BEAMS, SPRINGS AND THE 0-4-4T: The missing link?

If a problem is tough in 4mm scale – building an 0–4–4 chassis, for instance – it doesn't get any easier as the scale goes down. As debate over beams and springs continues, TIM WATSON, of the Model Railway Club's 2mm group, explains how he built an 0–4–4 using both:

The battle between the springs and beams seems to be well joined in No. 1 Shop with the balance apparently tipping towards compensation. Iain Rice has produced some very persuasive arguments, and what he writes seems very logical for 4mm scale models, although in the larger scales (7mm) I would have thought that springing would become more practical due to the increasing mass of the models . . . However, I am not here to weigh in with the heavies, but to attempt to put the case of modellers who need bionic eyes or thick lenses in their spectacle frames in order to confront the problems of building 2mm scale locomotives (or to be more precise, to discuss my encounters with them).

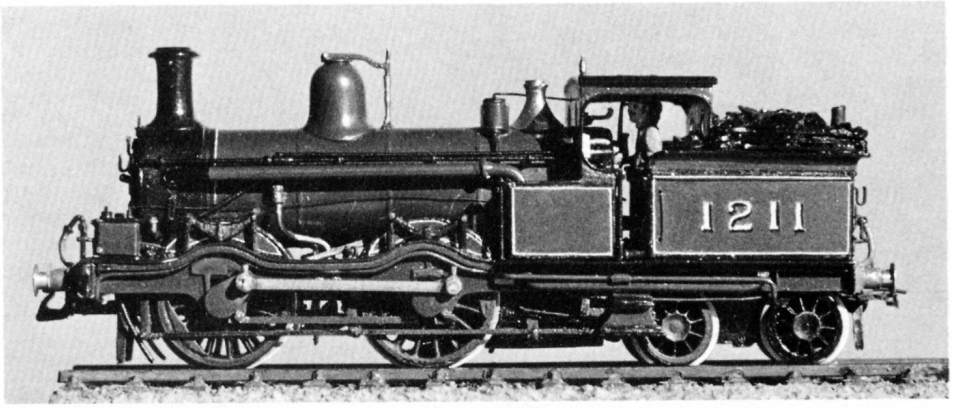
At the risk of being dogmatic there are a number of criteria which should be met if good running is to be achieved in the smaller scales: (1) excellent pick-up from all the wheels which must, of course, run true, (2) correct gearing for the motors being used, (3) models as heavy as possible and with the weight in the right places. I would add that large bearing surfaces are essential if the mechanism is expected to clock-up a high mileage on an exhibition layout. Simple maintenance is also desirable.

The first point is well covered by the range of wheels available from the 2mm Scale Association and for 'N' gauge standards from Mike Bryant. (109 Upper Holland Road, Sutton Coldfield, West Midlands, B72 1RD). These wheels are designed for split axle pick-up, using insulating muffs to keep the wheels apart (or together!). The axles run in frames which are electrically insulated and distanced from one another by blocks of Tufnol, Acetal, gapped copper-clad Paxolin or specially moulded frame spacers. This gives current collection via the axles and bearings to the motor. There are no wire wipers to increase friction, collect fluff or go out of adjustment – all of which are sudden death to 2mm scale locomotives. A range of worm and worm-wheel sets are available from the above sources and when used in conjunction with the 64 and 100DP spur gears also marketed it is possible to tame the most boisterous motors with double reduction gearing. The small motors now available are very much better than those of the early days and the coreless pattern is.now an accepted power plant – in fact, the Portescap 1219 was driving 2mm scale locomotives before its commercial advent in 4mm. The siting of motors is obviously a much greater problem when the ratio of loco size: motor size is so poor compared to their larger brethren. Nevertheless, there are many ways around this problem. Undoubtedly the easiest steam locomotives to model have tenders and these make very acceptable boxes in which to secrete similar shaped motors. Power has to be transmitted from the tender to the engine via a drive shaft with universal joints. The simplest system devised for this consists of thin (.010") steel wire bent into a loop at each end which engages in slots in the female half of the U/J; a shroud around the outside of the female coupling retains the wire within it. Angular movement and end play are therefore easily achieved. This sort of cardan shaft is virtually invisible, especially when working.

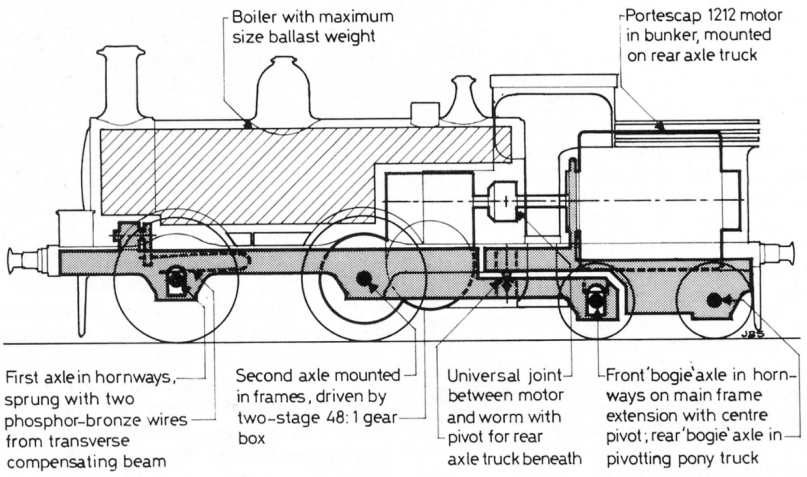
Weighting the engine is vitally important – and a rule of thumb seems to be that the heaviest run the best. It is therefore better to have the light motor away from the driving wheels and fill the boiler, along with every other nook or corner, with a heavy metal. The prodigious hauling capacities exhibited by some 'N' gauge mechanisms are attributable to traction tyres, which are not really practicable with finescale standards. Even so, excellent statistics can be achieved with metal to metal contact if the loco is heavy enough. A good grounding in small-scale loco construction is given in the 2mm Scale Association Handbook – required reading for anyone contemplating scratchbuilding.

My loco building experience amounts to a statistically insignificant 2½ (the third one is not yet finished!) but it happens that the second loco attempted was a Midland Railway Kirtley back or well tank. Iain's article on the design of 0–4–4 mechanisms took me back seven years to the time when this model was being built and the problems peculiar to the type had to be tackled.

These characterful engines did not have any side tanks which we could use to mask a motor (bearing in mind, of course, that we can't slip motors into boilers and between frames at the drop of a hat, unless we make our own). Unfortunately, the only decent-sized space available was in the bunker – where a motor would obviously play havoc with weight distribution. Fortunately, someone in the MRC suggested fixing the motor to the back bogie so that it was free of the bodywork. It seemed that the



This is 2mm scale at its best – Tim Watson's Kirtley 0–4–4T, a familiar sight to 'Chiltern Green/ Luton Hoo' fans.



Drawn by John Birkett-Smith

most sensible arrangement was to attach the Portescap motor (1212, 4½ volt rating – they now make a 6v version) only to the rear bogie wheels, with the front pair as a radial axle running in rigid extensions from the locomotive mainframes. In other words, the model effectively becomes an 0–4–2–2 with the last pair of wheels steering rather like a pony truck. This is made clear in the drawing.

This flexibility could only be achieved with a 'ball and pin' type universal joint between the motor and worm and a pivot for the 'pony' in the vicinity, an arrangement which can also be seen in the drawing and photographs. In fact, the U/J dissociates the motor from the end thrust generated by the worm – this is particularly important with these coreless motors because their bearings are not designed to take end-thrust. The drive was taken to the back wheels via a two stage reduction giving an overall ratio of 48:1.

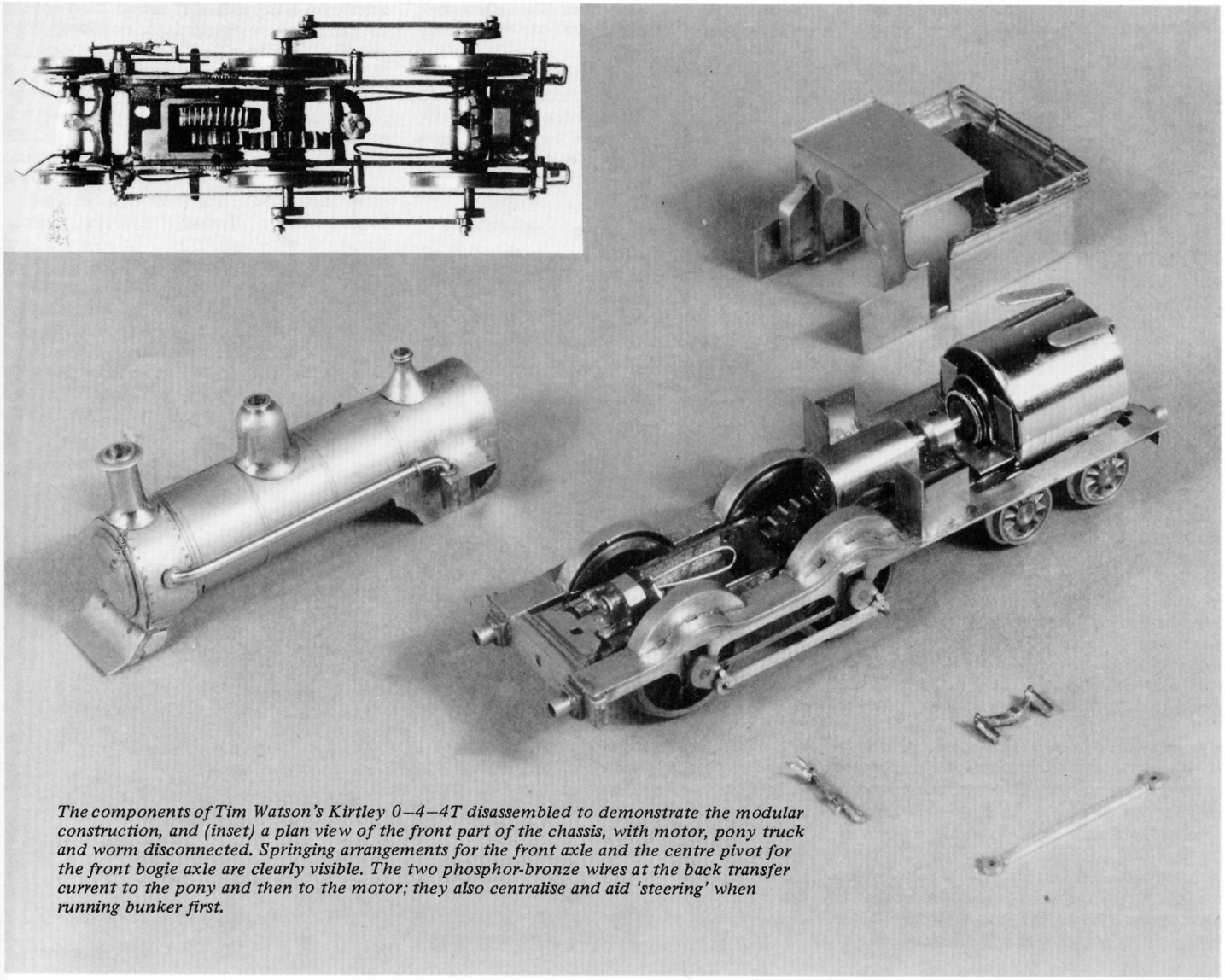
At this point the locomotive begins to confuse Iain's neat Linnaean classification of suspension systems. As any taxonomist/palaeontologist will tell you, species relationships may need altering when 'missing links' are found. This mechanism is one such, in that it is both compensated and sprung! A new species which I will leave to Iain to devise a new name.

The rear driven axle is rigidly held in the frames, whilst the front bogie wheel has a centre pivot acting on the delrin axle muff. This produces a three point suspension in the middle of the locomotive. The front driving wheels are free to move up and down in their hornways and are guided in this action by a pivoted compensating beam, between and across the frames. This did not work initially because of 'stiction' and so phosphor bronze finger springs were attached on each side of the beam bearing onto the axlebox tops (see drawings and photographs). The emphasis now changes so that the front end of the loco is supported by springs and the compensating beam serves to equalize the spring action. This system avoids the lurching which can be a consequence of 'gravity systems', especially when there are no carrying wheels at the front of the loco (0–6–0s, 0–4–0s, etc.).

Construction of the loco body is as straightforward as any outside-framed condensing tank can be. Points of interest are that the safety valve is a 'lost wax' casting in real gold and the springs are 'lost plastic' castings in a somewhat cheaper alloy. I am a firm believer in breaking down a locomotive into its various sub-assemblies, both for easy maintenance and each painting. Small screws (16BA) are used to hold it all together . . . 16 of them in this model.

The main body colour was sprayed with a car cellulose paint 'BMC Damask Red' – a good approximation to crimson lake when applied over a dark brown undercoat. This was then masked and cellulose black applied. One can use oil-based paints for the straw lining and finish off with Indian ink for the black edging without fear of one stage interfering with the other. All the lining was executed *in situ* with a bowspring pen as it is relatively easy to apply to the edges. 'SMS' transfers were used for the numbers and a final, light coat of 'frigilene lacquer' (Precision paints) sealed everything in place.

This loco has worked for the last six years and has covered well over 60 miles on various 2mm scale exhibition layouts. I would be the first to admit that the mechanism now exhibits a considerable amount of wear, but the running does not seem to be unduly affected. Apart from occasional 'defluffing', the model has never needed adjustments to its suspension



The components of Tim Watson's Kirtley 0–4–4T disassembled to demonstrate the modular construction, and (inset) a plan view of the front part of the chassis, with motor, pony truck and worm disconnected. Springing arrangements for the front axle and the centre pivot for the front bogie axle are clearly visible. The two phosphor-bronze wires at the back transfer current to the pony and then to the motor; they also centralise and aid 'steering' when running bunker first.

system. It has always been a powerful little engine, shifting fourteen carriages on the MRC test tracks with only prototypical wheel slip.

The 64,000 dollar question is would I do the same again? The answer is almost certainly yes, for this awkward engine with its particular problems. More conventional 0–4–4s with side tanks would present less of a challenge. Mike Randall has recently produced a GNR 0–4–4 with a double bogie arrangement in 2mm scale which works well, whilst Stan Garlick applied the same idea to an 'S' gauge Kirtley 0–4–4WT a few years ago (see letter on page 161).

I would suggest that for the vast majority of 2mm scale locos, suspension is an unnecessary complication. My present project, a Baldwin 2–6–0, is at least simple in that respect. Far better to aim at increasing the weight of our smaller models and improve their momentum, with heavy flywheels, than to produce more bits to wear out. Towards this end the MRC 2mm group is experimenting with heavy metals such as tungsten and copper tungsten alloy. Does anyone know where we can get some depleted uranium?