Brassmasters Scale Models

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EasiChas

Chassis Kit for Bachmann A1 Locomotive and Tender

For EM and P4 Gauges only

Prototype notes and instructions

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1 Introduction

1.1 The EasiChas frames for the Bachmann A1 locomotive, based on the original concept devised by John Brighton, have been specifically designed to allow easy conversion to EM or P4 gauge, which results in a fully sprung locomotive and tender. Furthermore, the basic conversion can be completed without the need to solder any of the main components together, although a way has not been found to attach the valve gear return crank without soldering.

1.2 The resulting locomotive has been found to be very sure footed and has managed, without any extra weight being added, to start and haul 16 ready to run coaches up a gradient of 1 in 200.

1.3 There are various levels of conversion with the builder choosing which, of any, additional detail required beyond the basic conversion.

1.4 Basic level of conversion makes use of:

fold up mainframes and keep plate with sprung bearings
fold up replacement bogie
fold up replacement tender frame with sprung bearings.

1.5 Further components are provided to add to the detail of the conversion. These are, working from the front:

AWS receiver protection plate
drilling jig to allow lifting holes to be drilled in front frame extensions
new middle cylinder cover and footplate overlay
overlays for the main frames in front of the cylinders with bogie wheel splashers
separate bogie dust guards
replacement coupling rods
replacement return crank
replacement tender brake gear
replacement tender guard irons

2 General Notes

2.1 There are two etches, one for the loco and one for the tender. Numbers shown in square brackets [ ] in the instructions refer to the etch (L for the loco etch and T for the tender etch) and part numbers, e.g., [L2] is part 2 on the loco etch. The part number appears on the separate etch diagrams. Certain parts, e.g. bolts, wire, springs, are not numbered.

2.2 Some of the parts are small and easily damaged, so do please take care. Parts should be removed from the sheets as and when needed by use of a small scalpel etc., and the tabs and etch cusp removed with a small fine-cut file.

2.3 All folds and bends are made with the half-etched line on the inside unless otherwise stated.

2.4 On some parts it is necessary to emboss rivet / bolt heads from the reverse sides by use of a punch.

2.5 There are half etched test rivet holes on the back of the etch edging strip. Use these to get used to forming uniform rivets.

3 Dismantling the locomotive

3.1 Tools Required

A selection of cross head and normal miniature screwdrivers
Small pliers

3.2 To remove the body from the chassis remove 2 screws from under the cab floor and one screw from under the front wheel of the bogie (mark up where the screws come from for later use). Unclip the wire-operating rod, LHS, from the motion bracket and slide back into the cab for safekeeping. Withdraw the chassis, making sure that you retain the loco-tender draw bar which will come away with the body. Put the body to one side.

3.3 Unscrew the 3 screws from the cylinder, slide bar support and motion bracket saddles (again marking up their identity).

3.4 Remove both crank pin screws from the centre axle and slide off the return cranks and connecting rods.

3.5 The front bogie and keeper plate is one assembly. See Photo 31. Remove the 3 screws on the keeper plate and gently press the keeper plate away from the chassis at the very front and behind the rear driving axle. Once free cut the red and black feed wires and tuck out of the way in the chassis for now, leave a tiny bit of wire on the keeper plate so you can see to which side the red and black motor feed are connected. Put the sprung plunger from under the front axle to one side.

3.6 Remove the wheel sets from the chassis, unscrew the machine screws from the remaining wheels and remover the coupling rods. Put the screws back into the wheels for safekeeping.

3.7 Hold the centre wheels and with a twisting pulling motion pull off the wheels from the axle (you will need to hold the axle with small pliers to get the second wheel off). Also slide off the plastic bushes.

3.8 Using a pair of pliers on one side of the gear wheel, gently slide the plastic gear down and off the axle by holding the axle vertical and pressing down. It is very important not to damage this gear.

3.9 Using two small normal screwdrivers, one on the top and one on the bottom, unscrew the bogie retaining screw from the boss. Note there is a washer between the bogie and keeper plate. Once free put the bogie to one side and re-assemble the screw washer and boss for use later.

3.10 Using a cross head screwdriver, unscrew the trailing wheel screw and remove the wheel carrier and spring. Unclip the Bachmann wheelset.

4 Dismantling the tender

4.1 Remove the coupling from the housing by gently prising it off with a small screwdriver.

4.2 Remove the front two fixing screws.

4.3 Prise out the rear axle and remove wheel set - quite a lot of force is required!

4.4 Unscrew the third fixing screw from under the rear axle. Keep all the screws safe. Put the tender body to one side for safety.

4.5 Remove the coupling housing by unscrewing the fixing screw from the top of the chassis.

4.6 Prise out the remaining axles and wheel sets. Your loco and tender are now ready for conversion.

5 Basic loco conversion

5.1 Remove the 3 sections from the middle of the loco mainframes [L1] and put the two washers [L3] and slide plates [L20 &L21] in a safe place for later use. Place the frames flat on the bench and with a thin metal rule fold to produce a 'U' section. Either again using a ruler or using a strong pair of pliers, fold up the small sections along the edge of the main frames at 90 degrees. See Photo 1 and Photo 2.

5.2 Ensure the mainframes fit over the original Bachmann chassis, the narrow slot in the etch fitting over the footplate support brackets. Note that they will need to be eased over the raised part of the Bachmann chassis by the driving wheel slots. The new frames will click into place once they are in the correct position. Remove the mainframes; they will need springing out at the tops to clear the edges and bosses on the cast chassis.

5.3 Check the fit of the brass bearings into the slots in the mainframes. If tight, using a smooth sharp file lightly file away the cusp equally on both of the edges of the slots until the bearing slides up and down with no binding. It is very important that too much metal is not removed resulting in a sloppy fit – no side play whatsoever is the aim, just a smooth sliding fit. See Photo 3 and Photo 4.

5.4 Remove the 3 parts from the locomotive keeper plate [L2] and put the washers [L3] in a safe place. Emboss the rivets on the locomotive keep plate [L2], 4 above each spring hanger. Fold up both sides at 90 degrees. See Photo 5.

5.5 Fit the mainframes to the Bachmann chassis, place the bearings in the slots and temporarily fit the keep plate, using the original Bachmann screws and a spacing washer [L3] under the head of each screw. See photo 32. Ensure the bearings slide to the bottom of each slot in the keep plate. If there is any tightness, lightly file away the cusp until there is no binding. See Photo 6.

5.6 Fold up the brake hanger attachment points so that they form a flat bottom 'V' shape (rather than a parallel-sided 'U' shape).

5.7 Take the new 3mm axles and test fit them, firstly in the axleboxes (if tight ream them out to 3mm using a reamer or, if you do not have one, a small round file), then place each through the axleboxes and through the "slots" in the Bachmann chassis block. If tight gently file the slots in the Bachmann chassis to allow the axle to move freely. The most likely problem will be the front edge of the leading axle.

5.8 Mount the Bachmann worm wheel onto the new axle by gentle pushing the gearwheel into the worm wheel, carefully ensuring that the worm wheel is offset on the axle. If it is a loose fit, a simple pop mark on the axle will grab the worm wheel. See photo 33.

IMPORTANT - Carefully examine the bearings as they are not symmetrical. It can be seen that the flange on one side of the slot is wider than the other side. For EM gauge the bearings need to be mounted in the frames with the thicker flange towards the

centre of the frames. For P4 gauge the bearings need to be mounted with the thinner flange towards the centre of the frames. Increased side-play on the drivers can be obtained by having the thin side of the bearings on the outside or rubbing off the circular beading round the axle hole.

5.9 Mount the bearings on all axles the correct way round, then any spacing washers required (there will be about 0.7mm lateral movement of an axle with no washers in 18.83 gauge –so not many washers are required) and finally mount the wheels on the axles. Quarter the wheels with the right hand wheel leading the left hand wheel by 90 degrees (a three cylinder loco should be 120 but can cause problems on a model).

5.10 Place the bearing springs over the tongues on the frames, fit the wheelsets into the main frames and attach the keep plate. Check that the motor turns the centre wheelset with no sign of any binding.

5.11 With luck you can re-assemble the Bachmann coupling rods onto the crankpins using the special bushes provided. See photo 34. Check that all the wheels now turn without binding when power is applied to the motor. A better solution is to solder up a new set of coupling rods (see 7.7).

5.12 The bogie is intended to be built as compensated with a spring between bogie and chassis (as in the Bachmann original) although it can be built as sprung (for the sprung version see 7.5). For the basic version, open the holes on the bogie etches [L4], [L5], [L6] and [L7] for the bogie wheel axles or 16BA bolts as appropriate. The axle holes should allow the axle to slide or rotate freely without any slop.

5.13 The basic bogie has the dust guards attached to the main spacer (for separate dust guards see 7.6). Emboss the rivets for the dust guards.

5.14 The prototype bogie sideframes were assembled to the stretcher by countersunk rivets. These sometimes were not flush. If required, push through lightly the half etched rivets on the sideframes.

5.15 Fold up the bogie sideframes [L4] and main spacer [L5], bend the spacer [L6] back on itself through 180 degrees to make a double thickness (with the half etch line on the outside) and fold down the small triangular sections on the top plate [L7]. Apart from spacer [L6], ensure that every other angle is 90 degrees. See Photo 7 and Photo 8.

5.16 Fit the main spacer into the sideframes. This should be a fairly tight fit, but shouldn't force the sides of the sideframes outwards. Ensure that the axle holes in both etches line up. Also ensure that the vertical front and rear plates of the main spacer line up with the sideframes. Any slight discrepancy can be corrected by tweaking one or more of the bends. See Photo 9 but note that the spacer [L6] is missing in photo 9.

5.17 Assemble the bogie by adding the spacer [L6] (with the larger hole towards the bottom) on top of the main spacer, followed by the top plate. Ensure that the tail of the top plate engages into the small slot in the rear plate of the main spacer. See photo 19 of completed bogie. Fit the two 16BA screws and nuts, passing the screws through the mounting holes from the top. An etched spanner [L8] is provided which needs bending at 90 degrees along the etch line, to hold the nut whilst the screw is tightened with a screwdriver..

5.18 Fit the wheels to the bogie using sufficient spacing washers to ensure there is no sideplay. Bend the guard irons to shape. See photo 18. Bend the dust guards back but not quite as far as the bogie side frame angle.

5.19 Cut the Bachmann keeper plate with a saw as indicated in Photo 10. See Photo 11. Ensure that the remaining front portion does not foul on the new sideframes or keep plate

5.20 Re-assemble the bogie to the front part of the Bachmann keep plate using the original screw and special nut, but using one of the new springs provided and with etched washer [L9] between the top of the spring and the underside of the Bachmann keep plate. (You will need to loosen the front fixing screws on the new keeper plate to slide the original bogie carrying block into place). See photo 35.

5.21 Fit the new trailing wheelset into the Bachmann rear truck with sufficient washers to take up most of the float. Attach the rear truck into the Bachmann chassis using the other new spring.

5.22 The original Bachmann keeper plate can be re-used as a pickup plate.

5.22.1 First carefully cut the brake gear off the Bachmann keep plate by sawing next to the main part of the centre solid section. Keep safely for later use. Then remove the springs again cutting with a saw. See photo 12. The original keeper plate screws are not quite long enough to retain this plate so deepen the countersunk holes with a 1/8" or approx. 3.5mm drill – do not open the holes right through! Remove the plastic central rib where this interferes with the screw/washer retaining the new brass keeper plate. Test fit the plastic pickup plate to ensure it fits flush.

5.22.2 Gently bend the phosphor bronze pickup wipers so they both touch the rear of the wheels (including when they move from side to side) and clear the new etched springs. See Photo 13

5.22.3 Remove the pickup plate and the keeper plate and file two "notches" in the keeper plate to line up with those in the rear of the chassis for the motor wires (sorry we forgot to etch these!) Unscrew the PCB block from the chassis behind the motor and feed the wires through the chassis. Solder to the pickup plate (this is why a little wire was left on the pickup plate - to get the polarity correct! Mine was Red to left side looking forward from above). If using wheels that have one side live to the chassis/frames there is a small tabbed washer [L10] provided to attach to the original Bachmann wire and which is placed under the rear frame screw. The piclups in place are shown in Photo 14.

5.23 Test run the chassis. If it is intended to run the loco round tight curves on a loco where the chassis/frames are live, then it may be necessary to remove the front leg of the leading brake hanger attachment point on each side of the sideframes together with the front sanding pipes. This is easy to do once the model is completed so a decision does not need to be made at this stage.

5.24 Clean up the cut line on the plastic brake hangers to ensure there are no raised edges. Attach the brake hangers to the brake hanger attachment points using cyanoacrylate glue or epoxy resin.

5.25 Take the brake pull rod etch [L11] and clip it into the holes in the bottom of the brake hangers.

5.26 Diagram 1 shows the new arrangement for the return crank and Photo 15 the completed valve gear (with replacement Rods). Remove return crank from the Bachmann valve gear by drilling out the rivet attaching it from behind; be careful not to damage the hole in the valve gear as a new rivet will have to go through this.

5.27 Form the new return crank by soldering the Return crank front [L12] to the return crank rear [L13]. Solder the return crank assembly to a crank pin nut.

5.28 Screw the return crank onto the centre crankpin. Adjust the length of the crankpin so the return crank sits at the same angle as the original Bachmann one.

5.29 When satisfied with the angle when fully tightened, attach the other end of the return crank to the Bachmann valve gear by a rivet inserted through the valve gear from the front. The rivet can be attached by squeezing with pliers firmly so the back expands. An alternative is to oil the moving link and carefully solder the rivet to the rear of the return crank working quickly with a very hot iron. The hole etched in the return crank is for those wishing to drill and tap the crank. This should be filled with low melting point solder or filler and filed flush.

5.30 Replace the cylinders and valve gear onto the chassis. Check the valve gear runs freely under power.

5.31 Attach the driving wheel balance weights [L14] and the coupled wheel balance weights [L15] to the wheels, using photographs to ensure the correct position.

5.32 Re-fit the loco body. It may be necessary to open out the motor hole in the footplate with a large flat file as the chassis is now marginally wider. The basic loco conversion is now complete. See photo 35.

6 Basic tender conversion

6.1 Taking the tender frames [T1], fold the outer half of the slotted sections back on themselves. Note: the etched line is on the outside of the bend. To ensure a tight bend, squeeze the two halves together using a pair of pliers.

6.2 Open up the slots in the tender frames [T1] so that the tender axles slide freely without any slop.

6.3 Bend out the eight small ears on each side of frames at 90 degrees.

6.4 Ensure that the new frames fit into the Bachmann tender (a light file around the rear slot and front edges of the frames may be necessary. It may also be necessary to remove a small amount of plastic along the bottom of the tender around the round ejection pin marks to ensure the frames fit flat).

6.5 Fold up the 8 axleboxes [T2]. This is best done by placing the etch with the ½ etched middle section perpendicular to the edge of a rule, or similar, to form a ‘T’ shape. Push down on each end of the etch so that it begins to wrap over each side of the rule. See photo 36. Remove from the edge of the rule and push together between the fingers. Complete the bend by squeezing the two edges furthest from the bend with a pair of pliers. The holes in the two halves of the folded section should be in line. Open out the holes so that the axles rotate freely without and slop.

6.6 Assemble the outer two tender wheelsets through the tender frames by firstly fitting a bearing, then fitting the axle through the frame, then fitting the second bearing, and finally the second wheel. Sufficient washers also need to be fitted between the wheel and the bearing to ensure there is minimum sideplay. See Photo 28.

6.7 Assemble the other two wheelsets in the same way but without the spacing washers.

6.8 Slide a piece of 0.25mm spring wire through the first ear on one side of the frames, then through the slot in the top of the first axlebox, through the next ear, and so on until all 4 axleboxes are mounted on the wire. Bend the wire over at each end to retain it. Repeat for the other side of the frames.

6.9 Fit the frames to the Bachmann tender using the original Bachmann retaining screw. If preferred, a second screw can be fitted through the hole in the brass frames towards the front of the tender. See Photo 14.

6.10 The basic tender conversion is now complete.

7 Additional loco components

The following additional items are provided in the kit and may be used if the builder requires.

7.1 Drilling jig for front frame lifting holes

7.1.1 Take the jig [L16] and hold it in place over the step on the outside of the front frames on the loco body. Using a 0.75 mm drill, spot through the hole and drill through the plastic frame, open up with a 1.1 mm drill. Repeat for the other side.

7.2 Front chassis overlays

7.2.1 Emboss the rivets in the two front chassis overlays [L17 and L18].

7.2.2 Curve the two bogie wheel splashers [L19] to match the radius of curve above the bogie wheel. NOTE: the two should be of opposite hands. See Photo 20.

7.2.3 Solder the splashers into position. The angled corner should be to the outside and towards the rear of the loco.

7.2.4 If required to fit the representation of the bogie slide covers, bend up the tab on the bottom of the chassis overlay to 90 degrees. Solder the middle plate [L20] and the bottom plate [L21] to the bottom of the tab to form a cut off pyramid shape - see Diagram 2 and Photo 20. File carefully to shape– see prototype Photo 16 (this is an A2/3 but these were of the same design). Repeat for the other side.

7.2.5 File off the detail on the Bachmann chassis ahead of the cylinders and attach the overlays using cyanoacrylate or epoxy resin.

7.3 Replacement center cylinder cover

7.3.1 The Bachmann model has this moulded against a vertical back plate whereas it should be angled (parallel to the sloping front frames - see photos). This is not a simple modification but the resulting improvement in the front of the loco is noticeable.

7.3.2 Study photos of the prototype.

7.3.3 Emboss the rivets on the centre cylinder cover overlay [L22]. See photo 21 and photo 22. Ensure that it fits over the valve rod cover and sits at the appropriate angle. Take the crescent shaped cover [L23] and gently file the so that the bottom edge fits into the recess, sitting flush at the (flat) bottom but the top is proud, thereby giving an angled plate as in the prototype. Solder in place. If required, remove the plastic valve rod cover and replace with a piece of 1.2mm diameter brass rod soldered into the overlay . There was also a feed pipe to this cylinder, which can be formed from copper wire (not supplied –use strands of multi-core electrical wire).

7.3.4 Attach the complete assembly to the front of the loco using cyanoacrylate or epoxy resin.

7.4 AWS receiver protection plate.

7.4.1 Not all locos had the AWS protection plate - study photos of the prototype. Emboss the rivets in the AWS receiver protection plate [L24] and bend to shape. This varies from nearly 30 degrees from vertical when ex works, to vertical when repeatedly bashed!

7.4.2 Attach to the front of the loco using cyanoacrylate or epoxy resin.

7.5 Fully sprung bogie

7.5.1 If desired the front bogie can be sprung rather than compensated. Open up the leading axle holes in the bogie sideframes to the half etched marks. Ensure the axles can slide freely without any slop.

7.5.2 Remove the tail from the top plate.

7.5.3 Assemble the bogie by fitting the main spacer into the sideframes. Place two lengths of 0.25mm spring wire in the half etched slots in the top of the main spacer. Trap the wires in position by placing the spacer on top of the main spacer, followed by the top plate. Fit the two 16BA screws and nuts, passing the screws through the mounting holes from the top. An etched spanner [L8] is provided to hold the nut whilst the screw is tightened with a screwdriver, which needs bending at 90 degrees along the etch line.

7.5.4 Fit the wheels to the bogie using sufficient spacing washers to ensure there is no sideplay. Ensure the spring wire is above the axles.

7.6 Separate dust guards

7.6.1 To fit the separate dust guards, first break off the integral dust guards on the front of the bogie and file flat. Solder the separate dust guards [L22 and L26] to the bogie front using the half etched lines as a guide.

7.7 Replacement coupling rods.

7.7.1 Each side is manufactured from 4 etches and hinged behind the center crank pin. There are also overlays for the bosses. In all cases cut the half etch supporting the bosses near the bosses and away from the rods in order to not distort the rods.

7.7.2 Cut rods from fret [L27 & L28]. Remove the bosses from the center but do not separate the two sides of the rods. See photo 23.

7.7.3 Bend the half etch tabs between each pair of rods to allow the rods to touch back to back - this holds them accurately ready for soldering. It is critical to align the two halves exactly in order to make one rod so take some time tweaking. Do not clean off the tabs from the rods at this stage in order to minimise risk of distortion. See photo 24 and photo 25.

7.7.4 Place a little flux along the top surface of the rod and apply heat; the solder on the soldering iron will run down between the rods and join them. The secret is to apply only a little solder at a time. Solder will fill the “cusp” and give the impression of a solid rod. See photo 26. Repeat for the whole length of the rod.

7.7.5 There are four bosses – the front boss [L29] and the centre boss [L30] are fitted to the leading coupling rod, and the the rear boss [L31] and the forked joint boss [L32] are fitted to the trailing coupling rod. The front boss [L29] forms a recessed hole for the front crankpin. Spare bosses are provided on the etch. Apply each boss holding in place with a cocktail stick and solder in place using the same technique as for joining the rods. Clean up each rod with files. Carefully blend the bosses into the front face of the rods.

7.7.6 The rear length of each rod has a knuckle joint to manufacture. The front and rear rods are joined with a rivet which is pushed through from the front and then cropped back on the rear leaving about 0.5mm proud. To stop solder flooding the joint apply a little oil to the surfaces not to be soldered - this will prevent the solder running into the joint. Keep the rear of the rod clean. Solder can then be quickly applied with a very hot iron to fix the rivet in place. Clean off excess solder leaving enough to keep a strong joint. See photo 27 of completed Rods

7.7.7 Open up the crankpin holes in order that the crankpin bushes will rotate in the rod. This can be done with a reamer, broach or a fine Swiss file. The front recessed boss must have a very short bush.

7.7.8 Fit the rods to the wheels and test run.
Note: on the A1 the axle protrudes beyond the wheel face, therefore ensure the rods do not catch on the axles. If necessary fit washers behind the rods.

8 Additional tender components

8.1 Tender brake gear.

8.1.1 The prototype had double pull rods, one each side of every wheel (i.e. 4 rods). The Bachmann tender has brake hangers and pull rods moulded in-line with the frames. See photo 28 of finished model. If desired remove these and replace as follows:

8.1.2 There are two versions of the tender brake blocks and hangers, the fully detailed version and the outline version. For the detailed version it is necessary to solder the two halves of each brake hanger together See photo 27, whereas for the outline version a single etch is provided for each brake hanger.

8.1.3 Drill out the holes in the tender frames to clear 0.7 mm wire. Also drill out the top and bottom holes in each brake hanger to clear 0.7 mm wire.

8.1.4 For the detailed version of the brake hangers solder together the two halves [T3 and T4] of the leading brake hanger. See photo 27. Repeat for the second leading brake hanger. Solder together all of the remaining brake hanger halves [T5 and T6].

8.1.5 Place a 24 mm long piece of 0.7 mm brass wire through each of the holes in the tender frames but do not solder. Hold centrally by using a piece of masking tape.

8.1.6 Solder a brake hanger (either the detailed ones assembled above or the outline version [T7, T8, T9 and T10] to each end of each piece of wire so that the brake block touches the wheel in the correct position on the tread.

8.1.7 Solder a piece of wire between the bottom holes of each pair of brake hangers, using the rear hole in the leading hanger, leaving a sufficient amount protruding each

side to allow the outside pull rods to clear the front face of the wheels. Remember to allow for side play.

8.1.8 Place a brake pull rod [T11] over the ends of the protruding brass wire on both sides of the tender. See photo 29.

8.1.9 Rotate the brake hangers backwards so that the brake blocks clear the wheels adequately and solder the top cross wire in the frames. Once the first one is done the pull rods will hold all the others in the correct position.

8.1.10 Solder the outside pull rods to the brass wire, allowing sufficient clearance for side play.

8.1.11 Cut a small section from the middle of the lower cross wires. Place the pull rods over the wire and solder in position allowing sufficient clearance for side play.

8.1.12 Trim the lower wire to the inside and outside of each brake hanger.

8.1.12 File through (do not snip - it will distort the chassis) each of the top wires between the frames and then trim each back flush with the inside of the frames.

8.1.13 Take the front Bachmann plastic brake cross shaft and front pull rods and carefully shorten the cross shafts so it fits in the front etched brake hanger holes. Clip in place.

8.2 Tender guard irons.

8.2.1 Cut off the moulded plastic guard irons from the Bachmann side frames.
Emboss the rivets on the etched guard irons [T12] and bend to shape.

8.2.2 Attach guard irons to the inside face of the Bachmann side frames using cyanoacrylate or epoxy resin.

Etched Component List

L1	Loco mainframes	L26	Dust guard right
L2	Loco keep plate	L27	Leading coupling rods (2)
L3	Keep plate washer (3)	L28	Trailing coupling rods (2)
L4	Bogie side frame	L29	Front coupling rod boss (2)
L5	Bogie main spacer	L30	Middle coupling rod boss (2)
L6	Bogie spacer	L31	Rear Coupling rod boss (2)
L7	Bogie top plate	L32	Forked joint boss (2)
L8	Spanner	L33	Spacer washers for 3 mm axles
L9	Bogie spring washer		
L10	Tabbed washer		
L11	Brake pull rods		
L12	Return crank front (2)	T1	Tender frames
L13	Return crank rear (2)	T2	Tender axleboxes (8)
L14	Driving wheel balance weights (2)	T3	Leading brake hanger 1st half (2)
L15	Coupled wheel balance weights (4)	T4	Leading brake hanger 2nd half (2)
L16	Frame drilling jig	T5	Brake hanger 1st half (6)
L17	Front chassis overlay left	T6	Brake hanger 2nd half (6)
L18	Front chassis overlay right	T7	Leading brake hanger (outline) left
L19	Bogie wheel splasher (2)	T8	Leading brake hanger (outline) right
L20	Bogie slide cover middle (2)	T9	Brake hanger (outline) left (3)

L21	Bogie slide cover bottom (2)	T10	Brake hanger (outline) right (3)
L22	Centre cylinder cover overlay	T11	Brake pull rod (4)
L23	Upper cylinder cover outer	T12	Tender guard iron left
L24	AWS protection plate	T13	Tender guard iron right
L25	Dust guard left	T14	Spacer washers for 2 mm axles

Other Components List

	Brass axleboxes (6)
	Axlebox springs (6)
	16 BA screw (2)
	16 BA nut (2)
	Replacement bogie and truck springs (2)
	0.25mm spring wire
	0.7mm brass wire
	Steel bushes for Bachmann coupling and connecting rods (8)

Diagram 1 – Return Crank Assembly

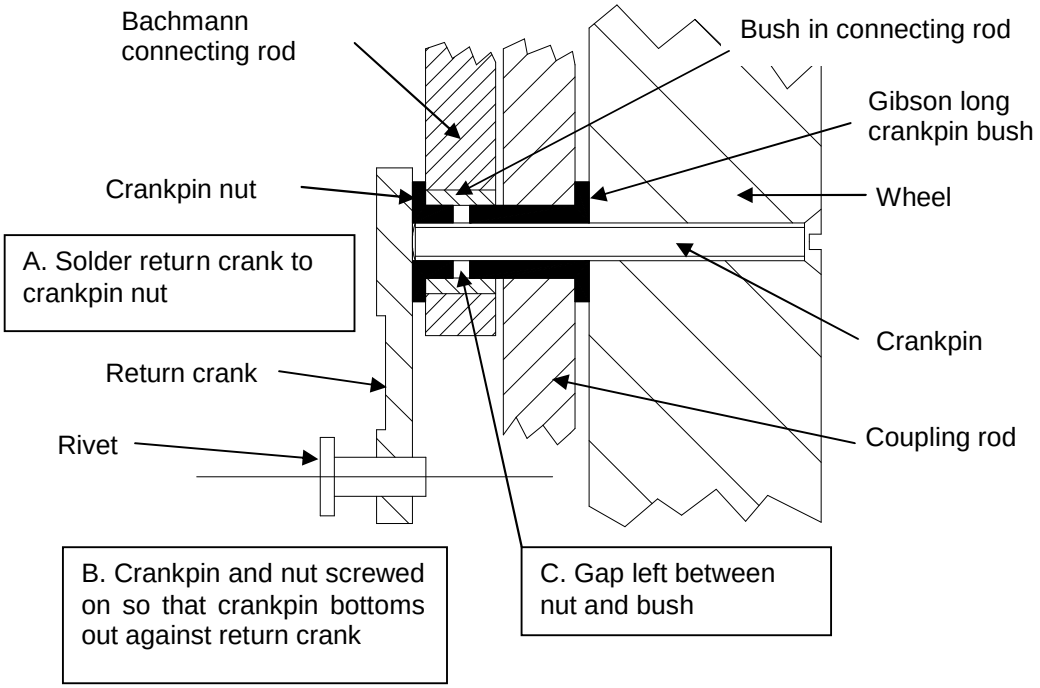

Diagram 2 – Slide Cover