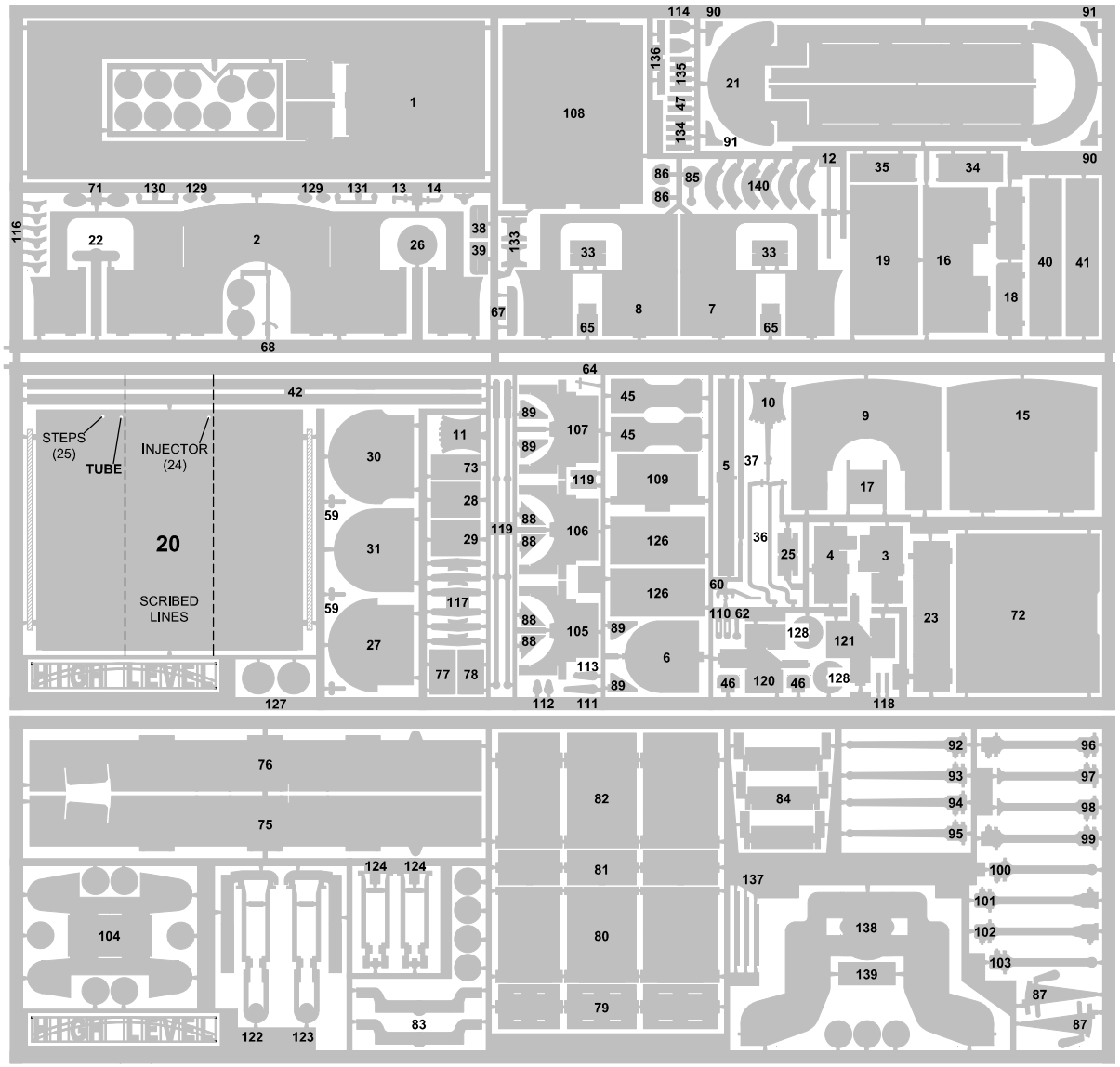
**Final assembly**

Once the body is in place it acts as a retainer for the various sub-assemblies. Before fitting the body, tape a small piece of packing (bubble wrap is ideal) under the motor so it sits more or less level, and then another small piece on top of the motor, You may need to experiment with different thicknesses - the packing should be snug enough to prevent the motor/gearbox from rotating about its own axis, but not so tight that it squeezes the mechanism when the body is bolted down.

Check that the boiler and cylinders are correctly positioned and lower the body on to the chassis. Invert the loco and fit M2 bolts at either end. Fit the brakegear as described earlier and test the loco on the track. Weight can be added for improved adhesion and haulage capacity, especially inside the saddle tank and in the bunker (chopped-up lead sheet looks remarkably like coal).

Finally, fit the saddle tank balance pipe. This can be formed from a single length of 0.5mm wire, but getting it in and out is difficult and is likely to scratch the paintwork. It is more easily represented by two 27mm lengths of 0.5mm wire, pushed as far as they will go into the locating tubes. The opposite end is routed past the inside of the valve tail rods, as in Fig 22 which hold it in tension - it is almost impossible to see that the two ends don't actually meet. The wires can easily be removed before taking the loco apart for maintenance.

# HAWTHORN LESLIE 'CENTENARY' CLASS 0-6-0 ST.




## ETCHED FRETS

## PARTS LIST

1. Footplate
2. Cab frame
3. LHS cab floor platform
4. RHS cab floor platform
5. Firebox wrapper
6. Firebox former
7. LHS cab side
8. RHS cab side
9. Cab front
10. Reverser body
11. Reverser detail
12. Double rod assembly
13. Damper lever
14. Draincock lever
15. Cab rear
16. Bunker front
17. Bunker hatch
18. Bunker lids (x2)
19. Bunker back
20. Saddle tank wrapper
21. Saddle tank frame
22. Filing/drilling guide
23. Smokebox
24. Injectors (x2) (L/W)
25. Footsteps (x2)
26. Safety valve cover plate
27. Hawthorn Leslie tank mounting spacer.
28. LHS smokebox overlay
29. RHS smokebox overlay
30. Hawthorn Leslie smokebox front
31. R.S.H smokebox front
32. R.S.H front tank mounting brackets (x2)
33. Handbrake stanchion (L/W)
34. LHS cab door
35. RHS cab door
36. Injector linkages (x2)
37. Reverser rod
38. LHS rear tank mount
39. RHS rear tank mount
40. Front bufferbeam
41. Rear bufferbeam
42. Valances (x2)
43. Hawthorn Leslie buffers (x4) (W/M)
44. R.S.H buffers (x4) (W/M)
45. Rear steps (x2)
46. Rear footsteps (x2)
47. Rear step rivet strip (x2)
48. Hawthorn Leslie type chimney (Tall) (W/M)
49. RSH type chimney (W/M)
50. Tank filler (W/M)
51. Safety valve (W/M)
52. Smokebox door (W/M)
53. Smokebox door handles (L/W)
54. Dome (W/M)
55. Clack valve (x2) (L/W)
56. Steam turret (L/W)
57. Hawthorn Leslie front sandboxes (x2) (W/M)
58. R.S.H type front sandboxes (x2) (W/M)
59. Lamp irons (x2)
60. Safety valve lever
61. Whistle (L/W)
62. Whistle mounting bracket
63. Gauges (L/W)
64. Whistle lever
65. Cab seats (x2)
66. Backhead (W/M)
67. Backhead shelf
68. Regulator
69. Gauge glasses (L/W)
70. Wheel valves (L/W)
71. Maker's plates (x2)
72. Cab roof
73. Roof hatch
74. Lubricator (L/W)
75. LHS chassis frame
76. RHS chassis frame
77. LHS chassis detail
78. RHS chassis detail
79. Front spacer
80. Second spacer
81. Midway spacer
82. Rear spacer
83. Compensation beam halves (x2)
84. Brake assembly guide –'OO' EM or P4.
85. Counterweight arm
86. Counterweights (x2)
87. Dummy inside motion (x2)
88. Front/rear webs
89. Midway webs
90. Railguards - front left, rear right
91. Railguards – front right, rear left
92. Connecting rod – RHS - outer layer.
93. Connecting rod – RHS - inner layer.
94. Connecting rod – LHS - inner layer.
95. Connecting rod – LHS - outer layer.
96. Coupling rod – RHS trailing - outer layer.
97. Coupling rod – RHS trailing - inner layer.
98. Coupling rod – LHS trailing - inner layer.
99. Coupling rod – LHS trailing - outer layer.
100. Coupling rod – RHS leading - outer layer.
101. Coupling rod – RHS leading - inner layer.
102. Coupling rod – LHS leading - inner layer.
103. Coupling rod – LHS leading - outer layer.
104. Cylinder saddle
105. Firebox/rear boiler mounting - OO
106. Firebox/rear boiler mounting - EM
107. Firebox/rear boiler mounting – P4
108. Boiler
109. Front boiler mounting
110. Handbrake die block halves (x2)
111. Handbrake lever
112. Actuating levers (x2)
113. Steam brake lever
114. Brakeshaft details
115. Brake cylinder (W/M)
116. Brake shoes (X6)
117. Brake hangers
118. Brake rod details (X2)
119. Brake pull rods (x2)
120. LHS rear sandbox
121. RHS rear sandbox
122. Motion bracket/slidebars – LHS
123. Motion bracket/slidebars – RHS
124. Slidebars – outer layers (x2)
125. Turned brass gland (x2)
126. Cylinder wrapper (x2)
127. Front cylinder covers (x2)
128. Rear cylinder covers (x2)
129. Gland flanges (x2)
130. Draincock linkage – LHS
131. Draincock linkage – RHS
132. Crosshead (x2) (W/M)
133. Crosshead backing plate (x2)
134. Rivet strip – chassis ends (x4)
135. Rivet strip – midway webs (x4)
136. Rivet strip – motion bracket (x2)
137. Firebox stay – 'OO' EM or P4
138. Gearbox
139. Ashpan
140. Balance weights (x6)

# BODY ASSEMBLY

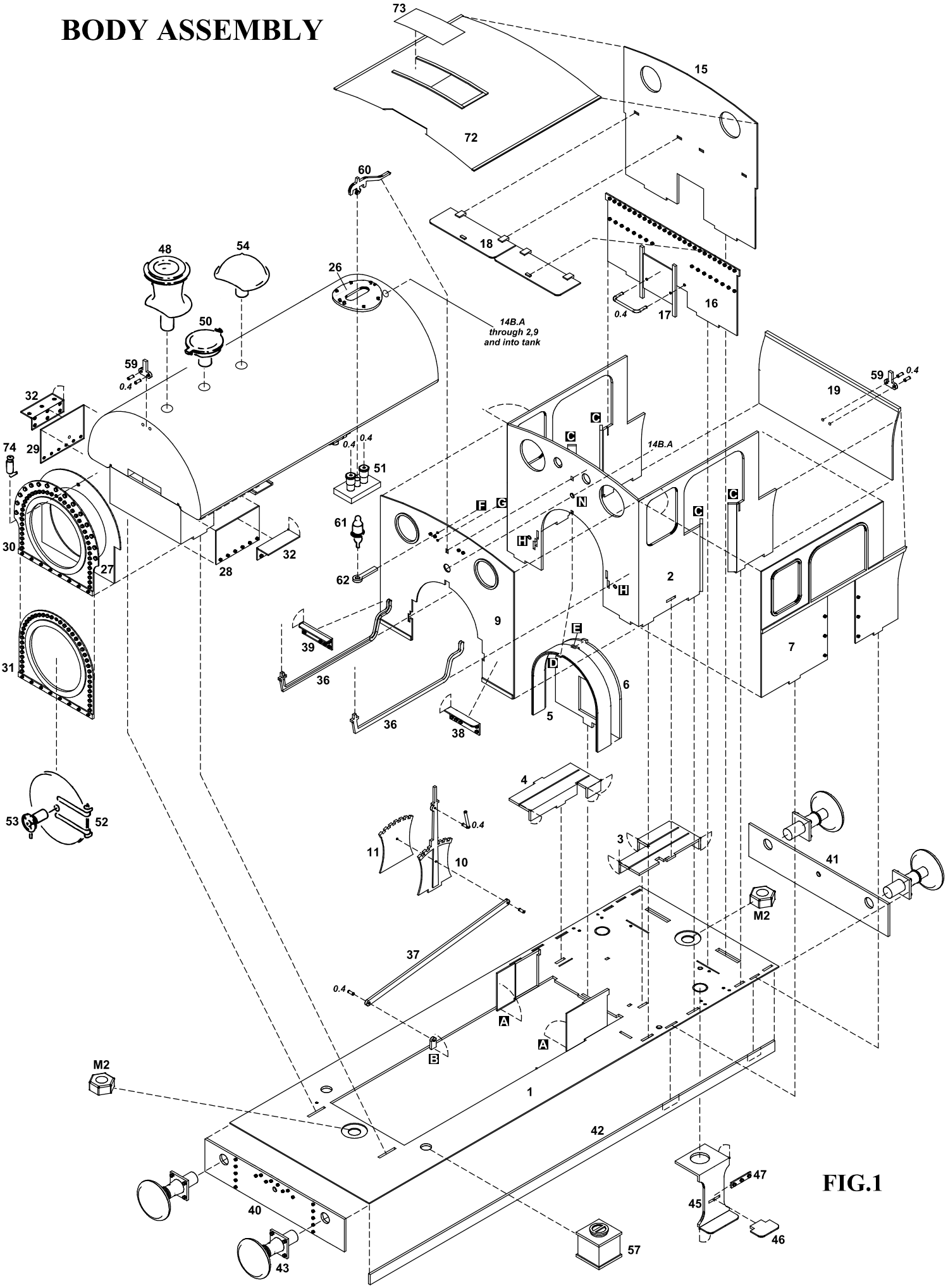



FIG.1

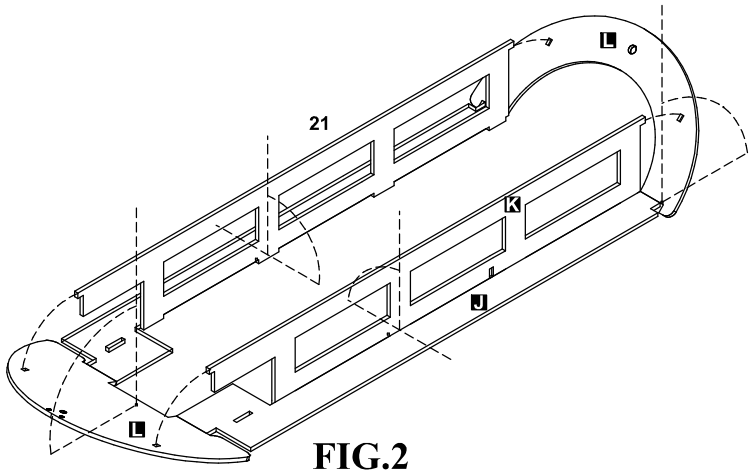



FIG.2

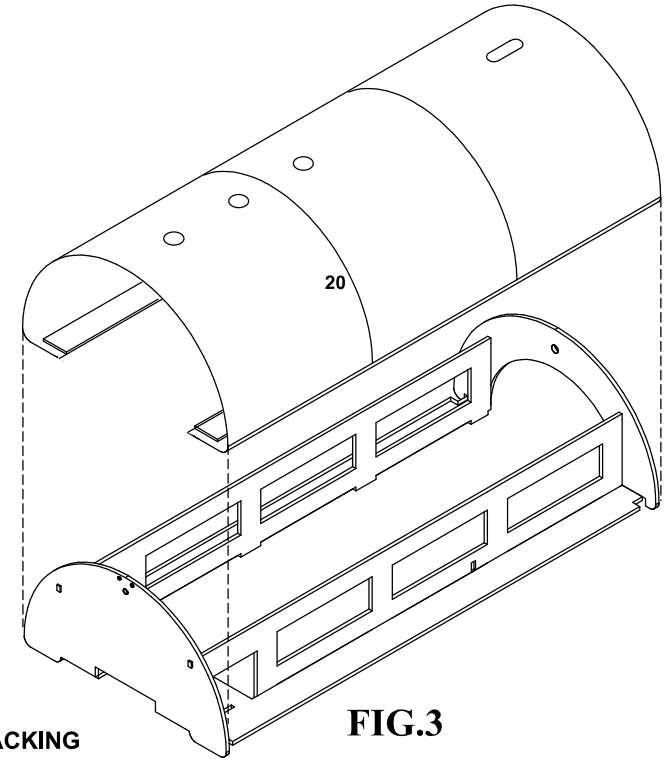



FIG.3

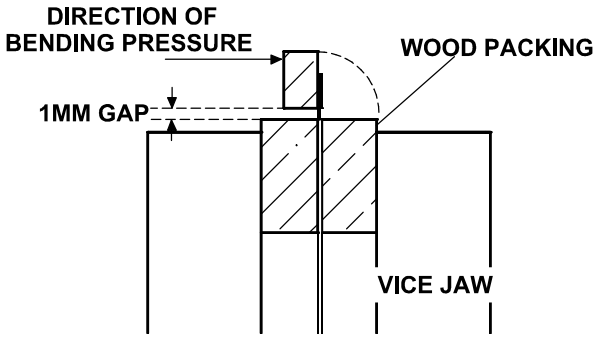



FIG.6

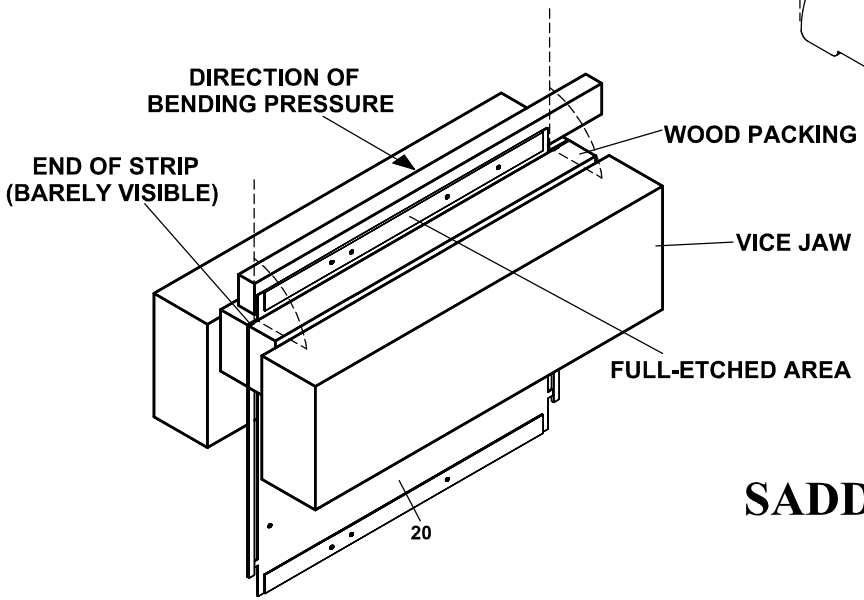



FIG.5

# SADDLE TANK ASSEMBLY

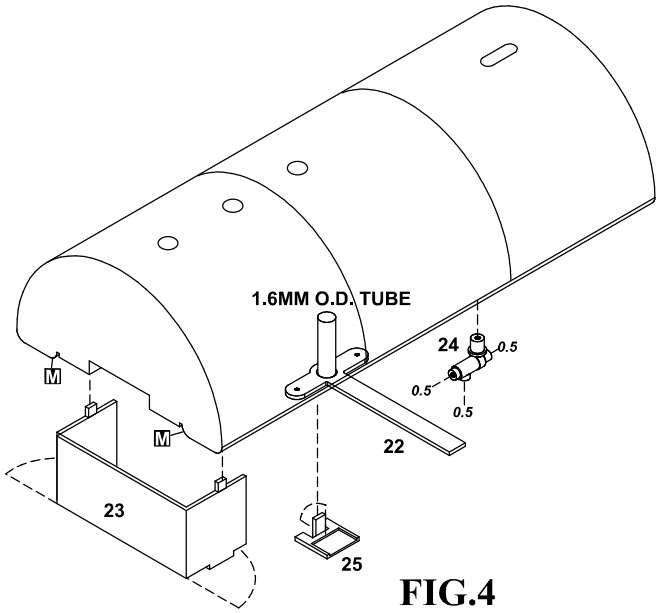



FIG.4

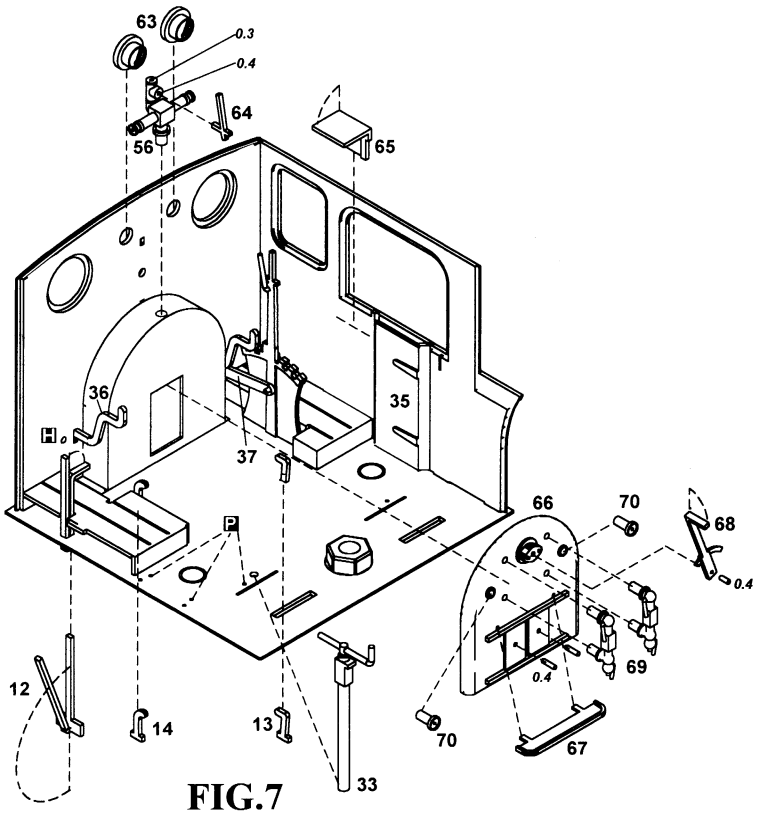



FIG.7

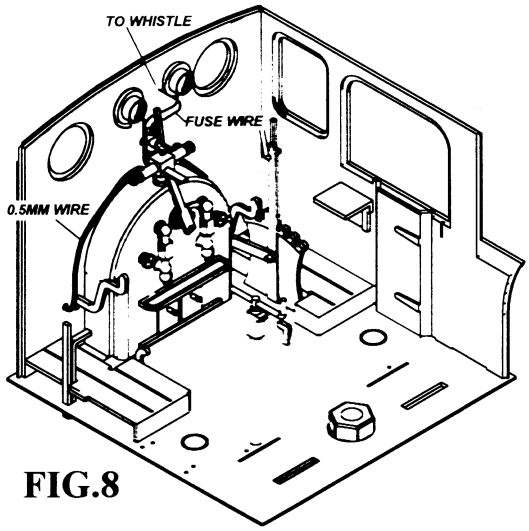



FIG.8

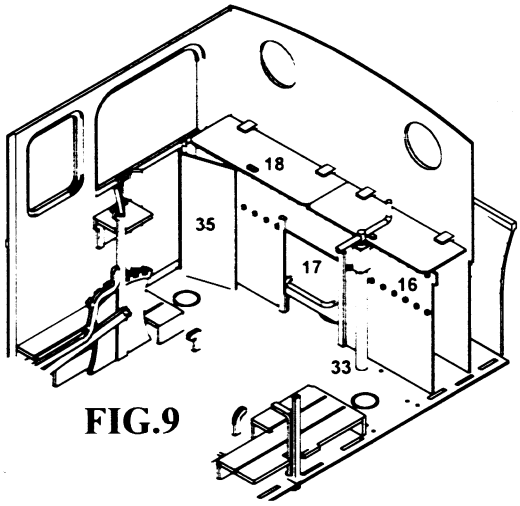



FIG.9

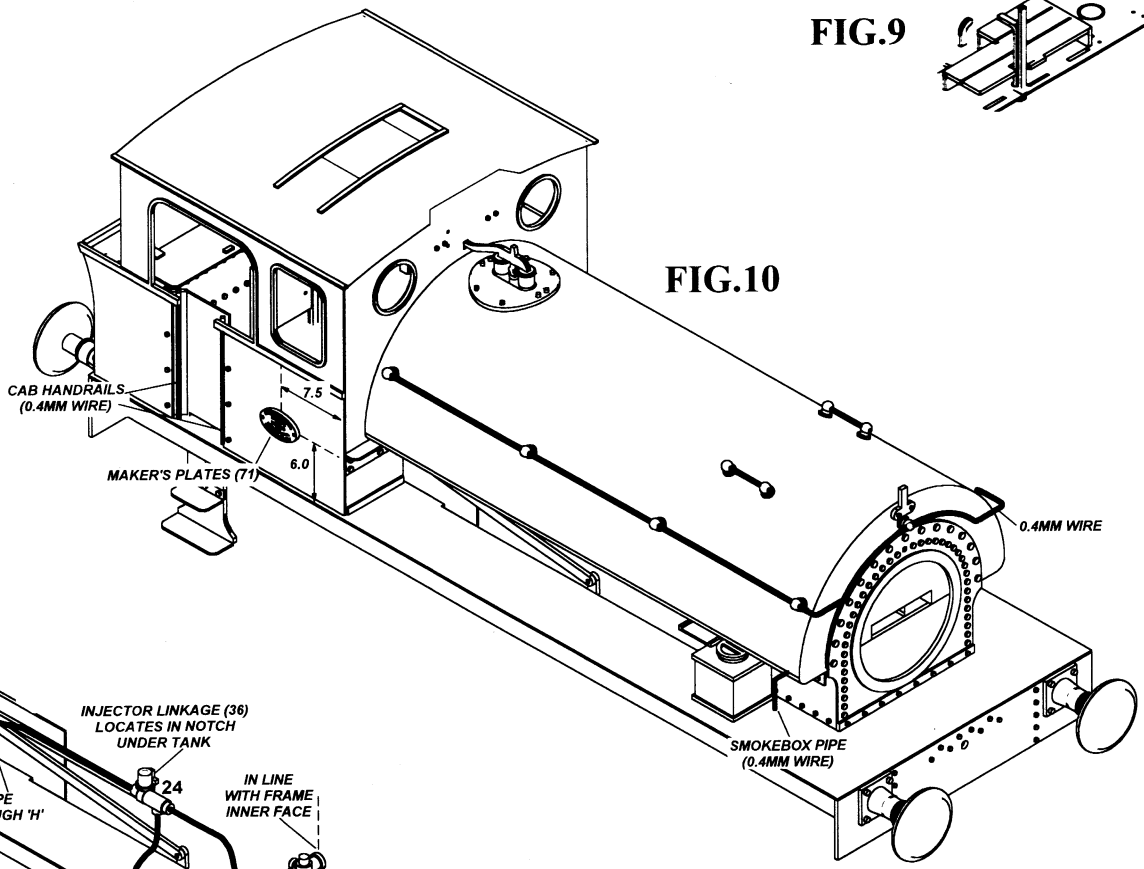



FIG.10

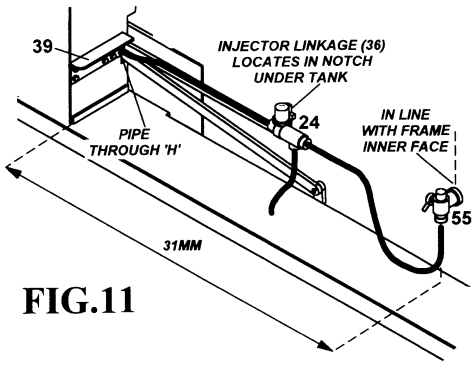



FIG.11

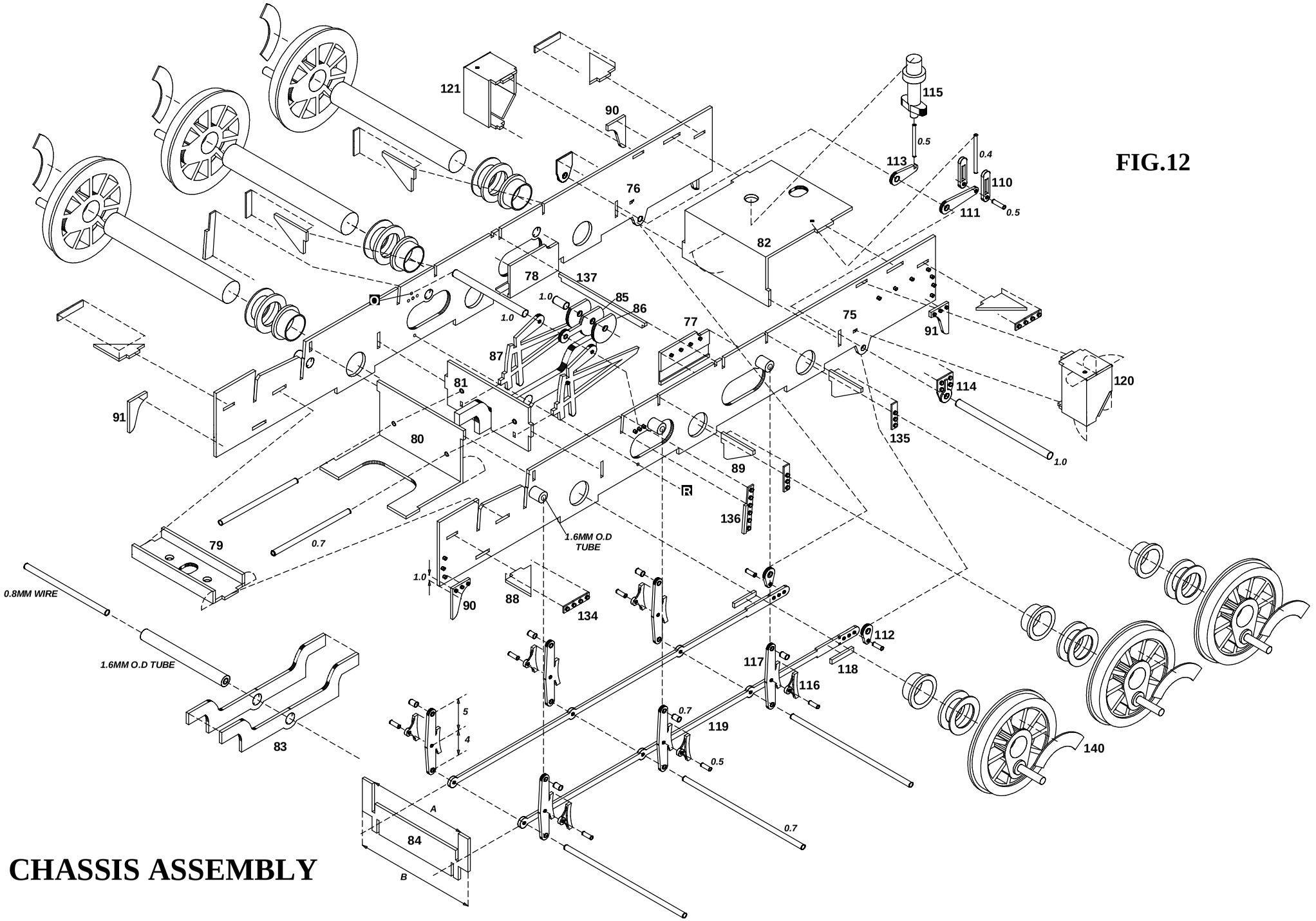



FIG.12

# CHASSIS ASSEMBLY

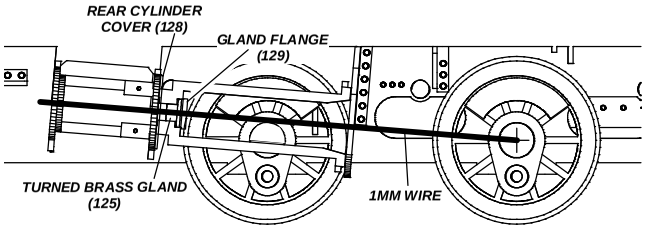



FIG. 15

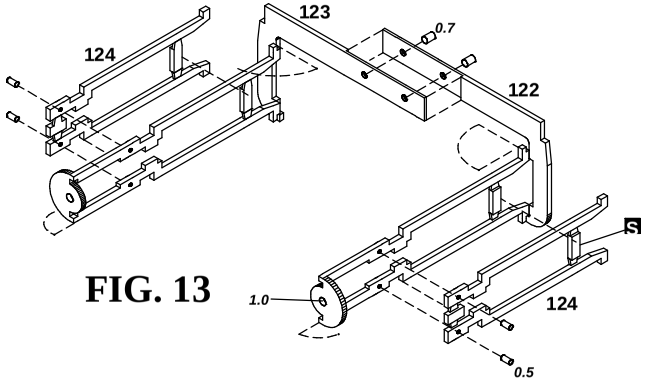



FIG. 13

# CYLINDERS AND MOTION

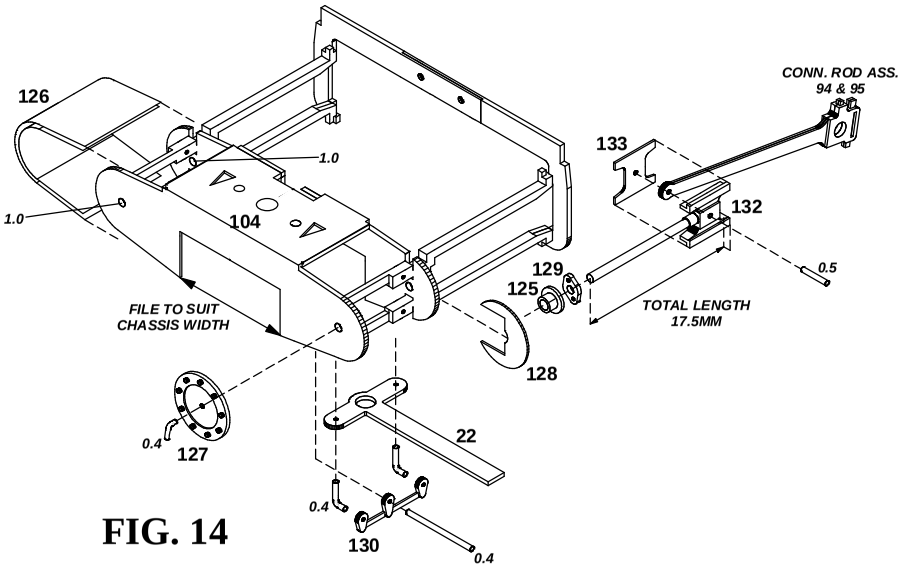



FIG. 14

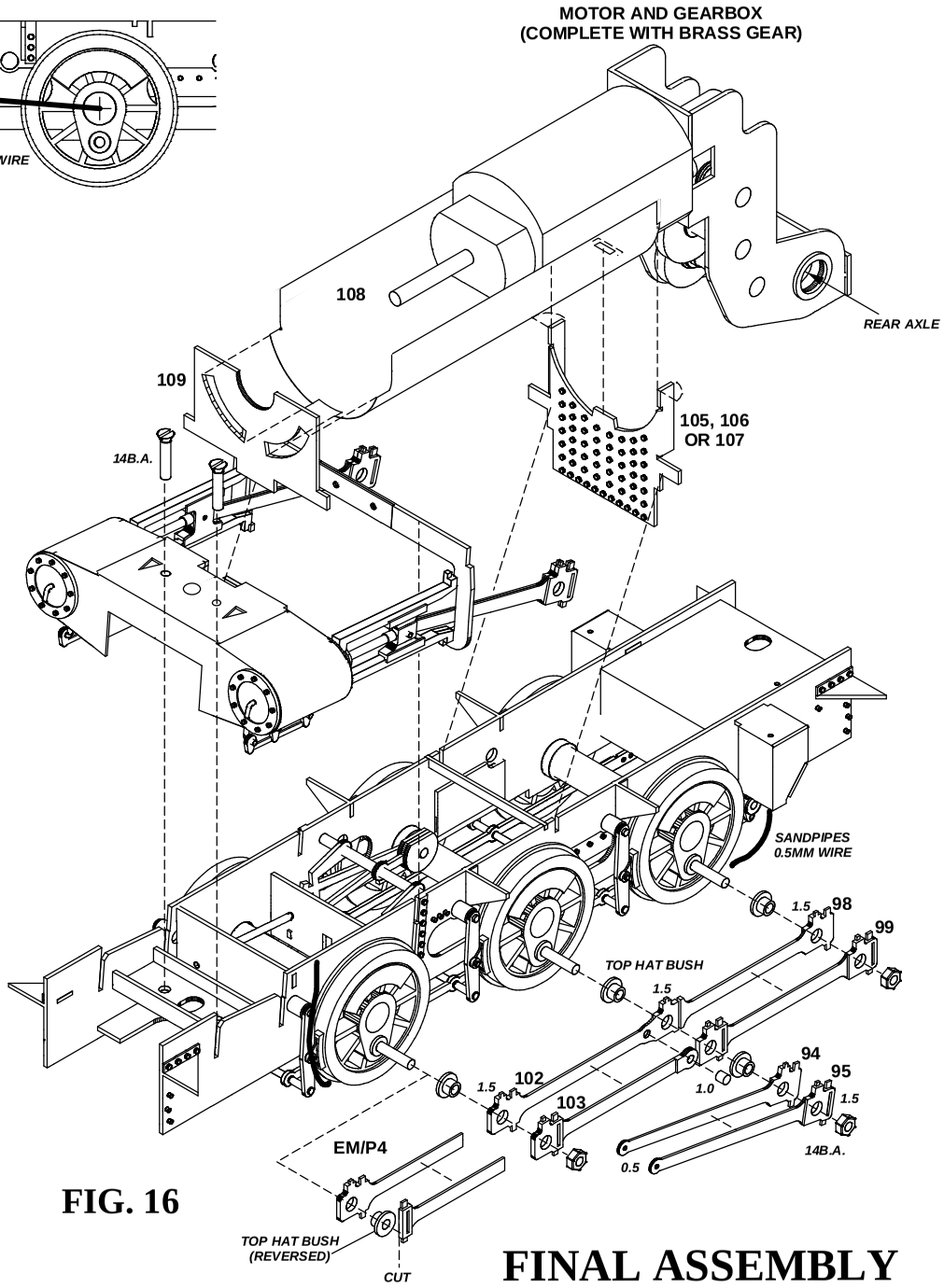



FIG. 16

# FINAL ASSEMBLY

# GEARBOX ASSEMBLY

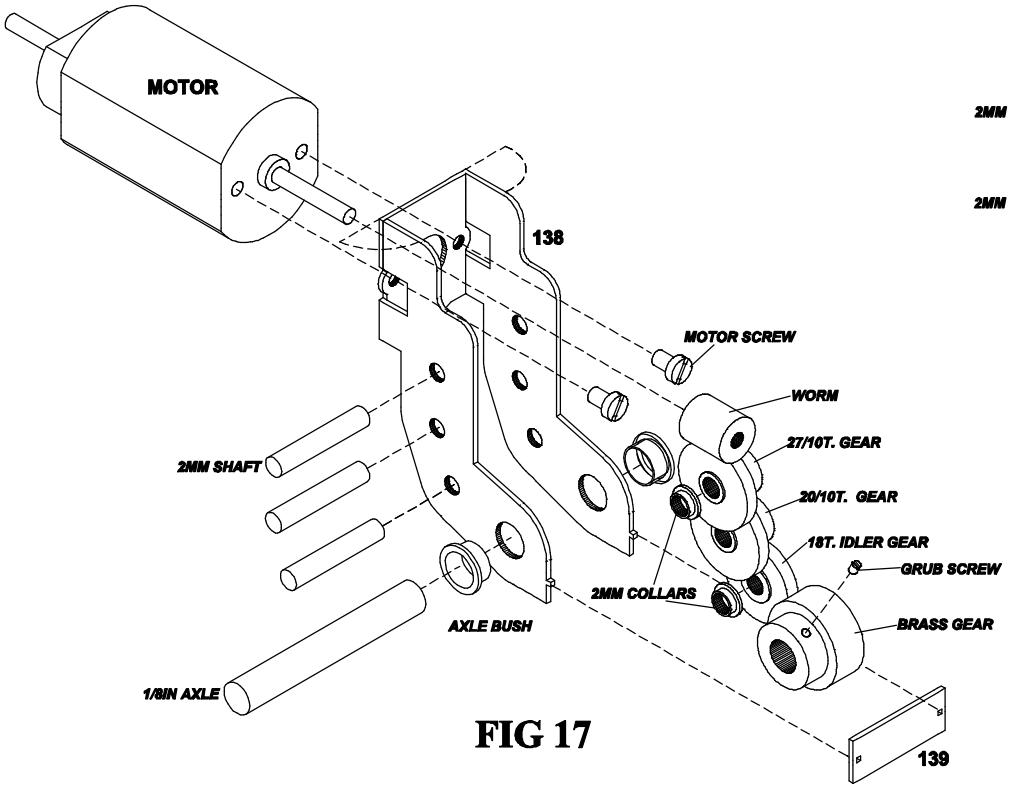



FIG 17

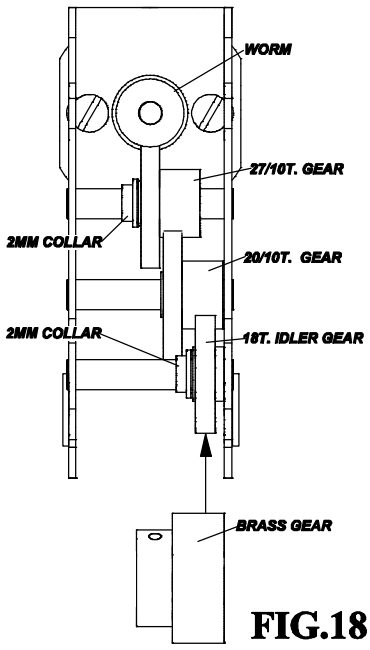



FIG.18

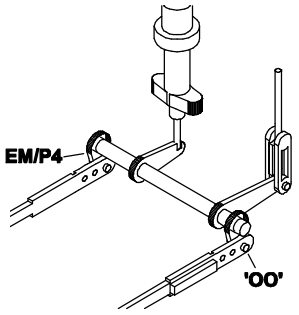



FIG.19

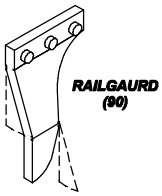



FIG.20

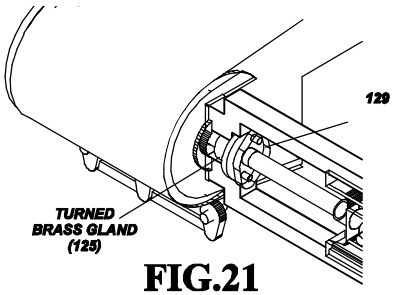



FIG.21

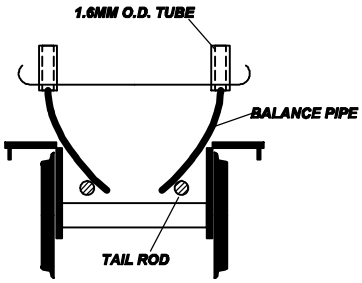



FIG.22

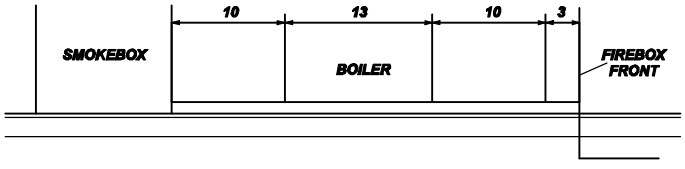



FIG.23