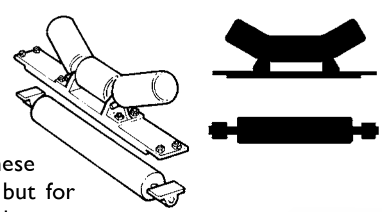
NG Sand & Gravel

014 Industrial Layout Part 3 – Building the Conveyors

Photos & drawings: REVIEW Studio

WHILE I DON'T FAVOUR the 'fairground' approach to operating layout accessories, early on I decided that a determined attempt would be made to create 'working' sand machinery to give some life to the scene, even when trains were not running. Belt conveyors, which replaced rail as a means of sand transport through the 1950s and 60s, were thus essential. I also wanted a screen and some means of hiding the fact that the 'sand' was not really going anywhere. Loose sand does not work well in 7mm scale. Fortunately, I had details of a 'wet washer', conveyor fed, where the sand and water mix was fed via a pump and pipes to a separator on top of storage bins.

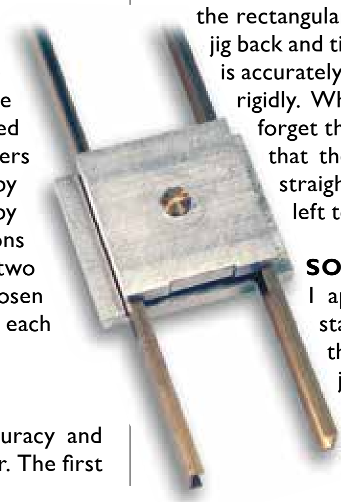
CONVEYORS



Some years ago, I made patterns for the top and bottom conveyor rollers and had them lost wax cast, in brass. The spacing of these varies, depending on load but for sand, four feet centres for the support rollers is sufficient. The lower, return rollers, are spaced at eight feet. The side runners of the conveyors are made from milled brass channel, 5mm x 2mm. My material came from John Flack but, since then, he has retired and passed his business on to Eileen's Emporium. A pair of side runners are cut to the required length. You can work this out by multiplying the number of rollers required, plus one, by four scale feet (28mm). The extra is for the end extensions and roller bearing/adjuster. Remember that, as there two top rollers to every one bottom roller, the number chosen must be odd, to ensure there is a bottom roller beneath each top roller at either end.

JIGS

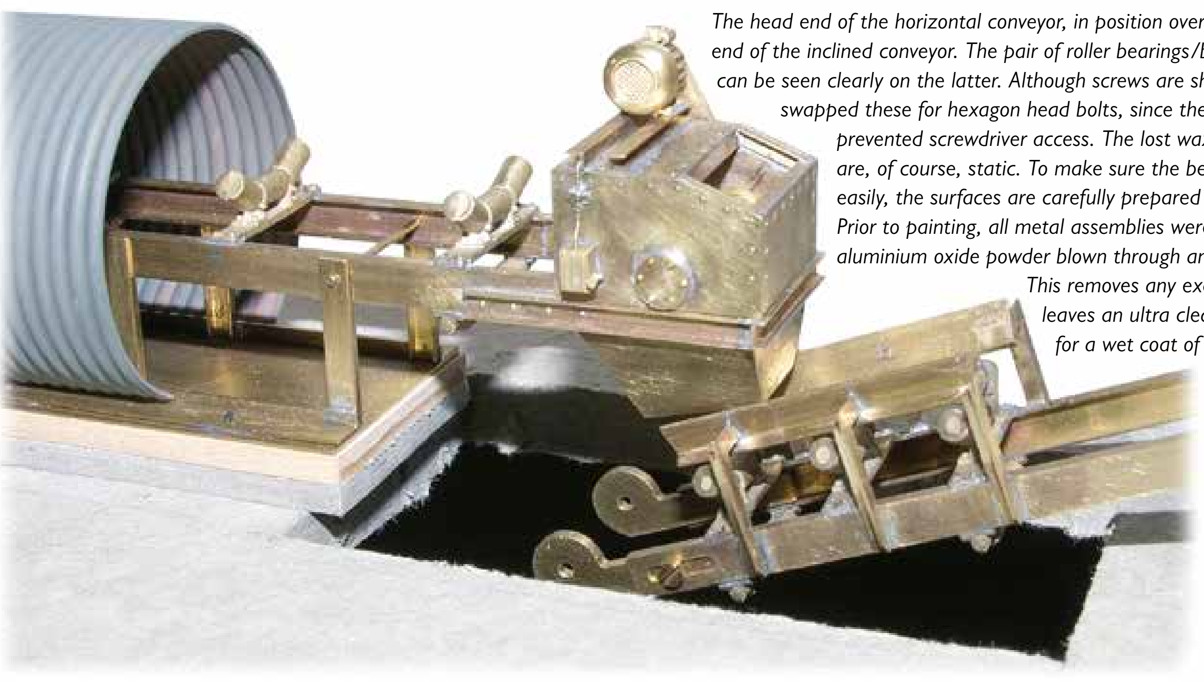
So as to make construction easier and build in accuracy and regularity, some simple jigs were made for the conveyor. The first comprised two aluminium plates, milled to hold the brass channel the correct distance apart. A brass screw clamps the two plates around the channel securely. The second jig is a simple aluminium plate, the length of which spaces the top rollers at four scale feet.



In use, the first top roller is soldered to the side runners, 14mm from the end of the side runners with a bottom roller exactly below. Slacken the screw and slide the jig along the channel, set the rectangular spacer in place, add a second roller, bring the jig back and tighten the screw. In this manner, each top roller is accurately located and the side runner spacing maintained rigidly. When the next (third) top roller is added, don't forget the bottom roller. On a long conveyor, take care that the assembly stays straight. Test against a long straight edge as the brass channel can curve gently if left to its own devices.

SOLDERING

I apply a tiny amount of solder paint (Fryolux standard grade), using a cocktail stick to the joint as the parts are assembled. On heating this wets the joint which is then fed with silver bearing solder (in fine wire form) as the solder paint runs. The resulting joint is very strong and neat. Heat is applied using a resistance soldering unit.



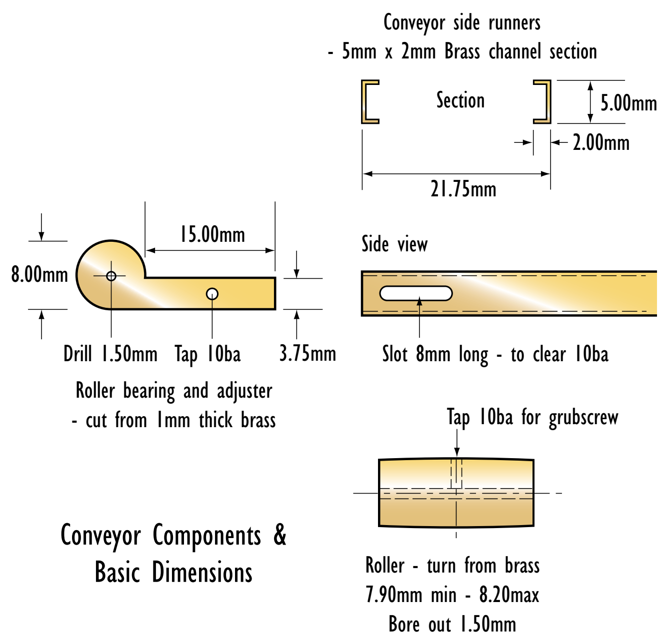
The head end of the horizontal conveyor, in position over the lower end of the inclined conveyor. The pair of roller bearings/belt adjusters can be seen clearly on the latter. Although screws are shown, I later swapped these for hexagon head bolts, since the walls of the 'pit' prevented screwdriver access. The lost wax brass rollers are, of course, static. To make sure the belt slips over them easily, the surfaces are carefully prepared and smoothed. Prior to painting, all metal assemblies were cleaned using aluminium oxide powder blown through an abrasive gun. This removes any excess solder and leaves an ultra clean surface ideal for a wet coat of etch primer.

Neither an iron nor torch, in this instance, is suitable, in my opinion. An iron will not heat the job with sufficient speed and a torch will overheat the fine section, resulting in distortion. The aluminium jig, while essential, is the main problem, coupled with the relatively fine brass section opposed to the bulk of the brass castings. Resistance soldering puts the heat very rapidly, direct into the joint, so overcomes the problem. In fact, without it, the assembly of all my sand handling machinery would have been far harder.

ROLLERS & BELT

While a fair amount of experiment was necessary to determine how to make an operating conveyor, most of the problems are well covered in David Rowe's book *'Industrial and Mechanised Modelling'* (Wild Swan 1990 oop). He discovered the two essentials, namely convex profile rollers and typewriter ribbon for belting. I used an adding machine ribbon, *'Group 1024FN Black Twin Premier Nylon Ribbon'* from Ordtech, which was sufficient for both of my conveyors with plenty left over for another. It is essential to make sure it is a fabric ribbon, not nylon film or some such, which is not suitable at all. The worst job is getting the ink out of the ribbon. I unwound mine into a large glass jar containing white spirit and left it to soak. It took four changes of spirit before the ink was removed. To dry it out, I tacked one end of the ribbon to our garden shed, the other to the fence and let wind and sunlight do the job. Once dry I re-wound the ribbon on to the plastic reel for storage.

The rollers are simple brass turnings running on 1.50mm dia. silver steel axles. Take care to ensure the 'barrelling' is symmetrical. You don't need much, but it must be even. These are supported at



Conveyor Components & Basic Dimensions

Steps lead up to the walkway. The electric panel has a 'stop switch' and 'master switch' for the conveyor. These are lost wax castings. Steps are milled brass open rectangles, with etched mesh treads.

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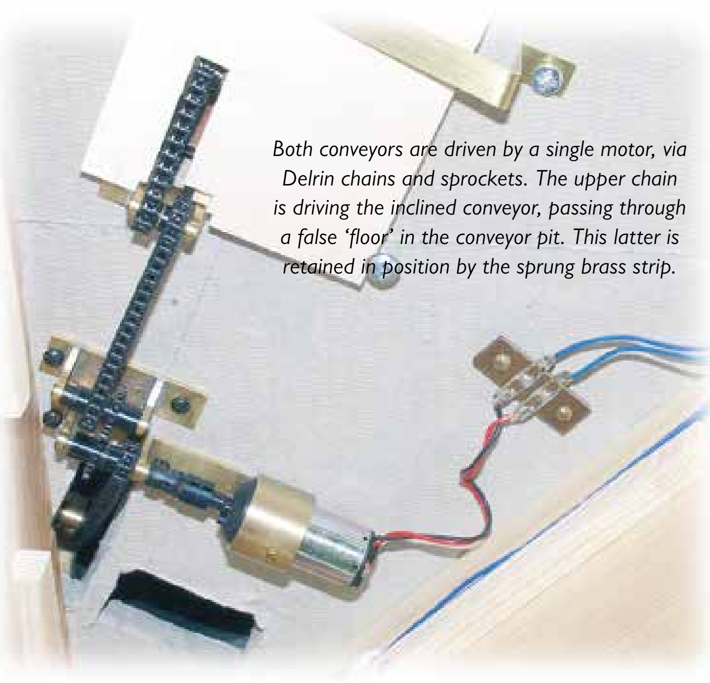


Both conveyors are driven by a single motor, via Delrin chains and sprockets. The upper chain is driving the inclined conveyor, passing through a false 'floor' in the conveyor pit. This latter is retained in position by the sprung brass strip.

each end of the conveyor in a pair of thick brass plate bearings, which also act as 'belt tension adjusters'. Each 'drive' roller is fitted with a grub screw, to allow the drive shaft (with a gear fitted at one end) to be withdrawn if need be. The 'idling' roller can have the spindle fitted permanently, using Loctite, or similar. At this stage, you can fit the rollers and drive, but not the belt, as this can only go in place once the conveyors are painted and fixed in place.

DRIVE

Both my conveyors are driven by a single motor, a Faulhaber coreless 1620 fitted with a 76:1 gearhead. This is mounted under the baseboard, between the head of the horizontal conveyor and the foot of the inclined one. Drive is via Delrin chain and sprockets. In order to ensure both belts run in the same direction, one pair of spur gears engage one another to reverse the drive to one unit. Power is supplied from a low voltage transformer unit made for me by Otto Schouwstra to provide adjustable low voltage feeds to turnouts and accessories etc. Although requiring a mains feed, it takes its supply via an auxiliary output in the sound system box, so only one mains lead is required.

DETAILS

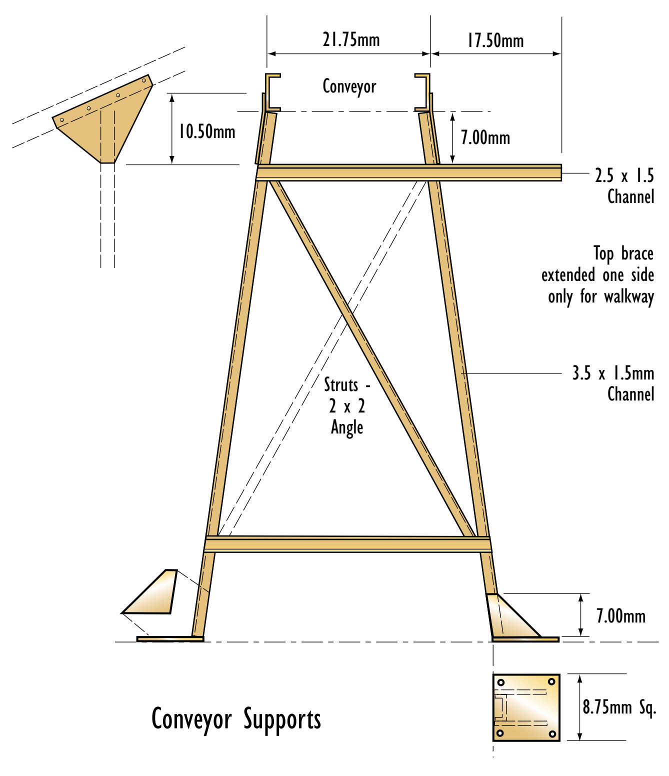
There is as much work in the details, supports, walkways, etc., as there is in the conveyors themselves. Just what these details are, and how they are applied will vary from application to application. You really need to study prototype photos to get a proper appreciation of what went where – remember that each installation was 'custom built' and subject to modification and addition over the years. However, each must have:- a drive motor and belt; electric supply and 'stop buttons'; supports; walkways and guard rails (where appropriate). As with the rollers, I knew I would need a few motors plus the associated electric boxes, so more patterns were made for casting in lost wax brass. I knew these structures would be quite fragile so determined they should be metal throughout and all soldered construction.

The supports for the inclined conveyor are made from milled brass sections, with 'feet' formed from brass sheet. The diagram shows the sections used and details of the 'feet'. I needed three supports for the inclined conveyor, of varying heights. After sketching them on plain paper, each, in turn, was glued to a scrap of Sundeala board to make a simple soldering jig. Each piece of section was cut to length, with the ends angled as required. The side members were pinned in place first and the horizontal stiffening braces soldered in place on one side. Note that there are three rows on the tallest support, two on the next and only one (at the top) on the third. The fourth, and smallest supports are really just a pair of 'feet', just after the loading end of the conveyor. The diagonal struts are added next, then the parts unpinned, and matching horizontal braces added to the other side. Note that only one top brace, on one side only, extends, if required, to take the walkway. All that remains is to add the 'feet', cut from brass sheet and soldered in place with the support held vertical and true, while on a flat surface. This ensures they are quite flat and will sit on the 'concrete' plinths.

Fitting the supports to the conveyor requires some care. I made up a simple wooden jig, on a flat piece of timber, to keep all the parts aligned. Brass plates, embossed with a row of rivets, cover the joint and provide strength.

Walkways will vary from structure to structure but, again, milled brass shapes are all you need. Mine are formed in 3mm equal angle. The sloping walkway is timber (basswood) planked with transverse battens at about 17.50mm centres. Step treads and horizontal platforms are surfaced with etched brass sheet. Try to get a fine elongated rectangular mesh, not diamond or square pattern, to best represent the metal decking used on real structures.

A characteristic of sand and gravel machinery seems to be the apparently haphazard stringing of cables etc., to supply current to the motors and lighting etc. To represent this I purchased a reel of 24swg tinned copper wire. Besides being easy to solder in place, this material readily shapes (and stays put) to give typically 'saggy'



cable runs. Brass strip is used to simulate brackets and, where multiple cables run, fine fuse wire is used to simulate the binding that holds the bundled cables in a group. Cables run into and out of the brass switch boxes via 0.75mm holes, drilled as required.

FINISHING

I made up 'concrete' plinths for the inclined conveyor to sit on, from basswood. Fixing is simply a matter of positioning, drilling through the holes in the 'feet' and fixing with 'nut-bolt-washer' castings (shanks left long). For added security, some 'thin' cyanoacrylate adhesive was run in, from one rear corner.

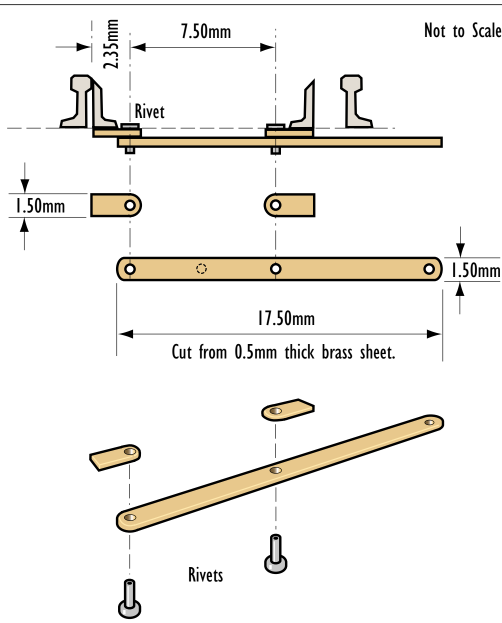
Once firmly in place, you can, finally, fit the belt. This has to be threaded through the conveyor itself, above the lower return rollers (on which the belt rests, in the prototype) curling round the rollers at either end and over the 'V' support rollers on top. Set the rollers to allow maximum adjustment. I ran a length of the cleaned tape off the reel around the conveyor as above, cutting it to give about a 20mm overlap. As it stands, the belt is black in colour, I 'stained' mine with pale grey Humbrol, streaked with 'sand'. Take great care to keep the belt flexible, too much paint, or too thick a coat will compromise its flexibility. When dry, fit the belt in place and trim the joint again, to give about 10mm overlap. I glued the ends with 'Copydex' fabric adhesive. This stays flexible and seems to be quite durable. Make sure the lap joint 'trails' in the line of travel i.e., the upper join faces down the conveyor. My test belt, formed five years ago was still joined firmly, up to mid 2004, when I deliberately pulled it apart to see how strong it was.

With the belt in place and the join set firm, tension it by moving out the rollers. Turn on the power and see if the belt runs centrally. If not, slacken an adjuster screw ON ONE SIDE ONLY and nudge the offending roller pivot up or down slightly to get the belt central on the roller. Expect to take some time getting this 'just right'.

Once the belt is running true, keep the drive on. Now comes the hardest part, adding the sand load. I have a good supply of fine washed sand and this, laid on a 'wet' film of Copydex, remains flexible once dry. I mix up a 50-50 mix of Copydex and water, applying it with a brush, in a thin line, to the moving belt. At the same time, with your other hand, sprinkle the sand onto the belt, into the wet adhesive. It is essential that the belt is kept moving, even after this is completed. I leave mine running for about 24 hours and then run it for a few hours every day, for at least a week. The reason is to prevent the belt, which is still 'curing' (even though the Copydex sets quite quickly) from taking up the roller shape when left static. I learnt this the hard way on my 'test' belt. After a week, it makes no difference how long the belt is left static.

To be continued…

The completed conveyor, with the belt in place, timber walkway and 'loose sand' – which is actually fixed in place with dilute PVA. The conveyor 'rollers' are painted with Humbrol 'steel' Metalcote and polished.



MATTERS ARISING – TURNOUT TIEBARS

A few readers queried just how the turnout tiebar, shown on page 165 of the last issue, was made and fitted. The diagram at the left shows the three parts – all cut from 0.50mm thick brass sheet. The holes are drilled to suit whatever rivets you use. Mine are Alan Gibson 'Valve gear rivets' so the holes are drilled 0.75mm and 'touched' with a taper reamer to provide either a 'push' or 'loose' fit.

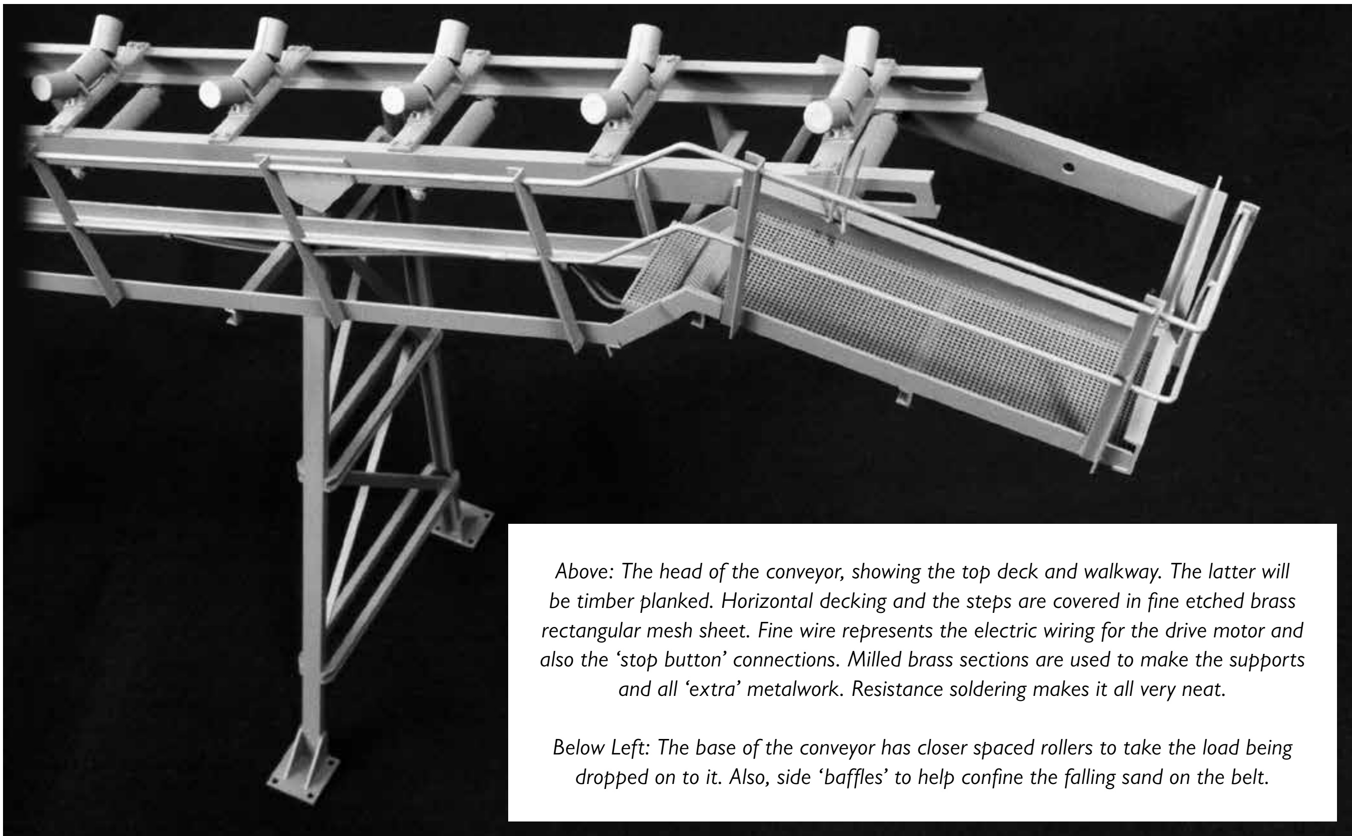
To make sure the riveted 'lugs' rotate freely, I use a piece of fine paper between the two components when closing the rivet. Tear the paper out afterwards, to give the clearance.

The turnout is laid, complete with tongue rails, articulated as shown in Part 2, page 165. The tiebar assembly, with 'lugs' in place, is slid between the sleepers beneath the pair of tongue rails. Now, all you need do is solder each 'lug' to the respective tongue rails. If you have followed the Handbook instructions, you will have left on the 'foot' of the tongue rail so the section is as shown left. This provides strength (as in the prototype) and also makes for a good joint with the 'lug'. Raise the tiebar assembly beneath the tongue rails by packing with thin card.

Align each lug with the respective tongue rails, add a dab of solder paint and touch with a hot iron or similar. Feed the joint with silver bearing solder to make it as strong as possible without being obvious. Check you have not soldered up the rivet joint!

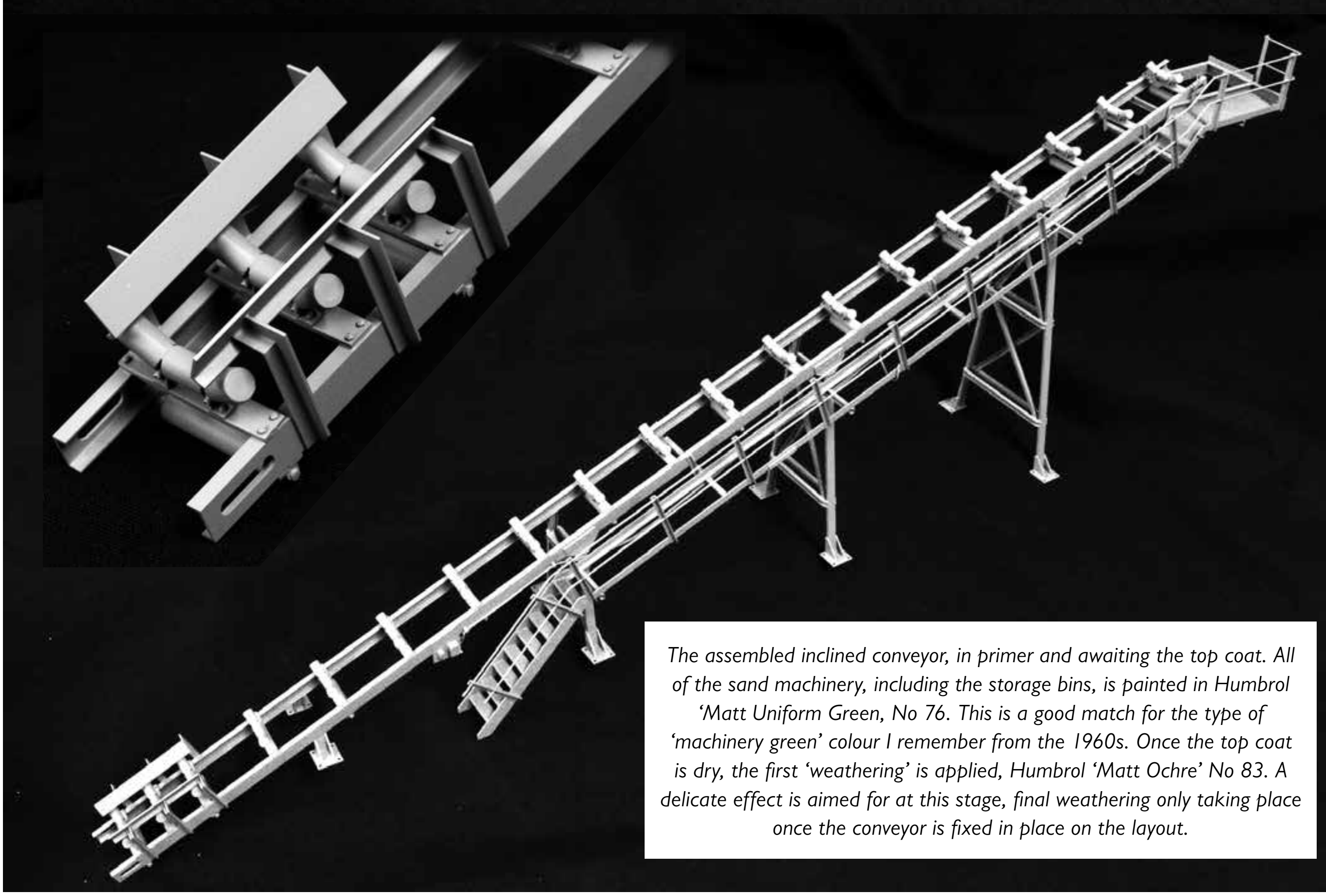
You now have both tongue rails firmly connected to the articulated tiebar. Check fit against the stock rails and then connect to your choice of operating mechanism.

Photos & drawings: REVIEW Studio



Above: The head of the conveyor, showing the top deck and walkway. The latter will be timber planked. Horizontal decking and the steps are covered in fine etched brass rectangular mesh sheet. Fine wire represents the electric wiring for the drive motor and also the 'stop button' connections. Milled brass sections are used to make the supports and all 'extra' metalwork. Resistance soldering makes it all very neat.

Below Left: The base of the conveyor has closer spaced rollers to take the load being dropped on to it. Also, side 'baffles' to help confine the falling sand on the belt.



The assembled inclined conveyor, in primer and awaiting the top coat. All of the sand machinery, including the storage bins, is painted in Humbrol 'Matt Uniform Green, No 76. This is a good match for the type of 'machinery green' colour I remember from the 1960s. Once the top coat is dry, the first 'weathering' is applied, Humbrol 'Matt Ochre' No 83. A delicate effect is aimed for at this stage, final weathering only taking place once the conveyor is fixed in place on the layout.