Modelling in Gauge 1

Book 4 : Coaching stock

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The Gauge 1 Model Railway Association’s principle objectives are to promote railway modelling in a scale which will involve a rail gauge of approximately 1.75 inches or 45 millimetres, and to bring together persons interested in the construction of Gauge One models, tools and apparatus of all kinds.

Information on G1MRA can be obtained from their web site at www.gaugeone.org or by writing to the Membership Secretary at PO Box 581, Northampton, NN6 0YW, England.

Front cover picture : *Pullman observation car Maid of Morven used on the Caledonian Railway.*
Built by John Clegg.
Photographed by David Emberton on Robert Head's indoor layout.
Featured on cover of G1MRA Newsletter 162 dated July 1944.
See the article by John Clegg Oct 1990 147/31

Back cover
Top picture: *LB&SCR 6 wheel carriage.*
Built by Barry Pulford, and photographed by him.
See the article by Barry Pulford Autumn 2007 215/12
Bottom picture *CWIL dining car scratch built by John Butler for a friend.*
The car still has to have its yellow lining added to the waistband below the window line.
Photographed by Peter Trinder.
Appeared in black and white in G1MRA Newsletter & Journal Issue 211 on page 74

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Top picture *Balcony end trellis detail from Weston Clevedon & Portishead Railway Company coach.*
Built by Dick Comber, and photographed by him.
See the article by Dick Comber Winter 2003/4 200/31
Bottom Picture *GWR Collett coach.*
Built by Don Evans from Barrett Engineering kit, and photographed by him.
See article by Don Evans Spring 2001 189/26

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Introduction to Modelling in Gauge 1 — Robert Houghton - President of G1MRA

Some 80 years ago I used to look forward to the next monthly issue of the then Model Railway News. Now, in my 97th year, I still have that same anticipation, but for the next issue of the Gauge One Newsletter and Journal, which never fails to come up to expectations. Could this be my second childhood? Not a bit of it; I just had the good fortune all those years ago to become interested in the Gauge One Model Railway hobby, and it has remained with me for the rest of my long life, with the added incentive of being able to share it with my two sons, both of whom have garden railways of their own. Age does not come into it. For the younger generations it is a hobby which provides a constructive and positive alternative to the TV and computer screens, whilst for those in retirement I can recommend it as an aid to keeping an active mind; and you can always borrow a magnifying glass! Gauge One is such a wide-ranging hobby, for young or old, steam or electric, indoors or out in the garden, skilled or unskilled, and above all as a means of meeting all manner of interesting and friendly people you would otherwise never have heard of.

Since the earliest days of our Association, in 1948, the Newsletter has been a central feature. Regularly produced and edited by volunteers, it has contained above all a wealth of contributions by the more skilled, erudite and experienced Members for the benefit of the rest of us. There is always something new to be learnt, and encouragement to be obtained from the descriptions of other people’s ideas and accomplishments. Typical of the spirit of G1MRA, Geoffrey Hammond and his team of helpers have voluntarily delved into over 200 editions of the Newsletter, and undertaken the laborious process of compiling and publishing this, the fourth of a new series of booklets. Our sincere thanks go to them for this further contribution to our enjoyable and fascinating Gauge One hobby.

I am delighted to have this opportunity to express my personal thanks for the help I have obtained from the Newsletters over the years. These new booklets, I am sure, are going to be a source of encouragement and enjoyment, particularly to newcomers to our hobby. In the words of one of our more illustrious Members, the late Freddie Wrighton: “Have a go at it”. You may be pleasantly surprised by what you can achieve.

Foreword to Modelling in Gauge 1 — Geoff Hammond

It was my Doctor, Dr. Greenway, who showed me Gauge 1 while I was still at school and he encouraged me to build some coaches. Shortly after this I visited the Model Railway Club Easter Exhibition and from the Gauge 1 stand I obtained a membership application and purchased a copy of “Modelling in Gauge 1”. This booklet, published in 1972, contained a selection of useful articles that had appeared in Newsletters 1 to 83. Over the following years many more useful and informative articles and letters have been written and there have been calls for an updated “Modelling in Gauge 1”. In response to those calls this is the fourth of a planned series of books drawing on the many articles and letters that have been published over more than 50 years of the Association from over 200 Newsletters. These books have been in the planning and production stage for 14 years and progress has been made as time and commitments have allowed. At times some have thought the proposal moribund.

We have drawn on the help and experience of various people to compile these books and for the fourth book our grateful thanks are offered to Peter Howland. Peter was rightly concerned that some references to suppliers in today’s context have little relevance, so we have included an appendix giving current suppliers for items related to coaches at the time of publishing.

Additionally, our thanks must go to the many contributors over the years, without whom the newsletter would be just blank pages; also the various newsletter Editors – Ella Roberts/Price, Kevin West, Martin & Pauline Hulse, Art Walker and Dick Comber; and to Martin Hulse for production editing, including typesetting and layout, of this book.

It has not been our intention to rewrite these articles but present them in the same hand that the Author originally prepared them, so we have done the minimum of editing that was felt necessary to make the articles readable. We have corrected obvious errors of spelling and punctuation. We have added comments or updates where these add to the article. We have removed opening and closing salutations, and invitations to future meetings. Over the years the Newsletter (latterly the Newsletter and Journal) has changed format several times. We have chosen to use a similar layout to the current Newsletter and Journal format for this book.

Articles are published in this book in their original Newsletter issue order, with the oldest first. Each article shows in its heading the title, author, year originally published, issue number, and page number within that issue. The contents section on page 5 lists these headings, together with the page number within this book where they appear. So for example:-

A simple coach bogie Bob Hines Mar 1970 75/20 9

appeared on page 20 of Newsletter Issue 75 which was published originally in March 1970. The index at the back of this book shows where selected topics appear.

These books hopefully will stimulate their own debate and development so if you feel you can add to this please submit your article to the current Newsletter Editor, assuming you are a G1MRA member, since the G1MRA Newsletter has always been for members only. If you are not a G1MRA member and would like more of the type of articles in this book then join G1MRA and you will receive the Newsletter once a quarter, packed with contributions on a wide variety of Gauge 1 topics, and will also be able to contribute your own views and experiences.

Coaching Stock **An introduction** **Peter Howland**

In the early days (of railways) passengers were carried in open wagons fitted with seats until purpose built vehicles were developed to meet demand. These early coaches were similar to road coaches before settling into the two basic configurations we know today - ie compartment and open saloon.

As with freight stock Gauge 1 is a large enough size to permit the inclusion of considerable external and internal detail in coaches and certainly internal fittings are necessary to present a good appearance.

The construction of a train of modern bogie coaches is a lengthy undertaking but very satisfying. It is hoped the information in this book will persuade modellers to have a go. The earlier articles reflect the lack of trade suppliers, being mainly about scratch building and tinplate repairs. Later articles deal with construction of kits which are now more readily available. Due to the lengthy timescale covered by this publication some of the suppliers and products mentioned here may not now be available and alternatives will need to be found. The Gauge One Model Railway Association provides a list of current suppliers to its members, and many of these advertise in the G1MRA Newsletter & Journal. An extract from this list is appended at the end of this book.

A beginner who finds himself in trouble for lack of information will need to look further afield, for example the various modelling and historic publications. Alternatively if they join the Gauge One Model Railway Association they will be able to draw on the resources of other members, many of whom have already explored their specific chosen interests and accumulated relevant information.

Articles in this book

Building coach bogies

Francis Dobson **Dec 1985** **128/48**

(*Subtitled "Improving the breed in Gauge One", this article originally appeared in the Model Railway Club's 40th Exhibition Guide for 1965 and was then reproduced in NL 128)*

One way in which the amateur modeller can find satisfaction in his hobby is by trying to make his models a little bit better than those he has built before, or those he has acquired.

Many people spend a lot of time building exact bodies, but lose interest in the running gear, and use the most suitable bogies available. Sometimes this means that the running and riding qualities of a coach leave a lot to be desired, and time and energy are devoted to producing more powerful locomotives to pull heavy trains, when it would be better to spend the time producing freer-running trains.

With these thoughts in mind the writer and another member of the Gauge I Model Railway Association, Bob Hines, set out to produce better bogies for a set of coaches then under construction.

The coaches were models of British Railways' standard main line vehicles, and twelve were to be built. Thus 24 bogies were required, models of the B1 standard bogie, and mass-production methods of manufacture were indicated. The main features of improvement were firstly ball bearings in the axle-boxes, and secondly full springing. The latter means springing of the axleboxes individually in the bogie frame, and also the provision of bolsters, so that the coach body is properly carried on the bogies, and does not lurch or wobble as the coach moves. The bolster is a prominent feature of the B1 bogie, and there is no great difficulty in making it work in the correct manner.

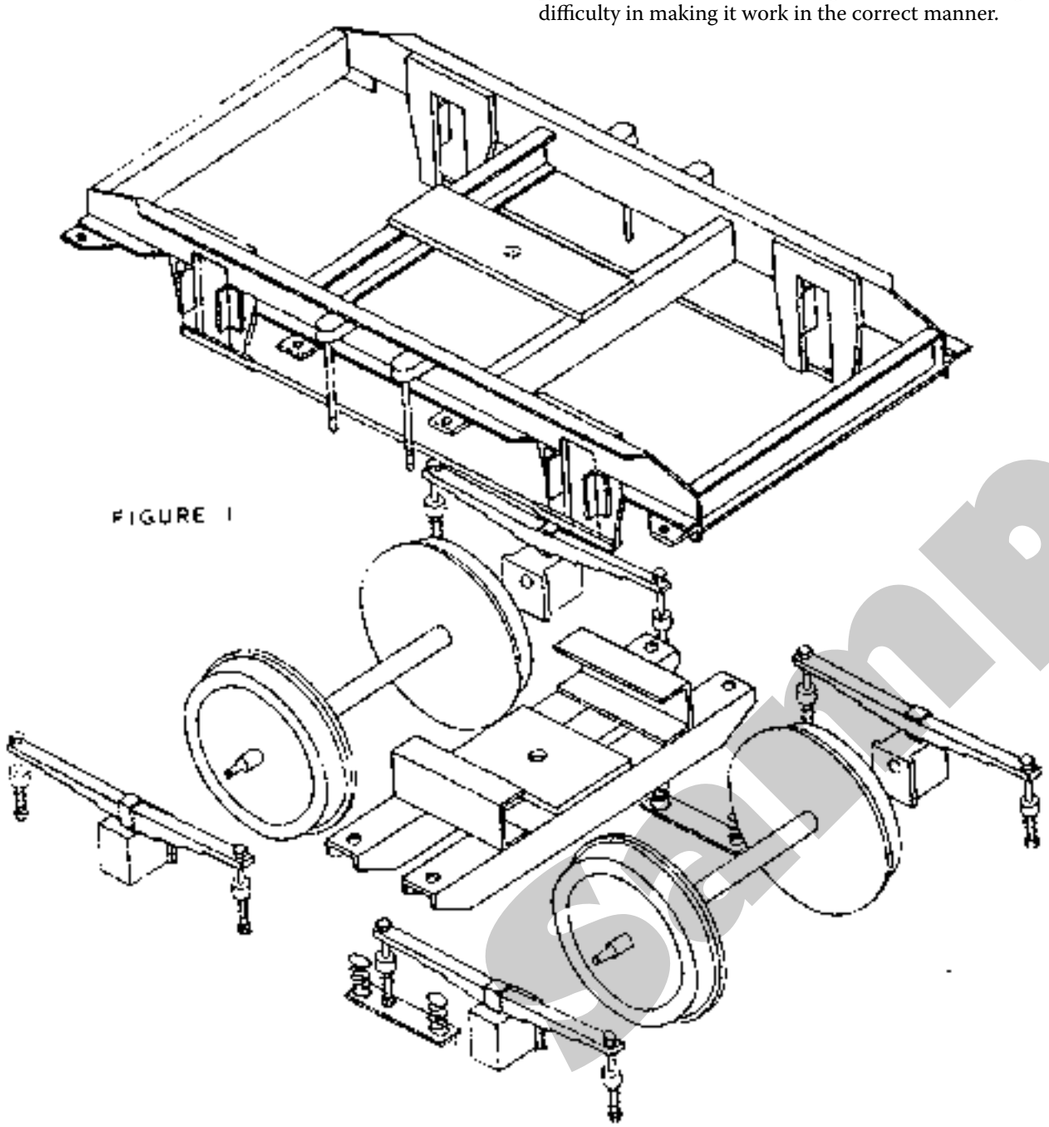


FIGURE 1

Figure 1 is an exploded diagram of the bogie, and makes the construction clear. The bogie frame is made of brass, of commercially available sections, and the first step is production of the axleguards. To obtain uniformity of sizing, the centre slots were punched out of brass strip with the aid of an industrial press—this was the only operation not carried out in the builders' workshops. The outsides were trimmed to shape, and the two axleguards to be joined to a channel side member were mounted in a jig. The channel section, trimmed and slotted as necessary, was mounted alongside and the pieces silver soldered together. The use of this jig ensured that the axlebox spacings on each assembly were the same and the two axles ran parallel

A second sub-assembly was now made in jig no. 2, consisting of the two inner bogie cross ties, joined by the bogie pin locating plate, and these three members were also silver soldered together.

The main frame assembly was carried out in jig no. 3. This jig mounted the centre cross-tie assembly, two side frame assemblies and the two outside cross-ties together, and the silver soldering of these into one unit produced the complete frame assembly. The jig ensured that axleboxes were located exactly opposite each other, and the axles were mounted squarely.

Onto this main frame were soft-soldered various small parts, bearing plates for the axlebox spring hangers, lugs for the holster hanger rods, and axlebox hornplates.

The other assemblies were the bolster, consisting of two channel sections joined by a centre locating plate, and two short channel cuttings to provide the rubbing plates, and the bearing plate assembly including the pivot pin to mount on the coach body. Both these items were made up in simple jigs, the latter having the pivot pin screwed in and soldered up.

Now to mount the bolster on the bogie. The hanger rods were of $^1/_{16}$" steel rod screwed into 10 BA tapped holes in the carrying lugs, and over these the bolster was threaded. The bolster springs, wound up from spring steel wire, were threaded on and kept in place by the bottom keep plate, which is secured by 10 BA nuts.

The axle ball bearing arrangement is shown in figure 2. It is very simple, there is no ball bearing cage, and it merely consists of six $^1/_{16}$" balls disposed round a $^1/_{16}$" diameter axle spindle. It will be noticed that the balls form an end bearing as well as a side bearing, so that the axles are held centrally in the bogie, and there is no tendency for the wheels to adopt a parallelogram form on curves, which is conducive to flange friction. Also, friction between the face of the wheel and the frame side is eliminated.

The axles were cut from silver steel rod, the ends turned down and ground to the shape shown. The wheels were turned from mild steel blanks, and press fitted onto the axles. The axleboxes were made from mild steel, and bored out for the ball race with a specially formed cutter: care had to be taken with this operation so that the final assembly of axle, balls and axleboxes fitted correctly between the frames, without binding or too much play.

A dummy leaf spring assembly was used, the actual springing being provided by small coil springs on the end hangers, a method previously used successfully. The complete assembly is screwed to the top of the axlebox with a 10 BA screw. The end hangers are formed of turned-down 10 BA bolts, on which are mounted the coil spring, partly concealed by a hanger cup formed to represent the dampers on the prototype.

One last job remained to complete the bogie—the fixing of truss rods between the axle guards, formed of $^1/_{16}$" rod, flattened at the ends and secured with 12 BA nuts and bolts.

A lot of work was involved in making these bogies, but the finished job is a very reasonable representation of the B1 bogie, and has very free-running qualities.

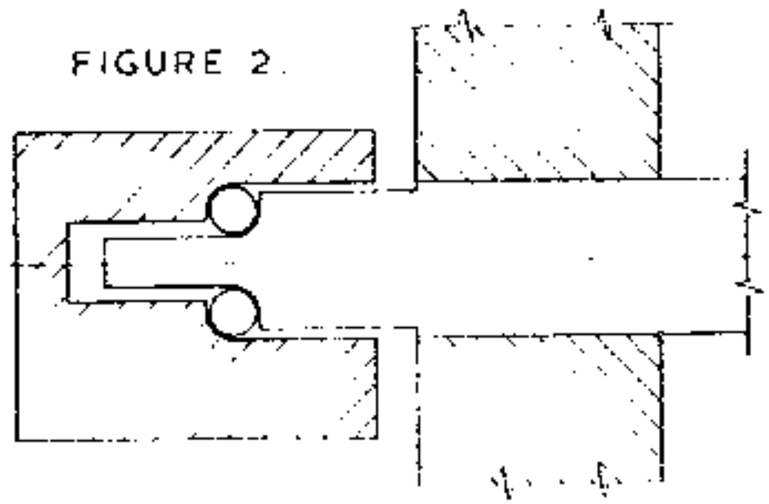
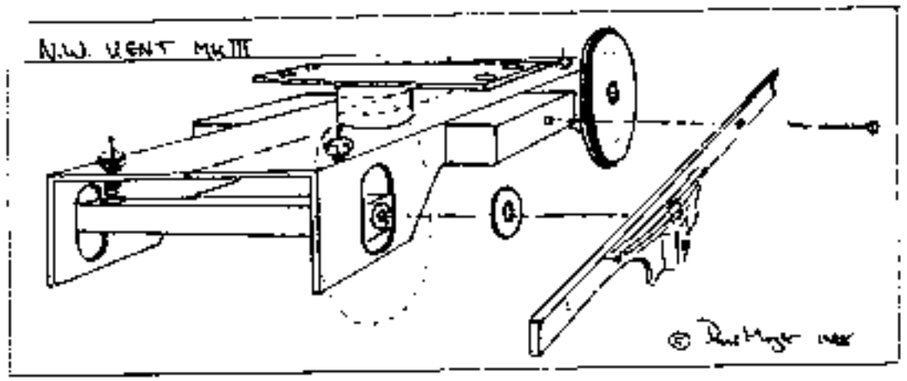


FIGURE 2.

And now something different — Dick Moger — Apr 1988 — 137/41



Designs for coach bogies have been done before of course, but the previous offering from our group was for a cut down quickie.

This one came about because I was asked to do a write up on the Premier coach kit. Having started on this kit I decided that it was very upmarket and liable to produce a splendid model despite what I did to it! It just cried out for a quality product for its running gear. The coach is well on the way to completion, and will be reported on in due course. In the meantime, here is the gen on the bogie.

The basis of the construction is ¾ x ¾ x 1/16 inch brass angle This is first cut to length and two pieces bolted back-to-back. I used the vertical slide to mill out the 5/16 slots and I then cut out the surplus metal from the sides. The two pieces were separated and butt welded (silver soldered) together to form a channel. This method gets round the problem of getting the axle alignment correct. ¼ inch holes were then drilled into lengths of 5/16 sq. brass (4 jaw chuck). I still have some of those tiny ¼ od ⅛ id ball races left, one of which was inserted at each end of the length.

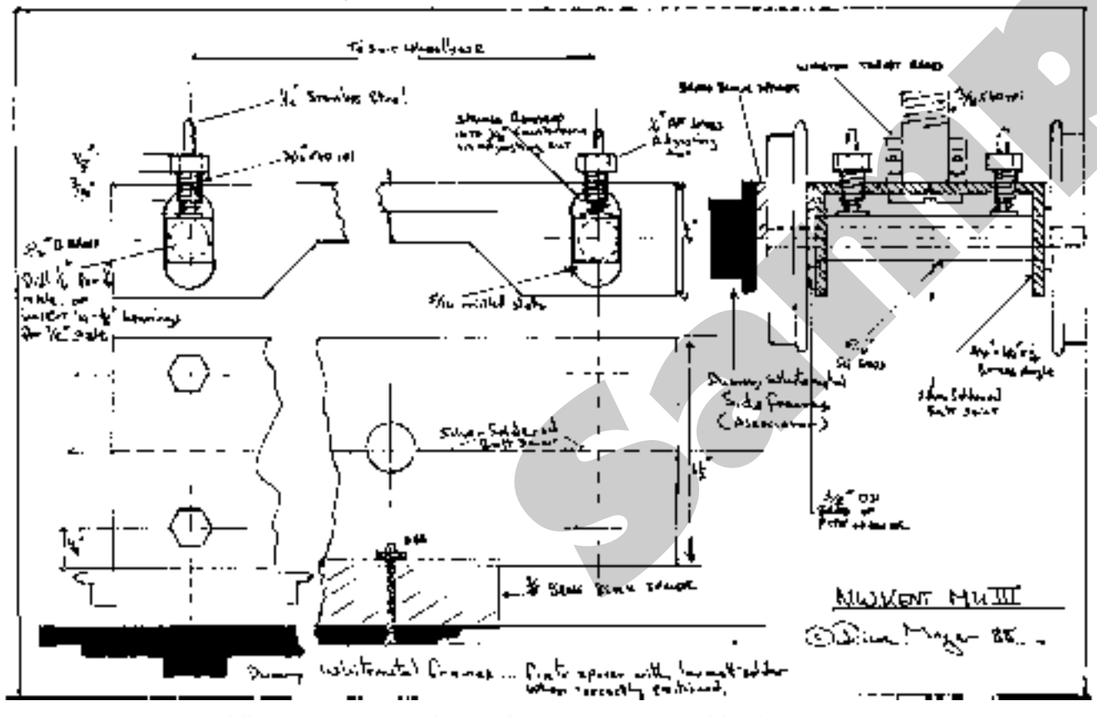
Suspension is provided by small ⅛ od springs acting on a little plunger reminiscent of safety valve practice. These are secured and adjusted by 3/16 x 40 tpi counter bored nuts as shown in the diagrams.

The brass axle beams are the same length as the channel width. They are kept in place by brass or PTFE washers of ⅜ inch dia. Only a very small amount of play is allowed here and does not inhibit the working of the suspension.

I also went to town on the pivot, as the scrap box revealed some very nice thrust races.

Whitemetal dummy frames were added and were soldered in place with lowmelt after positioning.

The end result is a nicely weighted smooth running bogie that would not be out of place on a Pullman . Curses!- Why didn't I think of this before building my Golden Arrow set ?



Fun with figures or are you overweight? — John van Riemsdjick — Jul 1988 — 138/13

The main line coaches of the four group railways commonly weighed about 32 tons. If you model to 1/32 scale, weight being a "cubic" dimension, a remarkably easy calculation gives the scale weight: divide by 32 three times over, getting 1 ton; 5/8 cwt (5 stone or 70 lbs); and finally 35 ozs. (Most of my British coaches weigh about twice that). A close and easily remembered approximation for scale weight can be taken as 11 ozs. for 10 tons, using 1/32 scale.

If you have gone all metric and use 10 mm scale (as I sometimes still do) instead of sticking to 3/8" to the foot, as the good Lord, to say nothing of Bing and Carette, intended, until H. Greenly of immortal memory decided that standard gauge was 4' 6" instead of what Geo. Stephenson had decreed – then your scale is 1/30.4, and no simple mental arithmetic is possible. But who does mental arithmetic when the pocket calculator has a new battery in it? So instead of dividing by 32,768 in your head, as above, you divide by 28,095 on the calculator, and 32 tons becomes 0.0011389 tons, or 41 ozs, as near as dammit, according to Casio. A pardonable and rememberable approximation is 13 ozs. for 10 tons.

So what? Well, I have a sentimental attachment to real practice and like to relate to it from time to time. So I am pleased when a 0-6-0T of moderate size has a scale weight of 44 tons; I begin to worry when a 4-4-0 weighs scale 86 tons without tender; and I am in shock when a 2-6-4T turns out at 187 tons! I usually expect an internally fired loco to come out about 50% over scale weight, when I have built it myself, but Aster do much better: the A4, which is powerful and robust enough for anything except hauling live passengers, is only 20% above scale weight, despite a third cylinder and a cast metal body, and the King Arthur is closer still to scale weight. No doubt factory production makes it easier to remove excess material.

As for coaching stock, the Mills type wooden bodied coach usually comes out at around 60 tons, a J.& M. International Sleeping Car 102 tons, the same make of German corridor coach 115 tons, and superior quality wood built LNER coaches (superior to Mills, that is) about 64 tons. All just about twice scale. But I have a very nice LNER articulated suburban set, which, in spite of masses of solid wooden seats, is only about 20% overweight, perhaps mainly because the wooden roofs are hollowed out on the underside, which is most unusual.

The next thing to compare with real practice is rolling resistance. If our little engines are pulling twice the scale weight, does this weight resist pulling like a real train, or like a garden roller on wet grass? Resistance varies in real practice, of course, according to the type of axleboxes, the rigidity of the track, to say nothing of curvature, which we will forget for the moment. But the rolling resistance of an express train at express speed on level track is about 1/200 of its weight, and about 1/300 when running slowly. 1 have two methods of testing rolling resistance of models: on an inclined plane and while running on the track. The first method is useful for comparisons, and helps me improve some rogue vehicles.

The inclined plane is a 4' 6" length of bright mild steel, 4" wide x 3/8" thick, on which I put clean track of a now defunct make, having shallow vignoles rails on a shallow plastic sleeper base, so it sits down without 'umps 'n 'ollers. The steel is supported at one end and at two thirds of the way along, to make bending unlikely. By varying the height of the second support I can get any gradient I want. On this track I can determine the gradient at which a vehicle will go on running without accelerating or slowing, after a push off, if needed; and also the gradient required to start a vehicle off. With ball bearing stock these two are usually the same, but with plain bearings they are not. However, rolling, not starting resistance is what we are after.

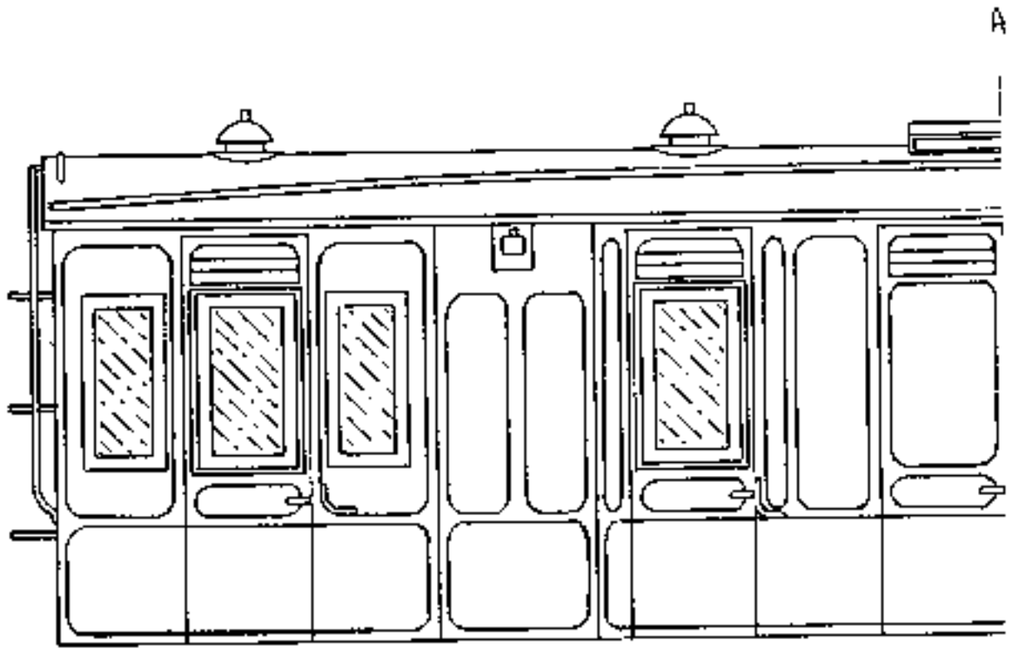
The best results I have ever obtained were with old ball bearing stock well run in – in fact for twenty years or more, and having a particular type of ball bearing axle which is not as generally used. Results lay between 1/240 and 1/300, in fact equal to the real thing at the low speeds involved. Close behind come J.& M. Models Wagon-Lits full brakes, almost new, but run in, which reach 1/200. Plain bearing stock never does better than 1/100. The heavier full length coaches are usually about 1/80, and light bogie coaches can be as bad as 1/40.

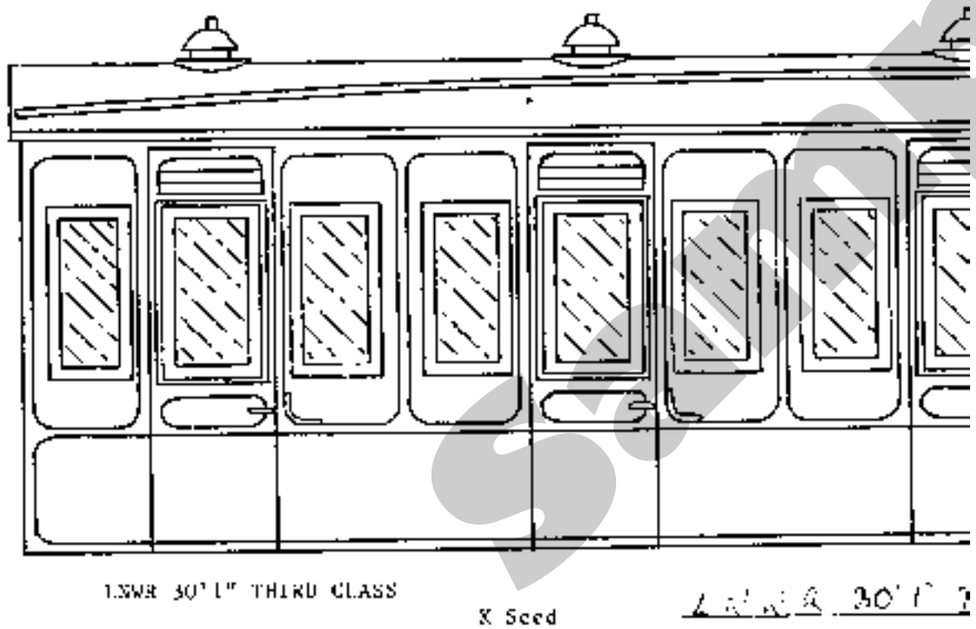
On the track, track dirt and dirt picked up on the treads will increase the resistance by an amount which reflects the operator's dedication to cleaning chores! But on an outdoor track it is bound to be at least a 25% increase. Gradients I say nothing about, as they are easily calculated. But curves are another matter. Here, the type of bearing is not relevant. I have calculated a resistance of 1/250 train weight on a 12 ft radius curve, from data obtained in running, and measured a 1/3 increase in pull at the hook on 10 ft., which amounted to about 1/200 of train weight, as the mixed stock behind the drawbar pull-measuring truck averaged out at around 1/65 rolling resistance, allowing for outdoor conditions.

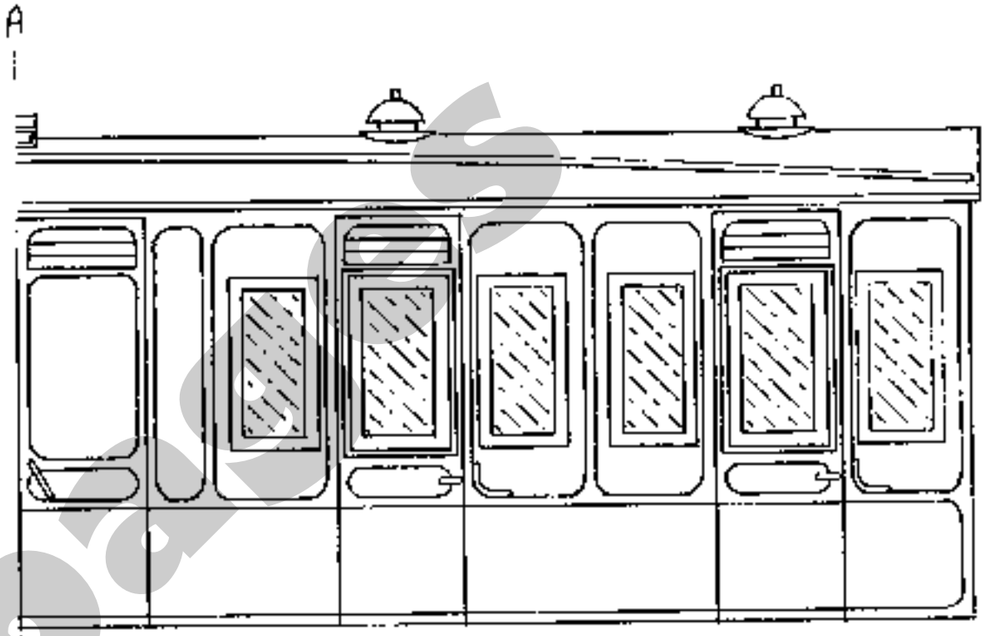
On a continuous track which is not too large, and when running at speed, gradients cancel each other out as far as average power is concerned. On a track like mine, where tight curves (10-12 ft radius) account for 1/3 of each lap – and probably most tracks are like that – we can estimate, from the above figures, that a ten coach train of British stock running fast will require a drawbar pull of some 13 ozs to be sustained. I have a test bed record of a smallish engine sustaining 14 ozs at a scale 100 mph, so this engine would pull that train. If the train had ball bearings the required pull would be almost halved.

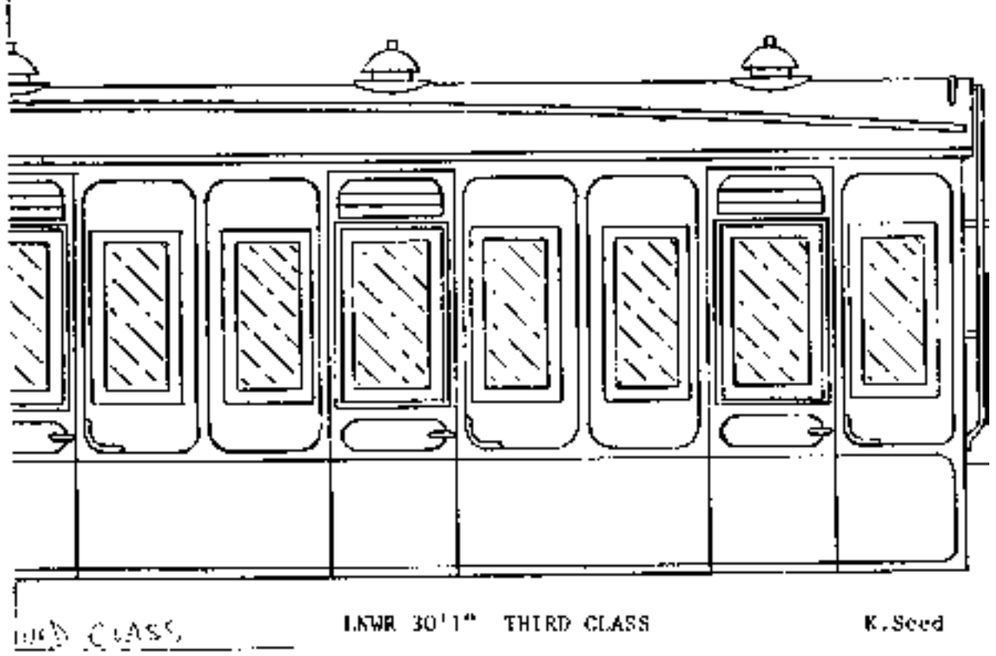
The above test bed performance represents 0.0073 horsepower, or 1/137. Scale horsepower, being derived from weight, or rather force (a cubic dimension) and speed/distance (distance being linear) varies as the fourth power of the scale. So, our 0.0073 has to be multiplied by 1,048,576, giving 7,655 scale horsepower! For 10 mm scale, the factor is 854,088, and gives 6,235 hp. As this is about four times the drawbar horsepower that would be needed in real practice with such a train, we can see the effects of overweight and plain bearings all too clearly, And the engine has to pull its overweight self against its own higher resistance. No wonder we never get anything like scale mileage from the capacities of our tenders!

I don't suppose it will deceive anybody, but for a change I will sign myself *U. Clydd*









Full rake of Bob Gamble's coaches in action on Dennis Gladstone's line in Luton

As I watched my newly completed locomotive steaming around Ken Martin's track in Dunstable, pulling an assortment of rolling stock borrowed for the occasion, I reflected that most of the stock represented companies and groups which were not in existence in the period my engine was based! I suppose most proud locomotive owners are faced with a decision regarding rolling stock – buy, build or continue to run with borrowed items. For me, buying ready made stock was not an option because neither kits nor ready made coaches were available "off the shelf". Running with wildly variable stock does not offend me, but then I am not a railway "buff". However, having spent so much time and effort on a Great Central locomotive, I felt a set of carriages of the same company and era would be a worthwhile addition. So, by a roundabout route, the decision to build was taken.

During the course of construction of the locomotive I came across several invaluable sources of information regarding Great Central locomotives. The first was volume 3 of *Great Central* by George Dow which set the historical background to my locomotive and also had simple line drawings of coaches and some reasonable photographs. Also of great help was the magazine *Locomotives Illustrated*, in this particular case number 98, which has a series of excellent photographs showing essential detail on my class of locomotive. More importantly in this instance was the fact that many photos showed clear detail of the stock making up various trains. George Dow stated that sets of stock for London suburban services were ordered between 1903 and 1908. Painted brown with cream panels, a typical set of five coaches comprised third class brakes, all third and all first class. All were non-clerestory, panelled, compartment stock sporting 8 foot bogies. Detailed plans were not available but by use of the line drawings in *Great Central* (which showed some actual sizes), and the photos, a start was made using CAD.

I set myself one overriding target – the set must be finished within one year. Perusal of the drawings revealed that a slight simplification of window/door window/window dimensions would enable me to cut all windows with one jig. Having taken that drastic decision the drawings were soon completed. In situations like this, where not all sizes are available, CAD comes into its own, for it is a simple matter to move details such as doors and windows around the drawing until they appear correct. A full size print out can then be cut and pasted to the workpiece without any further marking out – who said Blue Peter was only for children?

Needless to say several methods of construction were considered but I decided to use laminated ply for the sides, ends and roofs of the coaches. High quality ply, constructed of three equal layers of birch is available in 0.8 mm and 1.6 mm thicknesses. The surface is very smooth and fine grained and the thin sheets result in good flexibility in one direction. From experience I knew that two layers, clamped to a close fit, and glued with a waterproof hard-setting adhesive would retain the shape of a former. A hard-setting glue is very important as any movement or creep by the glue will result in the sheets slowly reverting to their previous, flat, state! Laminated ply gives an amazingly strong shape which is light in weight and very stable, indeed the Mosquito aircraft was constructed this way and it was generally regarded as a strong machine which saw very active service. As a newcomer to the model railway scene I have come across references to various constructional techniques but I do not recall seeing any notes on laminated ply, so at the risk of boring those who know, I have jotted down some notes which may be of help. I can especially recommend laminated ply for roof construction as only a simple former is required to produce an accurate, sturdy shape – and it's quick!

Laminating a typical side section

Fig 1 shows the former

Plane or sand a suitable piece of timber for the former (I used 1 inch well seasoned softwood) to the profile required and somewhat deeper than the side to allow for clamping. A strip attached to the bottom edge, at a slight angle, will help the clamps to hold on the curved lower edge.

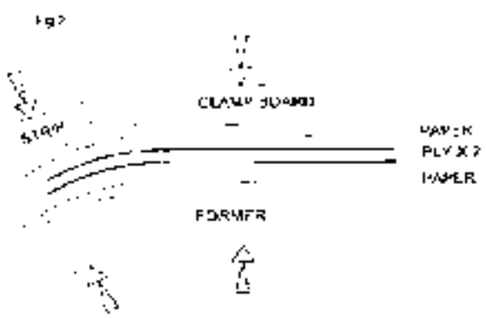
Cut two blanks of birch ply, 1.6 mm thick and oversize by about 20 mm, more or less depending on your confidence. Line the former with paper, glue one face of the ply sheet, place glue side up on former. I used fresh "Cascamite", a powdered resin glue which has to be mixed with water to salad cream consistency, and gives about 30 minutes to sort things out. Setting takes 8 hours plus, depending on temperature. Take care with any drips, sharp edges, etc. for the glue is very hard and brittle and can cut the unwary as well as shatter into the eyes. Glue the other sheet and place glued sides together. You must have good coverage for successful lamination.

Place a flat clamping board over the ply and former, do not forget to place paper between the outer surfaces of the ply and the former or clamping boards. Clamp up with as many clamps as you have – I used 4 clamps over the 500 mm coach length. Place a strip of wood along the curve and clamp this down. Fig 2 shows the complete set-up. You will find that glueing and clamping a side takes about as long as it takes to read this – once the trauma of the first session is over.

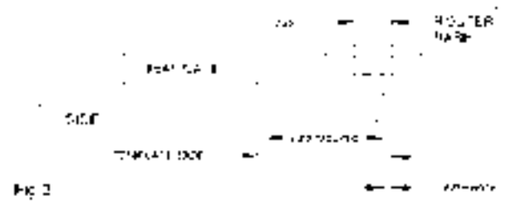
Repeat over ten evenings for a set of five coaches. Then the ends can be laminated on the same former, although you will get several ends from each lamination.

Routing

A router cuts much like a mill except that it is hand held and generally guided by a fence or template. As mentioned previously, the window spacing was optimised to enable just one template to be used. The router itself has



an interchangeable guide bush which projects under the base. The drawings dictated a 4 mm cutter, so I machined up a 8 mm bush with a 6 mm hole (they are available commercially). To determine the size of the template simply add the difference in size between the cutter and guide to the size of the window – so a 20 mm wide window, using a 4 mm cutter and 8 mm guide gives 24 mm hole in the template. Fig 3 shows the relationship between drawing and template. I used a piece of ⅛ inch aluminium sheet from an old printing machine for the template. The only problem with a template set to cut several holes is the spacing of the original – if they are too close the "bar" between holes is lost and you will need to revert to a single hole in the template, which means re-aligning each compartment 3 times!



The original former is now modified by the addition of a guide strip to the top edge. Trim the blank sides to width and mark out the position of the holes in pencil, or "Pritstick" the drawing on, ensuring accurate alignment. Clamp the former, the marked-out side and template so that no movement can occur (wood screws through template, window space and into former helps) and prepare to rout the windows, see fig 4.

You need a router which will allow the cutter to plunge into the wood. In operation the router will need to run at maximum speed, about 24,000 rpm, and will generate clouds of fine dust, so take precautions! Place the router over the work, guide bush against the former hole, switch on and plunge in deep enough to cut through the ply with a little to spare. Allow the guide bush to follow the template till a cut has been made all round the window. Repeat on the other two windows. This all sounds like a