Brassmasters Scale Models

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GREAT WESTERN RAILWAY

CITY 4-4-0
LOCOMOTIVE KIT

Designed by Martin Finney

4MM SCALE
OO - EM - P4

INSTRUCTIONS
AND PROTOTYPE NOTES

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SECTION 1: BRIEF HISTORICAL DETAILS

The prototype of this most famous of GWR 4-4-0 classes was the 'Atbara' class engine *Mauritius* rebuilt with the larger Standard No. 4 boiler in September 1902. Ten new engines followed in 1903 and nine more 'Atbaras' were similarly rebuilt in 1907-9.

For a detailed history of these classes Part Seven of 'The Locomotives of the Great Western Railway' published by the R.C.T.S. is essential reading. Also useful are 'G.W.Engines Vol 2' by J.H. Russell, 'Standard Gauge G.W. 4-4-0s' by O.S. Nock and 'Locomotives Illustrated 50 GWR double-framed 4-4-0s'.

In designing the kit I used the following Swindon drawings:

17849	3/1901	Lots 126,141	General arrangement
115623	10/1940		Inside motion

The locomotives were built under three Lots as follows:

Lot	Original nos.	New-1912 nos.	Built
126*	3400-3409	3700-3709	1902-9
141	3433-3442	3710-3719	1903

* Nos. 3400-3409 were rebuilds of Lot 126, 'Atbara' class, becoming members of the City class, between 1902 and 1909.

The 'Atbaras'(Lot 126), and hence the 'Cities' rebuilt from them, originally had Dean 'swing-hanger' bogies with shallow framing. The new 'Cities' (Lot 141) were built with 'swing-hanger' bogies with deeper framing.

All were built with steam reversing gear which was subsequently (by the early 1920's) replaced with screw reverse on most, if not all, of the class.

There are many further detail differences both between individual locomotives and as the class changed through time.

The following are possible with the kit.

Chimneys: two different types provided.

Safety valve casing: with or without top-feed.

Bogies: many rebuilt to 'de Glehn' type without swing-hangers and fitted with strengthening patches - built with beaded bogie splashers.

Coupling rods: built with fluted rods - many subsequently replaced with plain rods.

Frame strengthening: the locomotives acquired frame strengthening plates surprisingly quickly, probably during their first major shopping around 1904-1906. They were first fitted with separate plates for each axle and later larger, one piece plates were fitted to some of the class.

Smokebox: originally quite short and later front and back rings riveted.

Smokebox saddle: early flush rivets - later snap head rivets.

Sandboxes: originally below footplate for leading coupled wheels only - at around the time of the frame strengthening larger sandboxes fitted above footplate for all driving wheels.

Cab roof: early canvas covered wood - later steel - two types.

Splashers: early with beading - later beading removed and rivets visible

Leading coupled wheel splasher: Built with a beaded splasher, below the footplate, on the leading coupled axle which were gradually removed up to WW1.

Cab spectacle windows: plated over during the late 1920s.

Vacuum pipe: originally tall - later a shorter pattern introduced.

TENDERS

When built, the 'Cities' were fitted with standard Dean 3000 gallon tenders. Subsequently some acquired Churchward 3500 gallon tenders.

SECTION 2: CHASSIS DETAILS

Note that many of the components for both chassis and body are handed left/right and care must be taken to ensure the correct component is used. I have not always identified left/right components separately but with care and common sense no problems should arise.

Before construction can commence you have to decide which chassis you are going to construct. The options are:

1. Gauge 00, EM or 18.83.
2. Suspension Rigid, sprung, compensated.
3. Pick-ups Scraper, plunger or the 'American' system.

No pick-up material is provided. The options are:

- Scrapers attached to printed circuit fixed between the frames.
- Plunger - drill holes P and fit according to the manufacturer's instructions.
- The 'American' system with the wheels on the loco are shorted out on one side and the tender on the other. I have produced some etched shorting strips, as an additional item, for this purpose. The drawbar between the loco and tender can be used to carry the current.

4. Inside motion whether with or without

The working inside motion can only be fitted to the EM & 18.83 versions of the chassis. It is not possible to use plunger pick-ups if you wish to fit the inside motion because they will foul the motion.

SECTION 3: FRAMES

Having decided which chassis to construct, you can now start construction by preparing the inside frames (parts 1 & 2).

Form the frame joggle to narrow the frames from the rear of the bogie forward. Make the first bend inwards through 30° along the rear half-etched line and strengthen the bend with a fillet of solder. Then make the second bend outwards in the same way.

For a rigid chassis, open out the main axle holes to accept 1/8" top hat bushes (not provided) and solder them in place. If you are going to fit sprung horn blocks, you should remove the axle holes by cutting up the half-etched lines, leaving a standard 6mm wide slot and then follow the manufacturer's instructions.

To construct the kit as designed with a compensated chassis first remove all the axle holes as described above. Carefully widen the slot in the rear hornblocks (part 10) until the Flexichas bearings are a good fit. I find a significant variation in the bearings and once I have fitted a hornblock to a bearing I mark the bearing and hornblock so that they can be later assembled together. A good fit between hornblock and bearing is essential if the chassis is to run well.

Solder the rear hornblocks to the inside of the frames aligning them with the half-etched line and with the bottom of the frames.

Now open up the following holes in the frames:

P only if plunger pick-ups are being used
B for brake hanger pivots - 0.45mm
R for reversing lever cross shaft - 0.9mm
A for compensation beam pivot - 1/16"
C for steam reversing cylinder mounting pin (only if you are fitting steam reverse).

The last job on the frames is to emboss the rivets marked by half-etched holes as shown on the diagram.

SECTION 4: FRAME SPACERS AND ASSEMBLING THE CHASSIS

Remove the spacers (parts 6, 7, 8 & 9) to suit your chosen gauge. If you are fitting inside motion open up the slots in part 8 to the rear edge using the half-etched lines as a guide and remove 1mm from the rear edge. Check the fit of the 1/16" brass cylinder tube and then tap the cylinder fixing hole 10 BA.

Solder the 10 BA bogie pivot bolt in place in part 8 and then fold up parts 6 & 8 carefully, making sure that the half-etched fold line is on the inside and that each bend is a right angle.

Check that all tabs on the spacers fit properly in their corresponding chassis slots so that the rest of the spacer is hard up against the inside of the frames. Bend the frames inwards slightly at the front along the half-etched lines to match the shape of part 9.

Now assemble the frames and spacers. Start by tack soldering the rear spacer to both sides. Now check that everything is square and that the spacers are hard against the frames. Put an axle (or better a longer piece of 1/8" rod) through the rear bearings and place the chassis on a piece of graph paper to check that the axle is square to the frames. If all is well solder the remaining spacers to the frames. **It is important to check constantly that the chassis is square and that the frames are straight**.

Select the appropriate outside frame spacers parts 44 & 45 and fold along the half-etched line (Note they are handed). The long tab on the rear spacer folds down, after it is soldered in place, to retain the compensation beam.

SECTION 5: COUPLING RODS

The coupling rods should now be made up so that we can use them as a jig for fitting the front hornblocks (part 11) accurately in place.

First drill out all the crankpin holes to a convenient size which is undersize for the crankpins. Remove all burrs caused by the drilling. Now drill the same drill into a suitable small block of wood and leave the drill in the wood with its shank projecting. This projecting shank is used as a mandrel to accurately align the two laminations of each rod.

Tin well the front face of all the inner laminates and the back face of the outer laminates and place them over the mandrel. Using plenty of solder and flux, solder the two laminates together. You should now have a rod with the bosses on each laminate perfectly aligned.

The rods have been deliberately etched too large so that the thin etched edges can be carefully filed so that the 'laminated' effect is lost and the rods appear to be made from one piece of metal. The crankpin holes now need carefully opening out until they just fit, with no free play, the ends of the hornblock alignment jigs (available from London Road Models or Markits).

SECTION 6: FITTING THE FLEXICHAS HORNBLOCKS

Prepare the remaining bearings and hornblocks as described in section 3 and slide them over the hornblock alignment jigs with the springs between the bearings. Carefully compress the springs and clip the hornblocks between the frames and place the prepared coupling rods over the ends of the jigs. Make sure the hornblocks are square to the chassis and that their bottom edge aligns with the lower edge of the frames and then solder them in place.

Solder 0.45mm wire through the frame holes B to form the brake hanger pivots.

SECTION 7: CHANGING THE PORTESCAP GEARBOX

If you are using a Portescap motor and gearbox, the gearbox side plates will need replacing.

Disassembly of the existing gearbox.

Remove the two screws which hold the motor to the gearbox and put the motor to one side. Using a 1.7mm drill, countersink the ends of the three brass spacers ensuring that no swarf contacts the gears. Using firm pressure, prise the

gear box side plates apart. Note the order of the three gearsets and lift them off their axles, then drift the axles out of the side plates.

Preparing the new side plates (part 28)

Using the diagram, identify the different holes and open out as follows:

Spacer centres : 1.5mm (drill size #53)
Gear axle centres: 1.5mm (drill size #53)
Final drive centre: 4mm

On one side plate, open motor mounting holes to clear the motor mounting screws. On the other side plate, carefully open holes enough to enable the steel screws to self tap a thread (or tap 12 BA). Using a piece of fine emery paper remove all burrs from the side plates, then solder the 1/8" bearings (removed from the old side plates) into the final drive holes ensuring that the side plates present two mirror images.

Reassembly

Place the three brass spacers into their corresponding holes in one of the new side plates. Insert the three axles into their respective holes. The axles **should be a tight fit**, if not use a small drop of Superglue to locate one end of the axle only, then fit the second side plate temporarily in place to align the axles while the Superglue dries. Place the gearsets back onto their axles and fit the second side plate. Centre punch the spacers to retain them. Attach the motor to the gearbox using the old steel screws.

SECTION 8: BOGIE

There are several bogie options available and careful study of photographs is needed before you start. The options are:

- Different rivet patterns - emboss those wanted
- Shallow (part 61) or deep (part 62) frames
- Strengthening patches (parts 24 & 25)
- Splashers below the frame - remove for later period
- Beaded splashers - remove the riveted splasher fronts and solder part 63 in their place
- Swing hanger suspension or De Glehn type - omit the swing hanger castings for the de Glehn type

First, emboss all appropriate rivets including those in the hornguide ties. Fold over the hornguide ties through 180° and attach the strengthening patches if needed. Solder in the pin-point bearings. Form the splasher tops (part 64) to shape and solder in place on the top of the frames - very fiddly!. If you have left the lower splashers in place solder part 65 to the rear splasher.

Fold the bogie stretcher (part 60) into a 'U' section and solder it to one frame locating it in the half-etched groove. Now solder the second frame in place remembering to have the wheelsets in place at the same time. Check that the bogie is square and level.

Insert part 66 through the slots in part 22 and attach the guard irons (part 26) likewise. Solder the complete front stretcher in place. Repeat for the rear stretcher (part 23).

Form the spring steel wire for the bogie side control as shown in the diagram, thread it through the two outer holes in the projecting tab in the front stretcher and solder it in place. The side control wire will then act on either side of the bogie pivot and can be adjusted by bending the wire suitably.

Attach the lower swing hanger castings (part W8) through the larger holes in the stretcher and make flush with the upper surface of the spacer. Attach the upper swing hanger castings (part W7) and the axlebox/spring castings (part W6). Form the safety brackets from 0.3mm wire and solder in place through the small holes in the stretcher.

SECTION 9: FITTING THE COMPENSATION BEAMS

Cut a piece of 1/16" brass rod so that it fits through the holes A and is flush with the outside face of the chassis frames.

Prepare two pieces of 5/32" brass tube. Each should have a length of 2mm for an 18.83mm gauge chassis, 1.5mm for an EM gauge chassis and 1mm for an OO gauge chassis. Open up the hole to accept the brass tube in each of the compensation beams (part 12) and solder the beams to the pieces of tube 0.5mm from one end.

Modify the tops of the flexichas bearings as shown in the drawing and temporarily fit the beams.

Fit all the wheels and axles temporarily so that the beams are resting on the axle bearings and the bogie is mounted on its pivot supported by a suitable number of spacer washers (parts 42 & 136).

Confirm that the compensation works properly and check if the chassis is sitting level.

To retain the beams first dismantle the chassis and then solder the pivot rod securely to the frames. Cut away the centre section of the pivot rod so that the beams will fit with the rod flush. The beams can now be retained by folding down the tabs on part 44.

Solder a short piece of 0.7mm wire rearwards through the hole in the bottom of part 7 to form the motor support beam.

SECTION 10: INSIDE MOTION

If you are fitting inside motion, construct it now following the separate instructions.

SECTION 11: OUTSIDE CRANKS AND MECHANICAL TEST

The outside cranks are made from a triple lamination as shown in the diagram. Open the large holes in part 21 to 2.6mm so that the shoulder on the end of the axle is a tight fit.

Solder the three laminations together using the 2.6mm drill to align them accurately.

Open up (0.8mm) and countersink the crankpin hole and solder in the crankpin. File flush any part of the crankpin screw head protruding.

Fold the outside axle boxes (part 15) through 180o with the fold line outside and carefully solder together. Open out the axle holes to be a sloppy fit on the axle. These axle boxes are simply cosmetic. Check that these axle boxes are an easy fit in the slots in the outside frames, or the strengthening plates if these are to be used, and ease if necessary.

Permanently fix the wheels to the axles, not forgetting the gearbox on the rear axle, and ensuring that the axles extend equally on each side.

Thread the outside axle boxes on the axles. Solder both the outside cranks to the axles along one side of the locomotive. The outside crank on the crank axle is at 180° to the inside crank. Solder the other crank to the leading axle at 90° to the first crank with the right hand crank leading. Attach the second rear crank using "Loctite". This allows the crank to be adjusted whilst holding it firmly enough to allow the chassis to be tested.

Locate the axles and attach the coupling rods. Turn the wheels slowly and if any tight spots occur adjust the crank on the rear axle until they run smoothly. Solder the crank to the rear axle.

Connect the motor to the pick-up system you have chosen and test run the chassis.

SECTION 12: BUFFER BEAM, DRAG BEAM, BRAKE HANGERS AND OUTSIDE FRAMES

Emboss the rivets on the drag beam (part 47) and attach the rubbing plates (part 48).

Solder the buffer beam (part 46) and drag beam (part 47) to the frames locating the frames in the appropriate half-etched slots. Their upper edge **must be 0.012**" (0.3mm) above the upper edge of the frames so that they will be flush

with the footplate when it is fitted. Any piece of 0.012" material placed on top of the frames will help ensure correct alignment. I found part 104 ideal.

If you are fitting the frame strengthening plates (part 5) remove, from the part of the frames which will be behind the strengthening plates, (by filing) the rivets and hornblock detail. Then widen the hornblocks so that the outside frame axleboxes will pass through. This is done so that the outside frame axleboxes will slide in the hornblocks in the strengthening plates. The separate strengthening parts as shown in the drawing are made from part 5.

Attach rivet strips (parts 49 & 50) to the top of outside frames. Solder the strengthening plates in position carefully checking that each one is in the correct position by trying the outside frame in place over the outside frame axleboxes.

Align the top of the outside frame with the buffer beam and drag beam and tack solder in place. Ensure the axles move freely and when satisfied solder the outside frame to the spacers. Attach part 52 between frame and buffer beam and part 53 between frame and drag beam.

Fold up steps (parts 54, 55, 56, 57, & 58) and attach to frames. The four holes correspond to the four rivets attaching the upper steps and should be used to aid alignment.

Solder together the three laminations of the inside frame springs (parts 13 & 14) before fixing in place inside the spring hangers. Assemble the brake hangers (part 27) first embossing the rivet on each lamination. The front of each hanger is detailed with part 70, as shown in the diagram, one of the small holes in the back of part 70 locating on the previously embossed rivet. Attach the hangers to the pivot wires.

SECTION 13: FINISHING CHASSIS

Secure the balance weights in position using photographs as a guide to position.

The cast spring dampers are in two sizes. The smaller ones are used for the centre axle. Shorten the attaching 'stems' to about 5mm and then file the 'stem' to a half round section. Attach the dampers behind the frames as shown in the drawing - the etched rivets give a good guide to position. If appropriate fold up part 67 and solder in place on the front of part 44.

Emboss the rivets on the outside frame hornblock tie (part 16) and attach to the frames under the hornguides. If you have fitted strengthening plates fit part 51.

Attach the steam brake cylinders to the chassis. Note the cylinders are handed. Emboss the two rivets on the outside brake pull rods (parts 68) and fit together with the rear inside pull rods (part 69) using 0.45mm wire as shown in the diagram. They are also attached either side of the steam brake cylinders.

Form and fit the brake pull rods safety brackets (part 71) through the small slots in the ash-pan sides and under the pull rods.

Form sand pipes from 0.45mm wire and attach through the holes in spacers 49 & 50. Note: before the fitting of large sandboxes the engines only had sanding to the leading wheels.

Attach the buffers, vacuum pipe, coupling hook (part 40) and coupling (part 134).

SECTION 14: FOOTPLATE

Emboss the rivets on the footplate (part 76) inside frame extensions. Fold the footplate edges all round and bend the footplate 'step' ensuring the folded front side edges are outside the folded rear side edges. Solder the corners and the folded edges where they overlap adjacent to the 'step'. The four 'legs' on the rear side edges ensure that the footplate will stand level on a flat surface during construction. Solder the footplate strengthening plates (part 29) to the edge of the footplate. The half-etched slots will accommodate the springs and spring hangers later so ensure the plates are accurately aligned. File of the top edge of the plates flush with the surface of the footplate.

Fold up the inside frame extensions, the front angle, the cab floor support and the lamp brackets and solder the frame extensions to the front of the 'step'.

Prepare the footplate overlays (parts 77 & 78) by embossing the rivets under the lamp brackets and folding up the cab floor supports. The curve in the rear of the front overlay is formed over a 2.0mm drill shank.

Place the font overlay over the footplate so the lamp brackets pass through the holes provided and the body fixing hole aligns and solder them together all round. Similarly solder the rear overlay in place. The opening in the footplate to clear the motor will need enlarging at the front to clear the gearbox.

If you are fitting inside motion remove the section of footplate under the smokebox saddle as shown in the diagram. This opening must then be widened by 1.7mm on each side.

Solder the splasher faces (parts 81 or 82) inside the footplate edge so that their bottom edge is level with the bottom edge of the footplate side.

Curve the splasher tops (parts 83/84 & 85/86) by rolling underneath a suitable rod or dowel on a piece of rubber sheet and solder them in place.

Solder the cab floor support (part 114) in place and solder a 10 BA nut over the rear body fixing hole and reduce its thickness so that the cab floor will fit.

SECTION 15: FIREBOX AND BOILER

Solder together the two laminations of the firebox front (parts 30). The firebox rear and front must now be spaced apart by using suitable long bolts and washers through the pairs of holes in both front and rear. I use some old brass chassis spacers joined together with studding. When correctly spaced apart (26.35mm outside) the front should fit in the half-etched recess in the footplate and the rear (part 31), pinned to the cab front (part 98) with 0.45mm wire dowels, will fit in the footplate groove.

Emboss the four rivets for the ends of the cladding fixing bands on the firebox wrapper (part 91). In pencil mark the wrapper centre on its inside and outside. Using the notch in the top of the formers as a guide centre the wrapper and mark in pencil the position of the top bends. Form the bends over a suitable rod or dowel held in a vice. Repeat to form the lower bends. When happy with the forming solder the wrapper to the formers ensuring a large fillet of solder around the front join.

Check the fit on the footplate and then remove the temporary spacers.

Round the front edges of the firebox with a file, referring to photographs for the correct shape. Fold up firebox band joining clips (part 94) into a 'U' shape and solder them in place, from the inside, through the four slots in the top of the firebox. Complete by using a short piece of 0.3mm wire through the holes to represent the tightening bolt. Solder the washout plugs (parts 92 & 93) in place inside the firebox and attach the mud hole doors in place on the firebox corners.

Before rolling the coned section of the boiler (part 125 or 126) the boiler washout plugs can be drilled out and part 128 used if you prefer. Emboss the rivets alongside the top feed pipes on part 125. Roll the boiler and check for fit around the formers (parts 32 & 33). Bend the boiler band joining brackets on part 127 and fit through the small slots from inside the boiler. If the fit is good and the formers fit then solder the wrapper ends together with part 127. Solder the formers in place so that they are almost flush with the ends. The cut-outs in the formers are to clear part 141 and the etched notch at the top of the rear former must align accurately with the notch in the wrapper. Solder two short pieces of 0.45mm wire into the holes in the rear former to act as dowels to locate the boiler and firebox. Check the boiler/firebox fit. Represent the bolts in the joining brackets using 0.3mm wire.

Attach the top feed casting and form the top feed pipes from 0.8mm wire.

Prepare the smokebox/boiler wrapper (part 121) by shortening the smokebox for the early condition.

Roll the wrapper (part 121 or 122) and check the fit on the formers (parts 34 & 35). Solder the wrapper ends together using part 123 representing the fixing bolts as before. Solder in the formers flush with the back and front. The upper hole in the front former is for the handrail knob and the other two holes for alternative positions for the steam lance cock. Emboss the four rivets on the smokebox front overlay (part 36), drill through the appropriate lance cock hole and attach

to the front of the smokebox aligning the handrail and lance cock holes. Bend up the smokebox step (part 124) after first embossing the rivets and solder in place under the smokebox front.

Tap the hole in part 33 10 BA and open out the hole in part 34 to clear 10 BA. With a 10 BA screw, bolt the two boiler sections together and fix the boiler to the firebox by soldering the wire dowels to the firebox from inside.

Bend up the smokebox saddle spacer (part 118). Emboss the rivets on the saddle front (part 37) if needed (appeared in later years) and if you have fitted inside motion remove the section below the half-etched line on the saddle rear (part 38). Solder the saddle together with the spacer centrally positioned. Solder a 10 BA nut over the hole on the saddle spacer.

Attach the saddle to the footplate with the 10BA mounting screw. Locate the boiler on the firebox and check the smokebox/saddle fit and alignment. Remember the bottom of the boiler is horizontal and so parallel to the top of the frames and the rear of the saddle is in line with the rear of the smokebox. When satisfied with the alignment tack solder the saddle to the smokebox and footplate and the firebox to the footplate. When you are satisfied with the alignment complete the soldering.

Attach the smokebox saddle side plates (parts 119 or 120) - 2 alternatives provided. Note the rivet patterns are not symmetric - study photographs for correct fitting.

Attach the front frame extensions (part 79) locating them in the slot provided then attach the cylinder cover overlays (part 39).

Solder the upper lamp bracket (part 117) on the smokebox after first embossing the rivets.

Fix medium handrail knobs in the six holes in the boiler/smokebox and four small knobs in the holes in the firebox. Form the handrail to shape, thread on the front medium knob, and fix the handrail in place.

If appropriate, solder the nameplate brackets in place and bend up the footplate mounted lubricator bracket (part 88) and attach.

SECTION 16: CAB

Emboss the rivets on the cab front. The portholes can blanked off using part 101 or part 100 can be fitted from inside. Attach the window frames (part 99) on the inside. The whistle plate (part 102) appears on photographs of locomotives in later life. Solder the cab front in position.

Prepare the cab sides (part 95) by embossing any rivet detail you wish and attaching the cut-out beading (part 96) fitting the etched grove over the edge of the cab side. Form and fit the cab side handrails from 0.3mm wire and file off smooth on the inside. Assemble the cab seats (part 97). They are designed to be working. Now remove the seat from the bracket and solder the bracket to the inside of the cab side. Solder the cab sides in position. They are correctly aligned when the cab side handrails are vertical.

Solder part 103 between the rear edges of the cab sides. Curve the cab roof (part 104,108 or 111) and solder in place with the front edge in line with the cab sides. Parts 105 are first soldered to the canvas covered wood roof between the half-etched lines to represent the fixing battens. Parts 109 & 110 are soldered to the edges of the steel cab roof (part 108) to form the strengthening angles and part 112 in the slots in part 111 together with part 109 on the rear edge. For the canvas covered wood roof the fixing mouldings (parts 106 & 107) are fixed under the edges of the roof to the sides and part 103.

The cab floor (part 113) **must be reduced in width** to clear the rear wheels for EM or OO before folding up the cab splasher rear section. For EM and 18.83 the cab splashers (parts 115) are reduced in width to the half-etched lines and then soldered in place. Slightly curve the fall plate (part 116) and hinge it to the floor as shown in the diagram before soldering the floor in place.

SECTION 17: FINAL DETAILING

Form the spring shackles (part 89) and solder on a short length of 0.45mm. wire. Fix the shackles through the holes in the footplate soldering the wire in the grooves in part 29. Attach the springs - two sizes - the smaller ones are for the leading axle. The 'legs' on the footplate edge should now be removed.

Using short handrail knobs make the footplate mounted handrails.

Either fix the sandbox lids to the footplate behind these handrails or use the large sandboxes and operating rods (part 90).

Detail the cylinder front plate (part 80) as shown in the drawing and attach it to the saddle front with its top edge level with the top of the front frame extensions.

Attach all the remaining castings using the drawings and photographs as a guide to position.

The cab interior is largely based on the photograph in Great Western Engines Vol.2 - J.H.Russell - page 2 showing an engine with steam reverse. Using the photograph and the drawing the backhead can be assembled and the cab interior detailed. Use copper wire of a suitable size for the various pipes.

Best wishes

Martin Finney
November 1993

If you have any problem with the kit or any criticisms or suggestions please feel free to contact Brassmasters.

ETCHED COMPONENTS

1 Inside frame - left
2 Inside frame - right
3 Outside frame - left
4 Outside frame - right
5 Outside frame strengthening plate - (2)
6 Frame spacer - rear
7 Frame spacer - firebox front
8 Frame spacer - cylinder block/bogie mounting
9 Frame spacer - front
10 Hornblock - rear - (2)
11 Hornblock - front - (2)
12 Compensation beam - (2)
13 Spring - inner lamination -(2)
14 Spring - outer lamination -(4)
15 Outside frame axlebox - (4)
16 Outside frame hornblock tie - (4)
17 Coupling rod outer laminate - fluted - (2)
18 Coupling rod inner laminate - fluted - (2)
19 Coupling rod outer laminate - plain - (2)
20 Coupling rod inner laminate - plain - (2)
21 Outside crank lamination - (12)
22 Bogie stretcher - front
23 Bogie stretcher - rear
24 Bogie side frame patch - left - (2)
25 Bogie side frame patch - right - (2)
26 Bogie guard iron - (2)
27 Brake hanger/shoe lamination - (8)
28 Portescap gearbox side - (2)
29 Footplate strengthening plate - (2)
30 Firebox front lamination - (2)
31 Firebox rear
32 Boiler former (coned section) rear
33 Boiler former (coned section) front
34 Smokebox / boiler rear former
35 Smokebox front former
36 Smokebox front overlay
37 Smokebox saddle - front
38 Smokebox saddle - rear
39 Cylinder cover overlay - (2)
40 Coupling hook
41 Washer - 10 BA - large - bogie pivot
42 Washer - 1/8"
43 Inside motion mounting bracket packing piece
44 Outside frame spacer - rear - (2)
45 Outside frame spacer - front - (2)
46 Buffer beam
47 Drag beam
48 Drag beam rubbing plate - (2)
49 Outside frame rivet strip - front - (2)
50 Outside frame rivet strip - rear - (2)
51 Tie bar between frame strengthening plates - (2)
52 Angle bracket - frame to bufferbeam - (2)
53 Angle bracket - frame to dragbeam - (2)
54 Step - front - upper - (2)
55 Step - front - lower - (2)
56 Step - rear - upper - (2)
57 Step - rear - middle - (2)
58 Step - rear - lower - (2)
59 Drawbar
60 Bogie stretcher
61 Bogie frame - shallow - (2)
62 Bogie frame - deep - (2)
63 Bogie splasher beading - (2)
64 Bogie splasher top - (8)
65 Bogie splasher rear cover - (2)
66 Bogie front angle strip
67 Leading driving wheel splasher - (2)
68 Brake pull rod - outer - (2)
69 Brake pull rod - rear - inner - (2)
70 Brake hanger safety bracket - (4)
71 Brake pull rod safety bracket - (2)
72 Balance weight - front - original - (2)
73 Balance weight - rear - original - (2)
74 Balance weight - front – balanced cranks - (4)
75 Balance weight - rear - balanced cranks - (2)
76 Footplate
77 Footplate overlay - front
78 Footplate overlay - rear
79 Front frame extension - (2)
80 Plate - front of cylinders
81 Splasher face - with beading - (2)
82 Splasher face - riveted - (2)
83 Splasher top – un-riveted - front - (2)
84 Splasher top – un-riveted - rear - (2)
85 Splasher top - riveted - front - (2)
86 Splasher top - riveted - rear - (2)
87 Nameplate bracket - (6)
88 Bracket - footplate mounted lubricator
89 Spring shackle - (6)
90 Sandbox operating rod - (2)
91 Firebox wrapper
92 Firebox washout plugs - left
93 Firebox washout plugs - right
94 Firebox band joining clip - (2)
95 Cab side - (2)
96 Cab side cut-out beading - (2)
97 Cab seat - (2)
98 Cab front
99 Cab window frames - (2)
100 Cab porthole window frames - (2)
101 Cab porthole blanking plate - (2)
102 Whistle plate
103 Support - rear of cab roof

ETCHED COMPONENTS (continued)

104 Cab roof - canvas covered wood
105 Cab roof - canvas covered wood - transverse batten - (2)
106 Cab roof - canvas covered wood - side moulding - (2)
107 Cab roof - canvas covered wood - rear moulding
108 Cab roof - steel
109 Cab roof - steel - rear angle
110 Cab roof - steel - side angle - (2)
111 Cab roof - steel with sloping rainstrips
112 Cab roof - steel - sloping rainstrips - (2)
113 Cab floor
114 Cab floor support
115 Cab splasher - (2)
116 Fallplate
117 Lamp bracket - (2)
118 Smokebox saddle spacer
119 Smokebox saddle side plates – un-riveted - (2)
120 Smokebox saddle side plates - riveted - (2)
121 Smokebox/boiler wrapper – un-riveted
122 Smokebox/boiler wrapper - riveted
123 Smokebox / parallel boiler jointing strip
124 Smokebox step
125 Three quarter coned boiler wrapper - with top feed
126 Three quarter coned boiler wrapper - without top feed
127 Coned boiler jointing strip
128 Boiler washout plugs - (4)
129 Gauge glass lever
130 Brake lever
131 Steam fountain and blower levers - (5)
132 Backhead shelf
133 Cab pressure gauge - (3)
134 Coupling
135 Washer - 10 BA - large - bogie pivot
136 Washer - 1/8"
137 Inside motion mounting bracket packing piece

BRASS CASTINGS

B1 Safety valve casing - no top feed
B2 Safety valve casing - with top feed
B3 Vacuum pipe - tall - early
B4 Vacuum pipe - short - later
B5 Smokebox door handles
B6 Whistles - (2)

WHITEMETAL CASTINGS

W1 Chimney - original cast iron
W2 Lubricator
W3 Safety valve base - top feed
W4 Safety valve base - no top feed
W5 Safety valve springs - (2)
W6 Bogie axlebox and spring - (4)
W7 Bogie suspension swing hangers - upper - (2)
W8 Bogie suspension swing hangers - lower - (4)
W9 Spring - leading - (2)
W10 Spring - trailing - (2)
W11 Spring damper - leading - (4)
W12 Spring damper - trailing - (4)
W13 Buffer - (2)
W14 Sandbox - left - (2)
W15 Sandbox - right - (2)
W16 Sandbox lid - (2)
W17 Smokebox door
W18 Steam brake cylinder - left hand
W19 Steam brake cylinder - right hand
W20 Steam lance cock
W21 Casing to cover screw reverse on firebox side
W22 Steam reversing cylinder
W23 Backhead
W24 Combined ejector/brake
W25 Regulator handle
W26 Water gauge
W27 Screw reverser
W28 Screw reverser handle
W29 Firebox door handle
W30 Sight feed lubricator
W31 Steam heating valve
W32 Steam reverse lever
W33 Snifting valve
W34 Smokebox pipe cover - early pattern
W35 Smokebox pipe cover - later pattern

COPPER CASTING

C1 Chimney - parallel copper capped

OTHER COMPONENTS FOR CHASSIS

1/8" bore Flexichas bearings - (4)
Pinpoint bearings - (4)
Crankpins, bushes and nuts - (4)
Brass 10 B.A. C.H. screws - (4)
Brass 10 B.A. nuts - (3)
1/16" brass wire for compensation beam pivot
5/32" brass tube for compensation beams
Brass wire 0.45mm for brake hanger pivots
Spring wire for bogie side control
Buffer heads, bushes and springs - (2)

OTHER COMPONENTS FOR BODY

Brass wire 0.45 mm for handrails
Brass wire 0.30 mm for fallplate hinges, whistles and cab side handrails
Brass wire 0.8 mm for top feed pipes
Short handrail knobs - (8)
Medium handrail knobs - (7)
Mudhole doors - (4)

COMPONENTS NOT PROVIDED

Driving wheels with extended axles
(prototype - 6' 8½" diameter 22 spokes, outside crank)
- Ultrascale
- Alan Gibson
- Markits

Bogie wheels
(prototype -3' 8" diameter 10 spoke)
- Ultrascale
- Alan Gibson
- Markits

Motor and gearbox
- Hi-Level
- Branchlines
- Portescap 1219 (available second hand only)

Suitable pickups

INSIDE MOTION

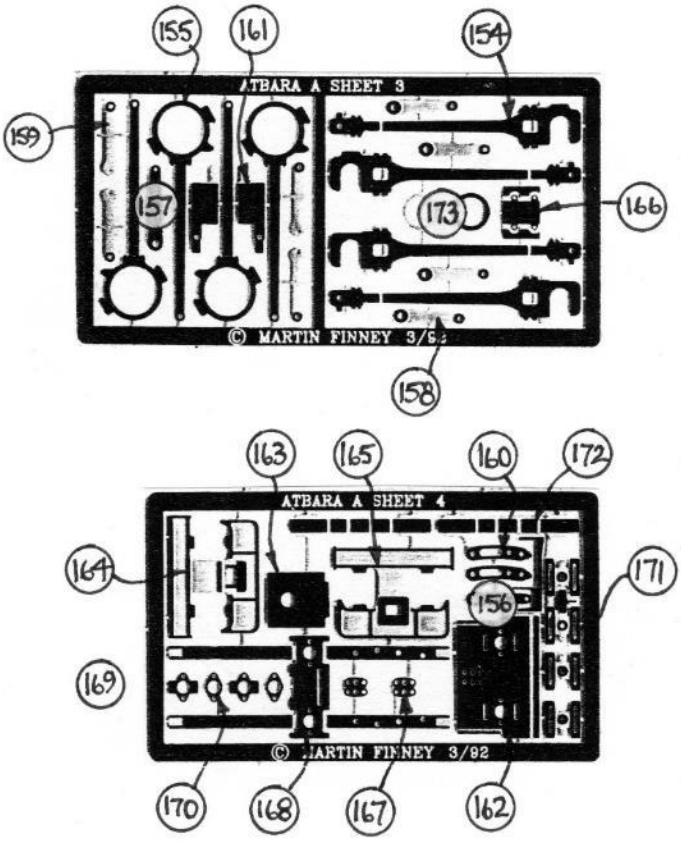
ETCHED COMPONENTS - 0018" nickel silver

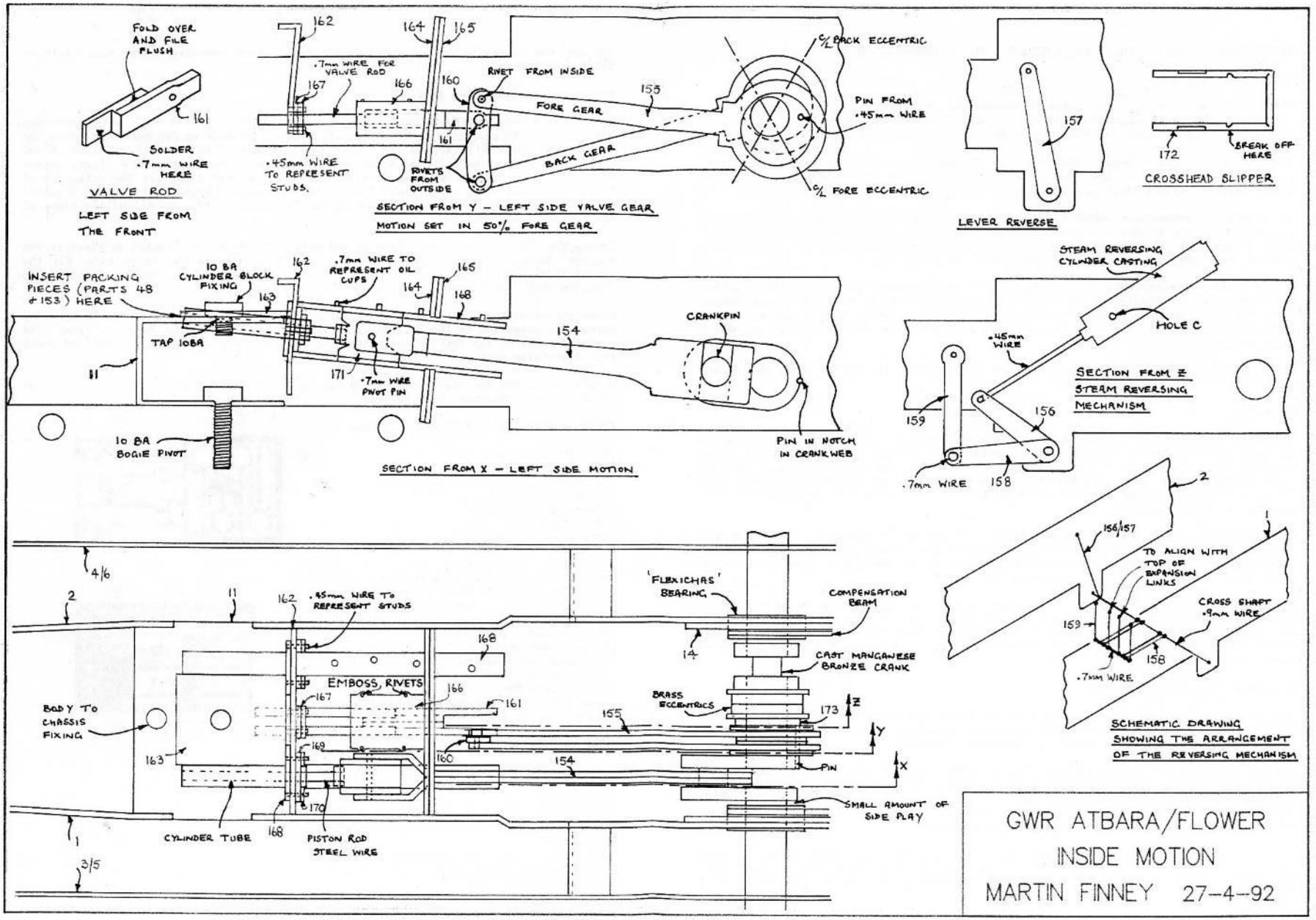
154 Connecting rod - (4)
155 Eccentric sheath - (4)
156 Reversing lever - steam reverse
157 Reversing lever - screw reverse
158 Reversing arm - (4)
156 Reversing lever - steam reverse
157 Reversing lever - screw reverse
158 Reversing arm - (4)
159 Lifting link - (4)
160 Expansion link - (2)
161 Valve rod - (2)
162 Cylinder block front
163 Cylinder block mounting bracket
164 Motion bracket - front lamination
165 Motion bracket - rear lamination
166 Valve rod guide box
167 Valve rod gland - (2)
168 Slide bar assembly
169 Piston rod gland inner overlay - (2)
170 Piston rod gland outer overlay - (2)
171 Crosshead face - (4)
172 Crosshead slipper assembly - (2)
173 Washer - to space out the eccentrics - (3)

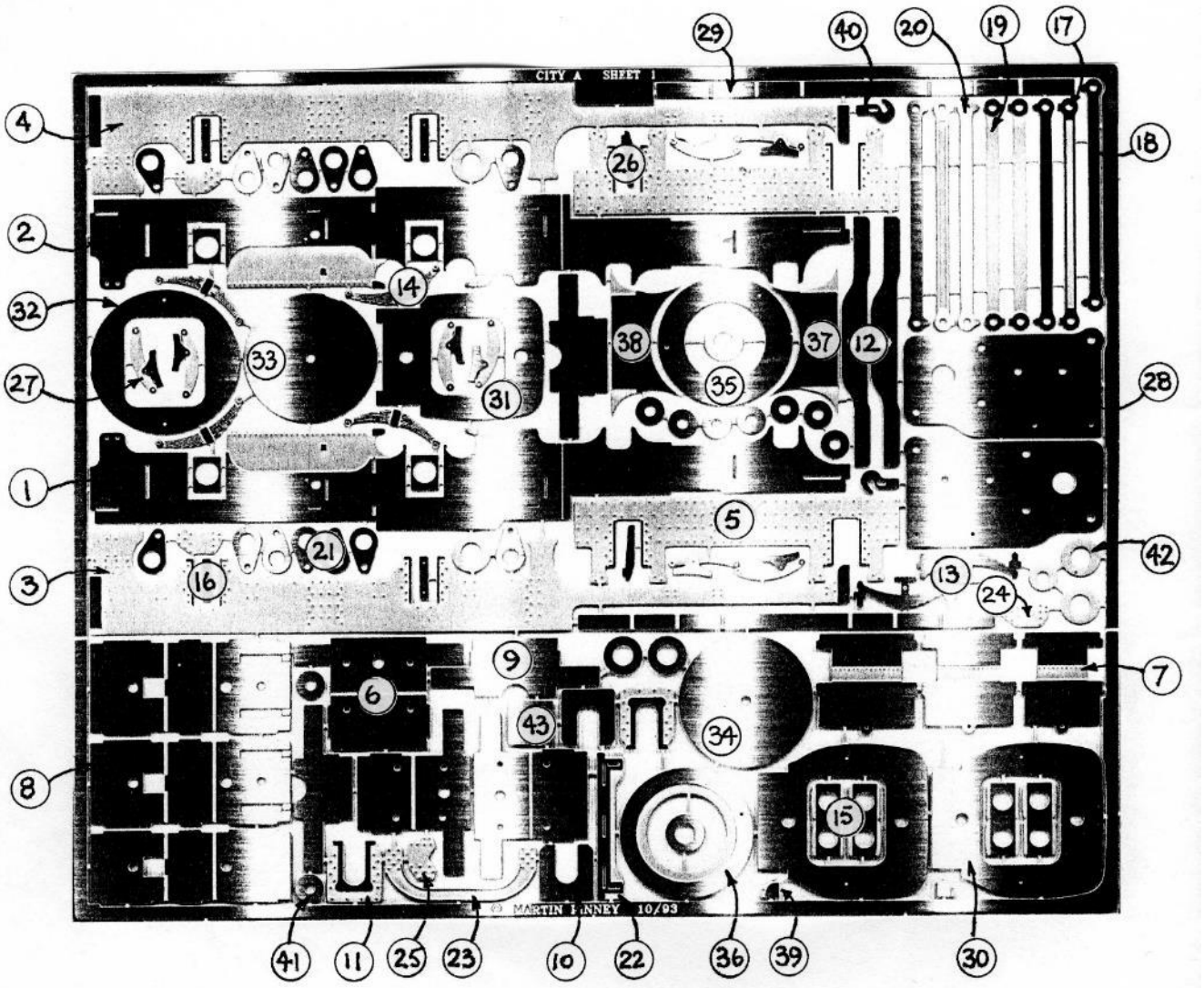
OTHER COMPONENTS needed for working Inside motion

1/16" outside diameter brass tube for cylinders
Steel wire - 0.8mm - for piston rods
Rivets - (6)
Brass wire - 0.7mm - for crosshead pins and lifting links
Brass wire - 0.45mm - for pinning eccentrics to cranks
10 BA screw
Brass wire - 0.9mm - for reversing cross shaft

Cast manganese bronze cranks - (2)
Brass eccentrics - (4)




FOLD OVER AND FILE FLUSH
161
SOLDER .7mm WIRE HERE
VALVE ROD
LEFT SIDE FROM THE FRONT
162
164
165
.7mm WIRE FOR VALVE ROD
167
166
160
RIVET FROM INSIDE
155
FORE GEAR
BACK GEAR
161
.45mm WIRE TO REPRESENT STUDS.
RIVETS FROM OUTSIDE
℄ BACK ECCENTRIC
PIN FROM .45mm WIRE
℄ FORE ECCENTRIC
SECTION FROM Y – LEFT SIDE VALVE GEAR
MOTION SET IN 50% FORE GEAR
157
LEVER REVERSE
172
BREAK OFF HERE
CROSSHEAD SLIPPER
INSERT PACKING PIECES (PARTS 48 & 153) HERE
10 BA CYLINDER BLOCK FIXING
162
.7mm WIRE TO REPRESENT OIL CUPS
165
163
164
168
TAP 10BA
11
171
.7mm WIRE PIVOT PIN
154
CRANKPIN
10 BA BOGIE PIVOT
PIN IN NOTCH IN CRANKWEB
SECTION FROM X – LEFT SIDE MOTION
STEAM REVERSING CYLINDER CASTING
HOLE C
.45mm WIRE
SECTION FROM Z STEAM REVERSING MECHANISM
159
156
.7mm WIRE
158
2
156/157
TO ALIGN WITH TOP OF EXPANSION LINKS
1
CROSS SHAFT .9mm WIRE
159
158
.7mm WIRE
SCHEMATIC DRAWING SHOWING THE ARRANGEMENT OF THE REVERSING MECHANISM
4/6
2
11
162
.45mm WIRE TO REPRESENT STUDS
'FLEXICHAS' BEARING
COMPENSATION BEAM
14
168
CAST MANGANESE BRONZE CRANK
EMBOSS, RIVETS
166
167
161
BRASS ECCENTRICS
173
Z
Y
X
155
BODY TO CHASSIS FIXING
163
169
160
154
PIN
SMALL AMOUNT OF SIDE PLAY
170
168
CYLINDER TUBE
PISTON ROD STEEL WIRE
1
3/5
GWR ATBARA/FLOWER
INSIDE MOTION
MARTIN FINNEY 27–4–92


CITY A SHEET 1
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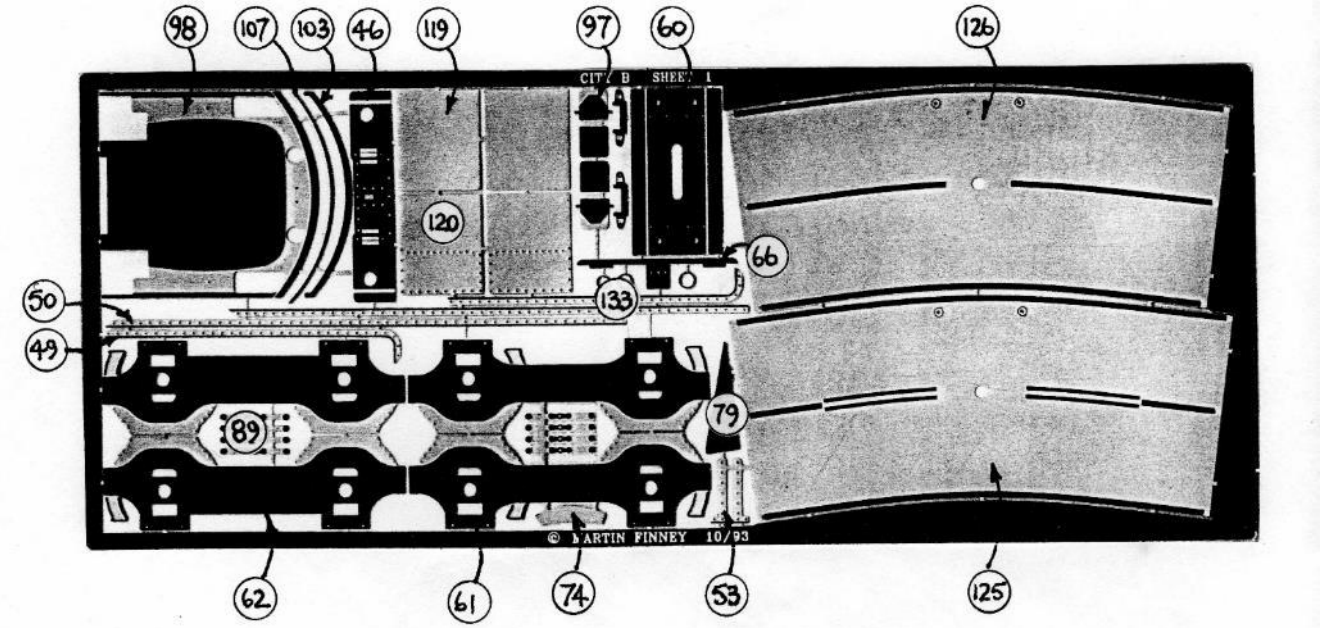
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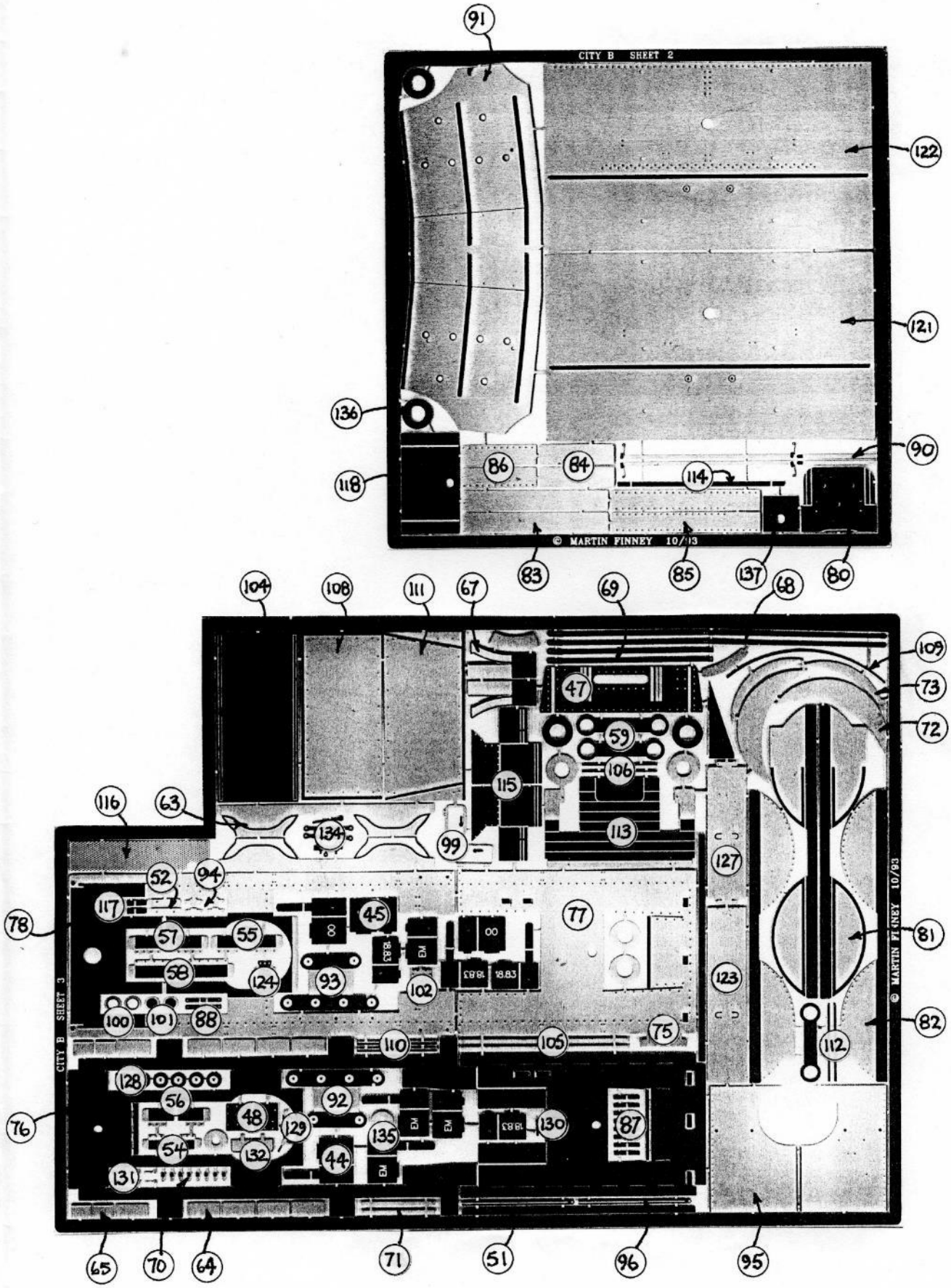
CITY B SHEET 2
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CITY B SHEET 3
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91
122
121
136
90
118
86
84
114
83
85
137
80
104
108
111
67
69
68
109
73
72
47
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106
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116
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134
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127
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55
45
77
81
58
124
93
102
123
100
101
88
75
82
110
105
112
128
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132
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131
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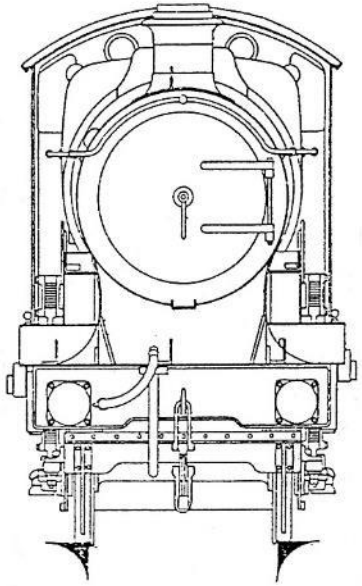
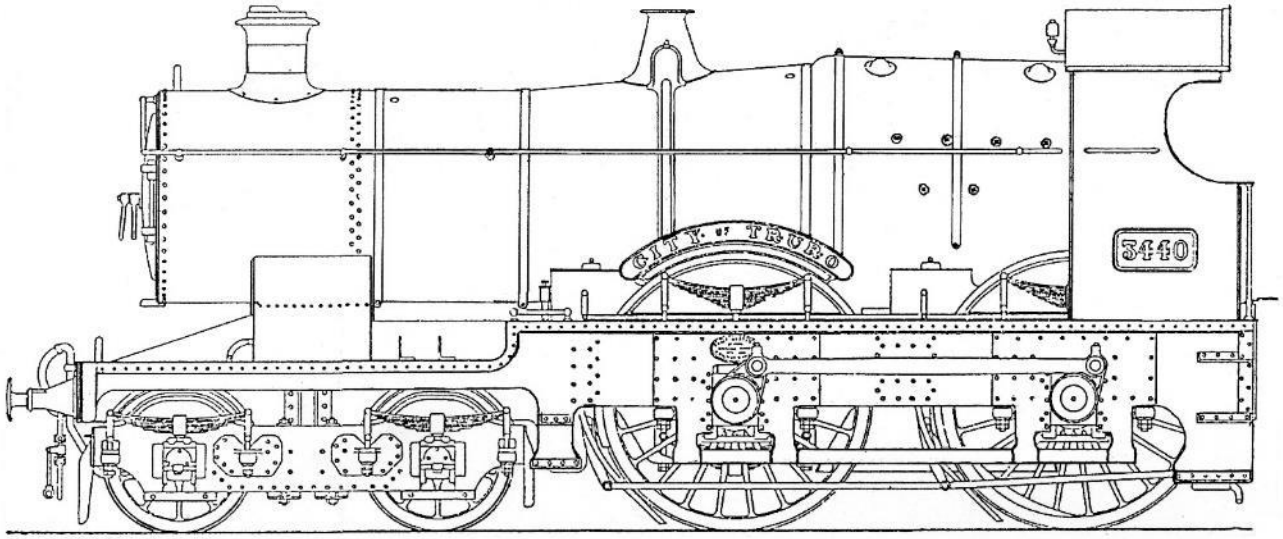
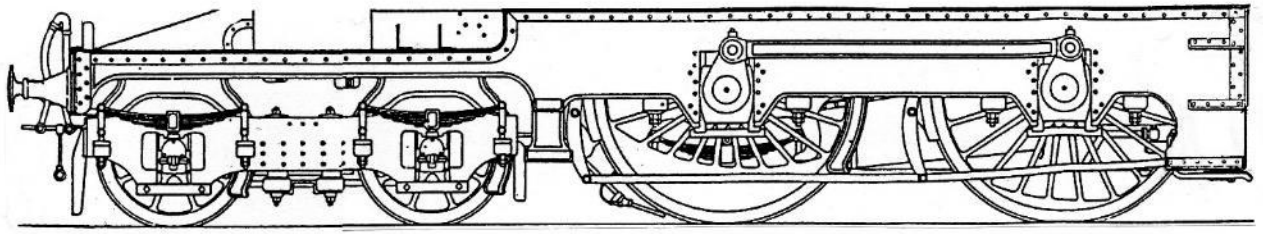
70
64
71
51
96
95





AS RUNNING IN THE 1920S

TOP FEED – SEPARATE FRAME STRENGTHENING PIECES FOR EACH AXLE
LARGER SANDBOXES ABOVE FOOTPLATE – COPPER CAPPED CHIMNEY
LATER, DEEPER BOGIE FRAMES WITH STRENGTHENING PATCHES
LOW VACUUM PIPE

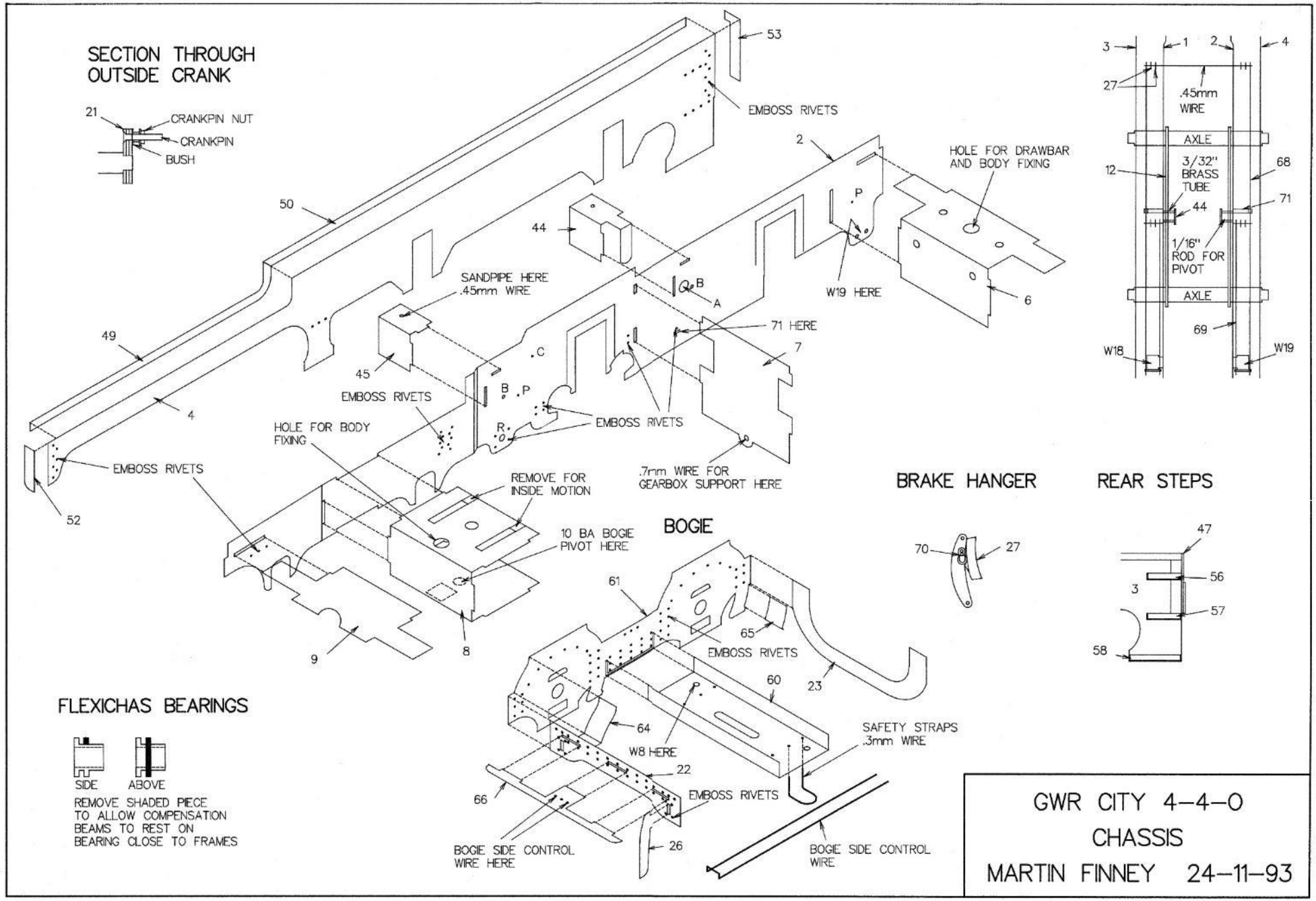


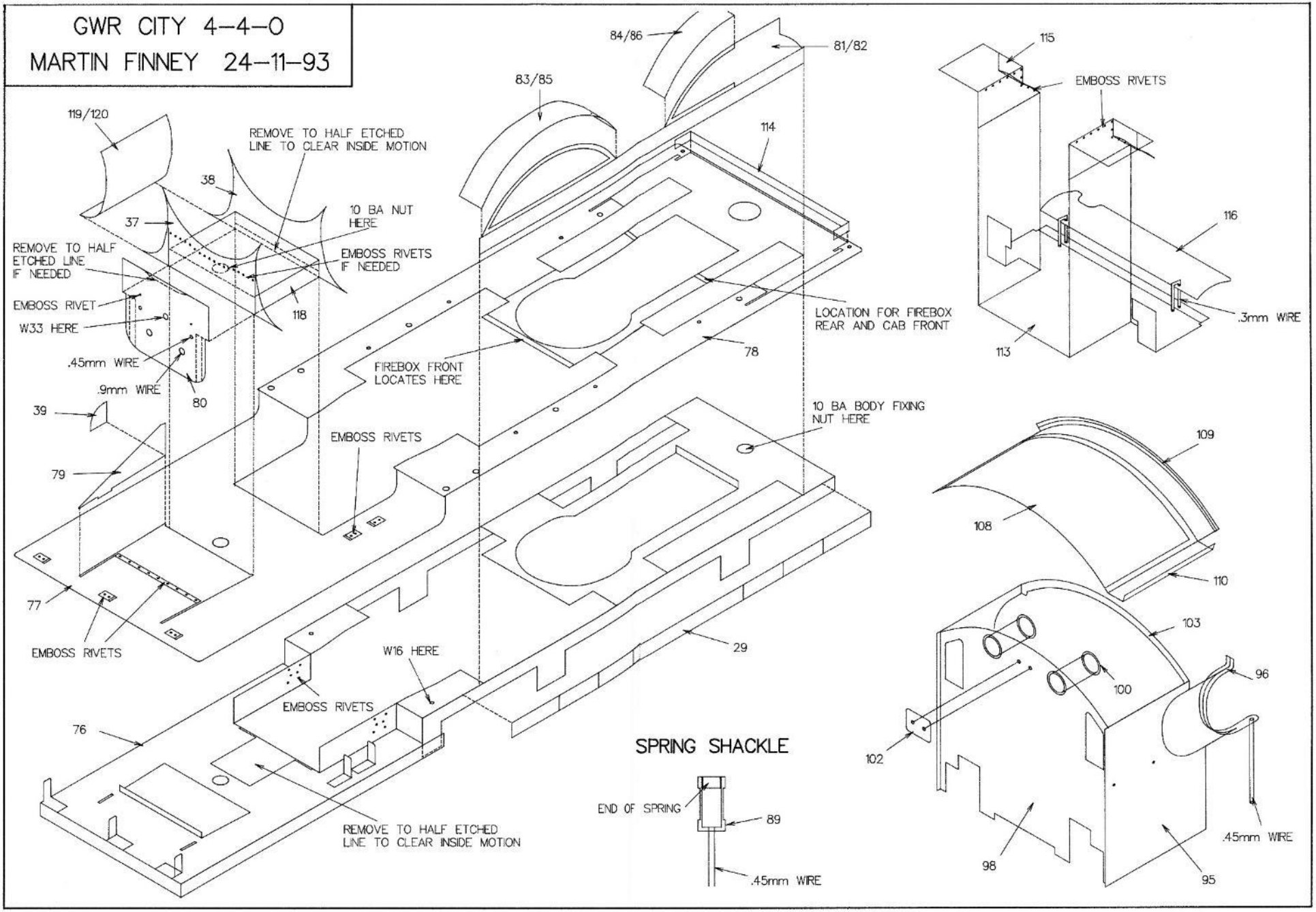
AS BUILT – CIRCA 1903

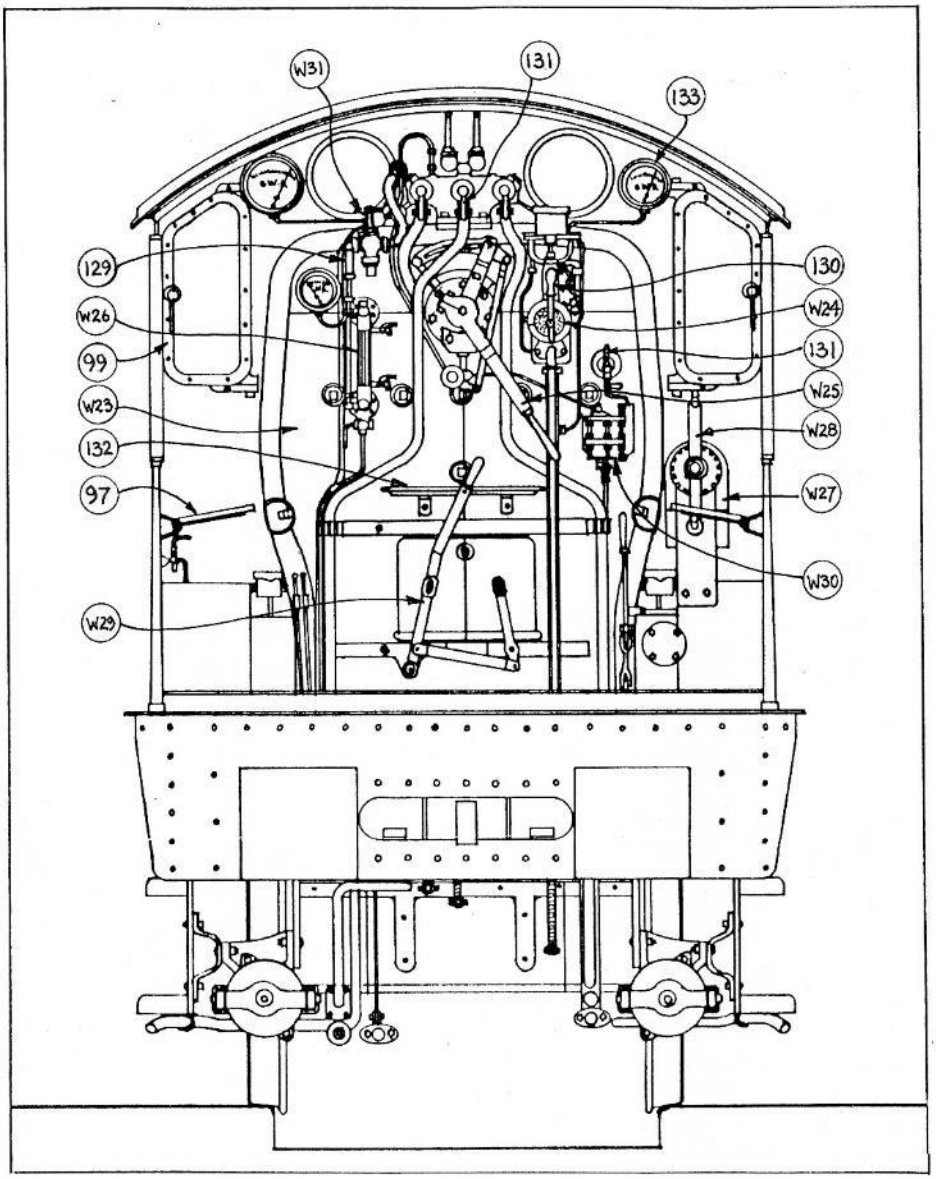
WITHOUT TOP FEED – SPLASHER BEHIND LEADING COUPLED WHEEL
ORIGINAL BOGIE WITH SPLASHERS AND FULL BEADING
HIGH VACUUM PIPE

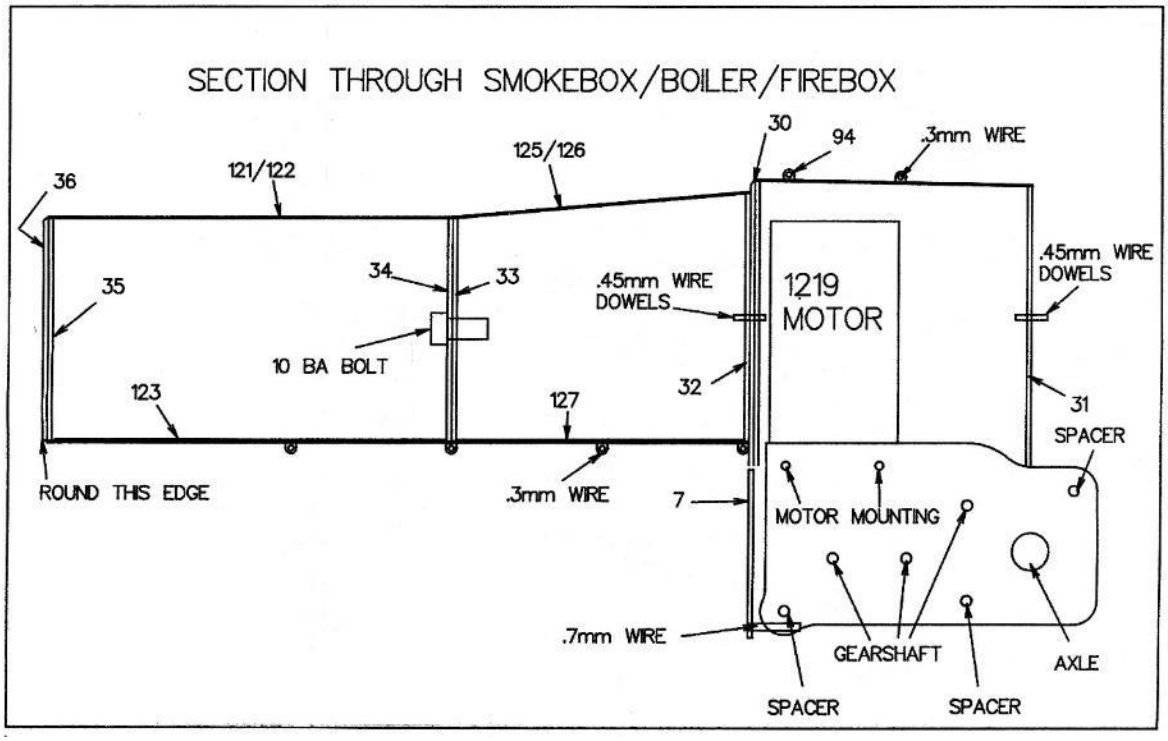
GWR CITY 4–4–0

MARTIN FINNEY 29–11–93


SECTION THROUGH OUTSIDE CRANK
21
CRANKPIN NUT
CRANKPIN
BUSH
53
EMBOSS RIVETS
2
HOLE FOR DRAWBAR AND BODY FIXING
50
44
SANDPIPE HERE .45mm WIRE
W19 HERE
6
71 HERE
7
49
45
EMBOSS RIVETS
EMBOSS RIVETS
4
HOLE FOR BODY FIXING
EMBOSS RIVETS
52
REMOVE FOR INSIDE MOTION
.7mm WIRE FOR GEARBOX SUPPORT HERE
10 BA BOGIE PIVOT HERE
9
8
BOGIE
61
65
EMBOSS RIVETS
60
23
64
W8 HERE
SAFETY STRAPS .3mm WIRE
22
66
EMBOSS RIVETS
26
BOGIE SIDE CONTROL WIRE HERE
BOGIE SIDE CONTROL WIRE
FLEXICHAS BEARINGS
SIDE
ABOVE
REMOVE SHADED PIECE TO ALLOW COMPENSATION BEAMS TO REST ON BEARING CLOSE TO FRAMES
3
1
2
4
27
.45mm WIRE
AXLE
12
3/32" BRASS TUBE
68
44
71
1/16" ROD FOR PIVOT
AXLE
69
W18
W19
BRAKE HANGER
70
27
REAR STEPS
47
56
3
57
58
GWR CITY 4-4-0
CHASSIS
MARTIN FINNEY 24-11-93


GWR CITY 4-4-0
MARTIN FINNEY 24-11-93
84/86
81/82
83/85
114
119/120
REMOVE TO HALF ETCHED LINE TO CLEAR INSIDE MOTION
38
37
10 BA NUT HERE
EMBOSS RIVETS IF NEEDED
REMOVE TO HALF ETCHED LINE IF NEEDED
EMBOSS RIVET
W33 HERE
.45mm WIRE
.9mm WIRE
80
118
LOCATION FOR FIREBOX REAR AND CAB FRONT
78
FIREBOX FRONT LOCATES HERE
39
79
EMBOSS RIVETS
10 BA BODY FIXING NUT HERE
77
EMBOSS RIVETS
W16 HERE
29
EMBOSS RIVETS
76
REMOVE TO HALF ETCHED LINE TO CLEAR INSIDE MOTION
SPRING SHACKLE
END OF SPRING
89
.45mm WIRE
115
EMBOSS RIVETS
116
.3mm WIRE
113
109
108
110
103
100
96
102
98
95
.45mm WIRE


W31
131
133
129
130
W26
W24
99
131
W23
W25
132
W28
97
W27
W30
W29


SECTION THROUGH SMOKEBOX/BOILER/FIREBOX
30
94
.3mm WIRE
125/126
121/122
36
.45mm WIRE DOWELS
35
34
33
.45mm WIRE DOWELS
1219 MOTOR
10 BA BOLT
32
123
127
31
SPACER
ROUND THIS EDGE
.3mm WIRE
7
MOTOR MOUNTING
.7mm WIRE
GEARSHAFT
AXLE
SPACER
SPACER