# GAUGE and SCALE

FOR TOY AND MODEL TRAINS

fredlub |SNCF231E | 23 oktober 2024

# 1 Content

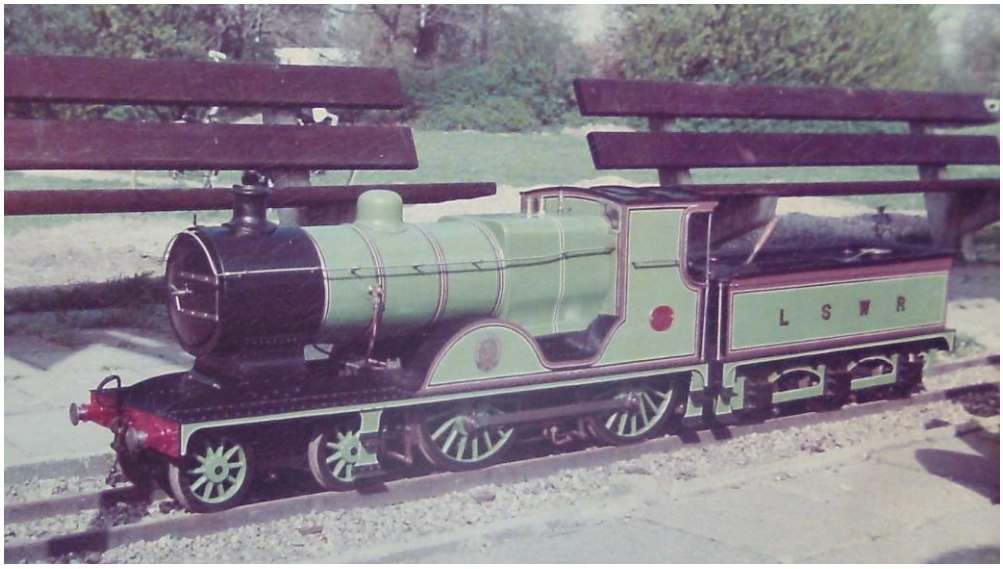
# 2 Introduction

My first train I received as a "Sinterklaas[1]" present at age 5 or 6. It was a Märklin clockwork train set (S 873/1) with locomotive and tender, 2 passenger cars and a circle of rails. The picture, taken by much older brother Ben, shows my older brothers Dick (right) and Theo (left) and me playing with the clockwork train and some other toys (Mobaco, Dinky Toys, Schuco).

The rails of the Märklin set were to H0-gauge, however the scale of the locomotive was undefined and not the scale associated with H0-gauge which is 1:87; both the locomotive and tender were very short and had 4 wheels, they seem to be based on a prototype from the Pennsylvania Rail Road which has a 4-6-2 wheel arrangement with 12-wheel tender.

Some 20 years later I acquired a 7¼ Inch gauge live-steam locomotive built to a scale of 1:8. From then on, I was lost and I occupied myself with all kinds of toy and model trains in all sizes, scales and gauges remembering the motto of the TCS (Train Collectors Society): Any make, Any gauge, Any age.

The very English 7 1⁄4 Inch gauge live-steam locomotive; one of the few items that are not in my collection anymore.




A couple of years ago when looking for some information I noticed that lots of books are written on toy and model trains, like the history of manufacturers, or construction of a model railway, but that gauge and scale were mentioned but not fully or objectively addressed. I promised myself I would write the book on gauge and scale and here is the result of that promise. I have tried to write this book as a history and global inventory of gauge and scale without a bias to what I think is the preferred gauge/scale combination. Although this is a worldwide overview it is of course subjective caused by my geographical background. A lot of stocktaking of gauges and scales is present on the internet, especially in tabular format, like on this German website: http://twhk.de/spurweiten/modell.htm; a nice and comprehensive table called "Worldwide Model railroad scales" which includes also gauges, can be found (and downloaded) on the website of a Swiss model railway group: https://www.on3trainbuffs.com/scales-ma%C3%9Fst%C3%A4be/. The present book is more descriptive.

[1] Sinterklaas is a Dutch holiday where children receive gifts.

I use the term toy and model trains. When (without success) trying to find a definition of these terms the well-known collector Sandor from Hungary mentioned: “When I try to explain to someone the difference between model trains and my toy trains, I take the difference between photos and paintings as an example. A photo reflects more or less, but always the direct reality. On the other hand, on a painting one finds rather a purposeful abstraction and well selected atmosphere of the original.”


Without a well-defined difference between a toy and a model, of course most people will recognise the grey locomotive in its Plexiglas case (a Micro Metakit product) as a model while the tinplate red and black Comet (a Japanese train by SKK) is a toy; however, when I am playing trains all my models become toys.

You will find first in this book some further description of scale and gauge and thereafter, organised by the well-known gauges a further detailing also giving examples and pictures. The listing is done by gauge since gauge is specific for toy and model trains. Most pictures are made by me and from items in my own collection. The artefacts in the model and toy train hobby are of course the trains themselves (locomotives and rolling stock), the rail or track and anything to model a world around the trains like accessories, scenery products, figures, automobiles etc. My interest lies in the trains themselves (more specifically steam trains), so the trains are discussed here[2].

**Acknowledgements**

First of all, thanks to Jacques for reminding me that I once said I would write a book like this when I was retired. Thanks to Jacques, Ludo and Tamme for proofreading and tips.

**Copyright**



**Cover page**

The picture on the cover page shows my multi gauge garden layout with an S gauge Stadtilm and a 1-gauge Bing locomotive.

**End page**

The picture on the end page is an edible train (gift from Marlies) which has scale nor gauge. When you read this, it will have been eaten.

**Remarks**

Any remarks or comments are welcome, they can be given via fred.van.der.lubbe at planet.nl. The current version of this e-book does include changes due to some remarks and comments I received on a previous version.

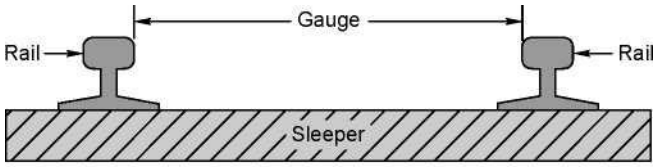
[2] One could define a difference between model train and model railway enthusiasts. I am the former, the latter are not only modelling trains but also the surroundings.

# 3 Gauge and Scale explained

Before going into the different toy and model railway gauges and scales, I first describe gauge, scale and their combination.

## 3.1 What is Gauge

Gauge is the width of railway track, i.e. the distance between the 2 rails forming the track.



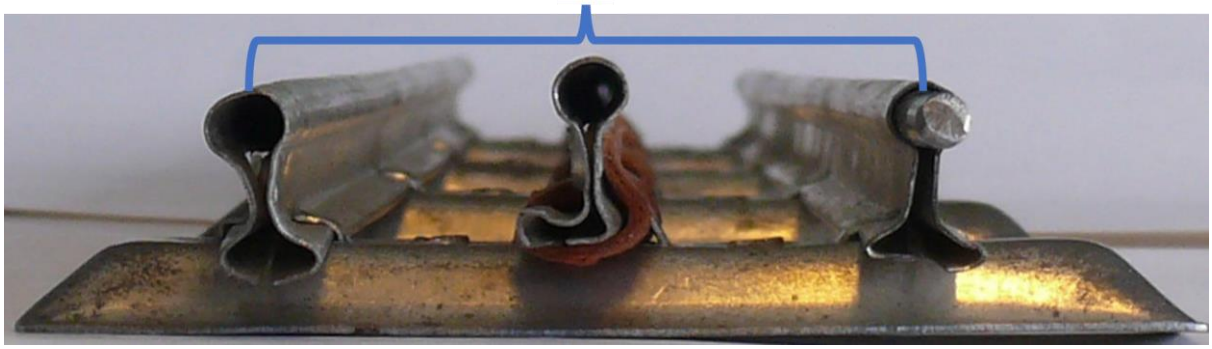

### 3.1.1 Real trains

In the real world three different gauges are recognised: standard gauge[3], broad gauge and narrow gauge. Standard gauge is fixed around the world and used on more than half of the railway track worldwide; the gauge measures 1435 millimetres or 4 feet 8.5 inches. Broad gauge is any track width larger than standard gauge; to mention two: in Spain and Russia broad gauge is used with a measurement of 1668 mm and 1520 mm respectively. Narrow gauge is of course a track width smaller than standard gauge; to mention some: The Harz Railway in Germany and the Rhaetian Railway in Switzerland are meter gauge (1000 mm), the Ffestiniog Railway is a 1 foot 11.5 inch (597 mm) narrow gauge railway in Wales, in Japan the non-high-speed railways are to a gauge of 1067 mm (3 feet 6 inch). Of course, the value range of broad gauge is theoretically much larger than that of narrow gauge, however the amount of narrow-gauge widths used around the world is much larger than those of broad gauge.

### 3.1.2 Toy and model trains

In toy and model trains the gauge is the distance between the 2 rails forming the track, however in early days of toy trains the track gauge was measured from between the middle of the 2 rails (or more correctly: between the middle of the two railheads.)

**Toy-train gauge measured from middle of the railheads**



Since at that time the (tinplate) rail profile was 3 mm wide the track gauge was 3 mm more than now; for instance, a track gauge of 45 mm now was called 48 mm then. Many of the track gauges for toy and model trains are an industry standard and are indicated by a letter or number, the most common currently are: Z (6.5 mm), N (9 mm), H0/00 (16.5 mm), S (22.5 mm), 0 (32 mm) and 1 (45 mm). Märklin started this standardization in 1891 introducing a complete gauge I railway system with track, rolling stock and accessories. Gauge I, which had a width of 48 mm, i.e. 45 mm between the rails, is still used and now in general called gauge 1. Larger gauges where standardised indicated by Roman numerals II (54 mm), III (75 mm) in 1892. In1898 Märklin introduced a smaller gauge of 35 mm (32 mm between the rails) which was called gauge 0. Other toy train makers like Bing and Carette followed and later almost all manufacturers around the world followed this industry standard. The following table shows these original gauges.

[3] To complicate things: The term Standard Gauge, with 2 capitals, was an early toy train rail gauge, introduced in the United States in 1906 by the Lionel Corporation.

| Gauge Designation | Width in mm (original) | Width in mm (as measured now) | Approximate Scale | Remarks |
|---|---|---|---|---|
| 0 | 35 | 32 | 1:45 | |
| I or 1 | 48 | 45 | 1:32 | |
| II | 54 | 51 | 1:28 | |
| IIa | 65 | 62 | 1:23 | Not introduced by Märklin; Bing and Carette called this Gauge 3 |
| III | 75 | 72 | 1:20 | Bing called this Gauge 4 |
| IV | 95 | 90-92 | 1:15 | Gauge only used in England |

Nowadays there are two organizations issuing standards, including standards on gauge and scale, for model (but not toy) railways: MOROP (the European federation of national model railway associations) is a European organisation which publishes NEM-standards. NEM-standards are used by model railway industry and hobbyists in Europe. The NMRA (National Model Railroad Association) standards are used widely in North America and by certain special interest groups all over the world. To some extent NMRA and NEM standards are compatible, but in areas, the two standards specify certain model railway details in somewhat incompatible ways for the same gauge or scale. Of course, it helps to have standards, however the standards are no law and there are no model-train police officers that will arrest you when you do something non-standard. Every toy and model railway hobbyist can and should decide for himself in what way he has fun with his trains with or without standards.

### 3.1.3 The name of the gauge

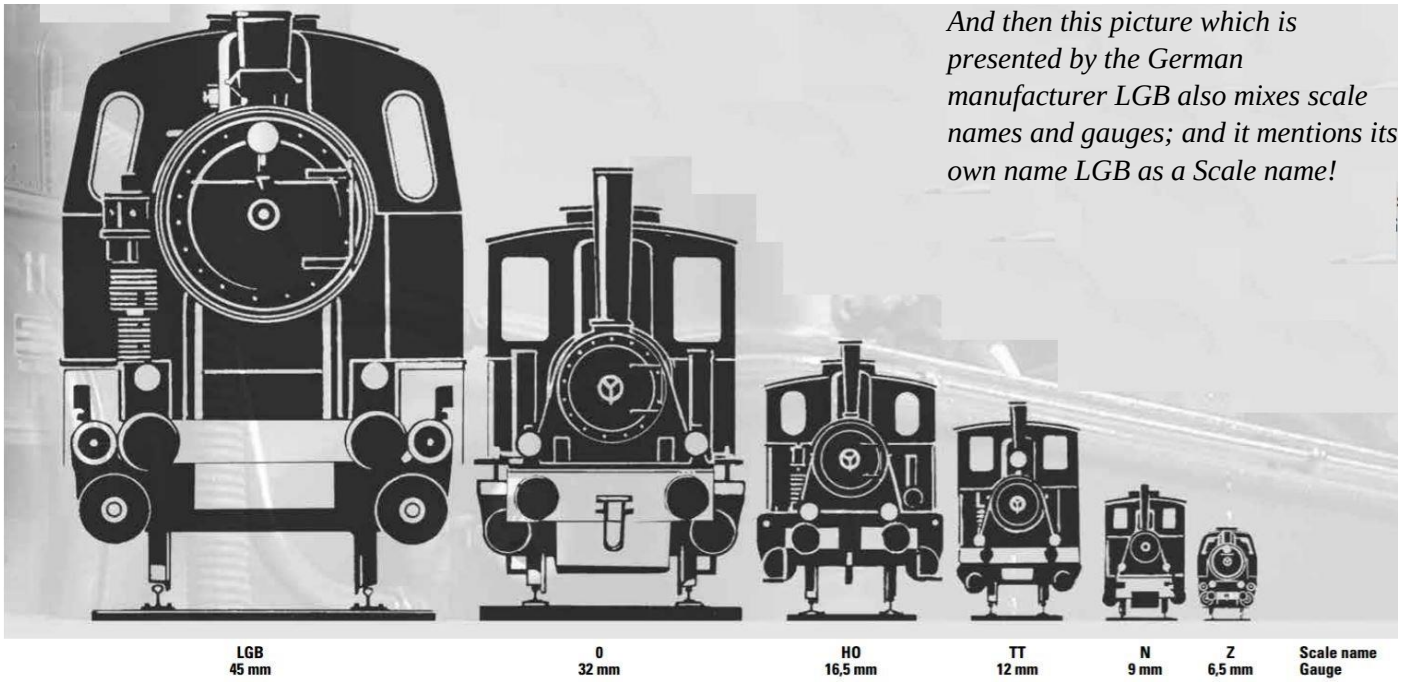
The European MOROP issues the NEM (Normen Europäischer Modelleisenbahnen = Standards of European model railways) standards; they use explicitly the 0 (zero) in gauge names. https://www.morop.eu/downloads/nem/de/nem010_d.pdf

The American NMRA however uses the capital letter O in their standards. https://www.nmra.org/sites/default/file ... 009.07.pdf

I mentioned that the track gauges for toy and model trains are indicated by a letter or number. As described the first gauges were given Roman numerals and when a smaller than I gauge was created it was called 0-gauge. In common parlance the zero might be pronounced as an O and it might also be written as an O. I remember well that in the large train shop Merkelbach in Amsterdam a lady asked the shop assistant for an HO train; he instantly corrected her by saying the HO is Oatmeal[4] and H0 are model trains. Of course, the shop assistant should not have tried to correct his client; the shop was declared bankrupt later. Also 00-gauge is often named and written OO gauge; OO is of course a double O and Hornby trains in this gauge were once named Hornby Dublo (which has nothing to do with Duplo toys, even if I normally pronounce it like that). My spelling checker gave alerts when I used the word gauge with a number before it, but not with a letter before it; a hyphen should be included. So, in this document I write H0-gauge, 00-gauge, 0-gauge or 1-gauge and Z gauge, N gauge or S gauge. Often the letter and number follow the word gauge, i.e. Gauge 1 and gauge H0; I try to be consistent by not doing that here.

[4] HO Oatmeal was launched in the second half of the 19th century by Hornby's Oatmeal Company of Buffalo, USA. In the 20th century it was exported to Europe where the product still under that name in stores can be found but made today by the Quaker Oats food company that is owned since 2001 by the soft drink company Pepsi Cola. It is noteworthy that the H of HO Oatmeal stands for Hornby; the train manufacturer with the same name never made any H0 but kept to 00.

Often the gauge name is also used as a scale name and a train enthusiast might say he is modelling in 0 scale. As long as his fellow modellers know what he is talking about that is OK, but it might be more correct to say I am modelling 0-gauge. One could argue that when modelling not a train but something else on the model railway, say a car, it would make sense to name the scale and not the gauge. The width between the tires of a car which is used on a "0 scale" model railway might not be 32 mm 😉. The following text, which mixes up scale and gauge names, can be found on the website of the German scenery manufacturer Faller: "*From 1:22.5 (G) to 1:220 (Z) - we have every possible track gauge you could need. The most commonly used size is 1:87 (HO) followed by 1:160 (N). As a happy medium between the two, the gauge 1:120 (TT) is gaining in popularity.*"

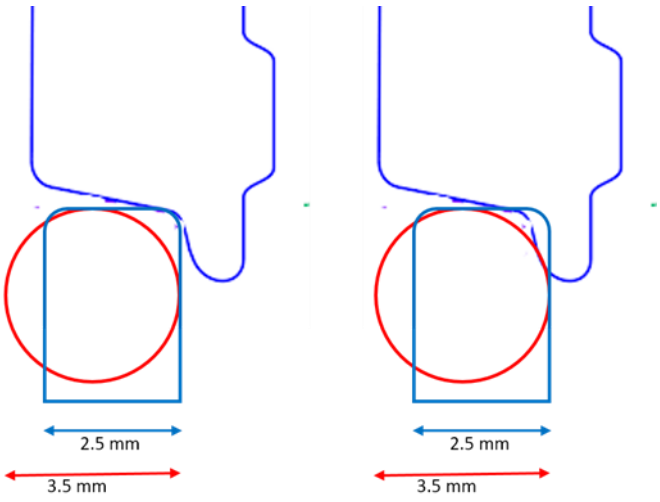



*And then this picture which is presented by the German manufacturer LGB also mixes scale names and gauges; and it mentions its own name LGB as a Scale name!*

To further illustrate the mix up of terminology, this I a quote from the website of the NASG (National Association of S Gaugers): "*Throughout this web site we refer to modelling in 1:64th scale as "S-scale" (the hyphen is significant). You will find magazines and other web sites using the term "S-gauge" or "S gauge". That terminology is not correct*". Some people might then remark that the NASG should be called the NASS 😉

### 3.1.4 Gauge and rail-profile

Since I run trains of various makers on track of various makers it occurred to me that the combination of wheel and rail profile sometimes influences the gauge and even sometimes causes problems when mixing manufacturers products.




This diagram shows the same wheel on different rail profiles. The measurements are from an S gauge example. The rectangular blue railhead has the contour of an American Flyer rail while the red railhead has the contour of a BUB tinplate rail. It shows that a train made for tinplate track might have difficulties running on rails with a rectangular contour. And indeed, BUB S gauge trains do not run on American Flyer track.

### 3.1.5 A third rail?

In real trains as well as model trains a third rail is sometimes used. The third rail however has no influence on gauge, so the next 2 paragraphs are just here to fill the page.

On real trains a third rail is a method of providing electric power to a railway locomotive or train, through a semi-continuous rigid conductor placed alongside or between the rails of a railway track. It is used typically in a mass transit or rapid transit system, which has track in its own corridors, fully or almost fully segregated from the outside environment[5]. On most systems, the conductor rail is placed on the sleeper ends outside the running rails, but in some systems a central conductor rail is used. The trains have metal contact blocks called shoes (or contact shoes or pickup shoes) which make contact with the conductor rail. Another method of supplying electricity to a train is using overhead wire or catenary.

In a large part of electric model trains the electricity is supplied by the two running rails, however also the method of a third rail is used[6]. This method is not only used for models of real trains that used a third rail; electric models of steam or diesels trains can also use this method. In model trains the third rail is sometimes obscured by colour; Märklin uses in their H0 system, which is largely spread, contact points coming through the middle of the sleepers instead of a continuous third rail, however their system is still called a 3-rail system. In most 3-rail systems the running rails are electrically connected, but there are also systems where the 3-rails are used independently. In general, the third rail is running in the centre of the two running rails; some early model railways, like the “Delta Lines” from Frank Ellison, which was featured in early model railway magazines in the USA, used an outside third rail. Of course, also in model trains supplying electricity to a train with overhead wire is used. Since my main interest is steam locomotives, either running on live steam, clockwork or electricity, I will not further discuss overhead wire.

### 3.1.6 Monorail

A monorail has of course no gauge, the distance between one rail makes no sense. Models of monorails do exist but will not further be discussed here. I however still like the monorail in Naha, Okinawa:

See also: https://www.youtube.com/watch?v=CHzvlXJFEAw

[5] People living south of London know that the former Southern Railway, now Southern region, also use a third rail for their electric track, which is a large part of the Southern region network.

[6] There are also electric model trains using batteries for their energy; in this case the track does not have to be used for supply of electricity. These trains are sometimes called “Dead rail” trains.

## 3.2 What is Scale

When making a model of something, say a submarine, one of the important considerations is the scale. Suppose the submarine to be modelled has a length of 25 meters and you like to model to a scale of 1:25, the length of the model will be 1 meter. Note that with a correct model the width and the height will also be $1/25^{th}$ of the prototype. The mass of the model, and in this case the displacement in water will be 1 divided by 25*25*25 = $1/16525^{th}$ of the displacement of the real submarine. Scale is normally given as a fraction like 1:25, assuming the model is smaller than the prototype. With three-dimensional objects (i.e. the majority of objects) the scale fraction is mentioned for one dimension only; e.g. a model of the Eiffel tower at a scale of 1:300 will have a height of 1 meter with a width which is also proportionally.

In the UK a scale of a model is sometimes indicated as a length as a fraction of a foot. This means that a model to a scale of 1 inch has a scale fraction of 1 inch to the foot which is 1:12. In railway modelling also millimetres and feet are considered; a scale of 4 mm means a fraction of 4 mm to the foot, which comes to 1:76.

Lots of toys are actually a “model” of a real thing. However, a toy is in general not to scale. See this German made Steiff lion named Jag, who is guarding my train collection. He is large and I guess about 1:5 of a real lion. But only when you would like to model a zoo the scale of this type of toys would be of some interest.

And when you see the picture of my brothers and me with our toys (see 2) you see some Dinky Toy cars, made to 1:43 scale - the most popular scale for model cars worldwide, and a Dinky Toys aircraft (Super Constellation). Dinky Toys aircraft were made at scales ranging from 1:122 to 1:265. We did not care about this discrepancy.

To further demonstrate scale difference: here is a picture of two similar Märklin German tank locomotives in 1:220 and in 1:32:

In the toy and model world three-dimensional objects are sometimes modelled in only two dimensions like the mountains with village as background on this older model railway called the Voltabahn and the conductor with his whistle.

A scale is associated with a model of an object in the real world. There are however many ways to model an object, or in the context of this book, a train. As I discuss toy and model trains the question arises what scale has to do with toy trains, so a paragraph about toy-scale is relevant. Further the terminology fine-scale is sometimes used, which would then suggest there is also something called coarse scale. The term coarse scale is indeed sometimes used for model trains made recently in a nostalgic style, i.e. in a style that was used in a time that model trains were THE present for a boy. Fine scale is often associated with trains made in the last 50 years; the beginning of fine scale might be the introduction of brass models made in Japan and imported by companies like Fulgurex in Europe and Pacific Fast Mail in the USA. Enough about this, since this is not the history of toy and model trains but a paragraph about Scale and Gauge.

There are also items that look like a train but cannot be considered models at all like this pencil sharpener or Thomas the Tank Engine plush toys; these are further not considered by me.

### 3.2.1 Toy-like scale

Older trains, e.g. trains made before 1920, are often toy like. In what I call a toy-like scale the train looks like a train but the proportions are far from correct (in general too short) and often the prototype is not recognisable. A first example is the JEP SNCF streamlined clockwork train. The SNCF did have streamlined locomotives, but not an 0-4-0 type without any sign of driving or coupling rods. Further the two cars in this set have the correct colour, green for a passenger car and red for a postal car, but their length and the number of windows is incorrect.


In the next example the American Flyer locomotive looks American but with a 2-4-4 wheel arrangement, a gold plated smokestack and a tender with lettering of American Flyer Lines it is toy-like, not to mention the funny looking rodding. The boxcar and hopper in this train however, products by Dorfan, have a reasonable length, the correct number of wheels and correct lettering. These could be also considered coarse scale.

### 3.2.2 Coarse scale

The term coarse scale is used in England for 0-gauge trains made according to the coarse standard[7] with higher flanges and suitable for smaller radii. In the USA for 0-gauge, apart from the modern 2-rail products, the terms 3-rail traditional sized and hi-rail, and the meaningless term semi-scale, are used. More of this subject specific for 0-gauge is mentioned in chapter 12.

As an example of a coarse-scale train here a Bassett-Lowke 4-4-0 locomotive with two Bing coaches. Although the locomotive, a clockwork 4-4-0 named Duke of York and numbered 1927 for the year it was made, does not follow a specific prototype, it is according to the manufacturer a scale model 4-4-0 express locomotive "with a strong tendency towards the LMS practice in its general outline". The coaches are a bit short but do have the necessary detailing, albeit in lithography, and correct LMS lettering.


### 3.2.3 Fine scale

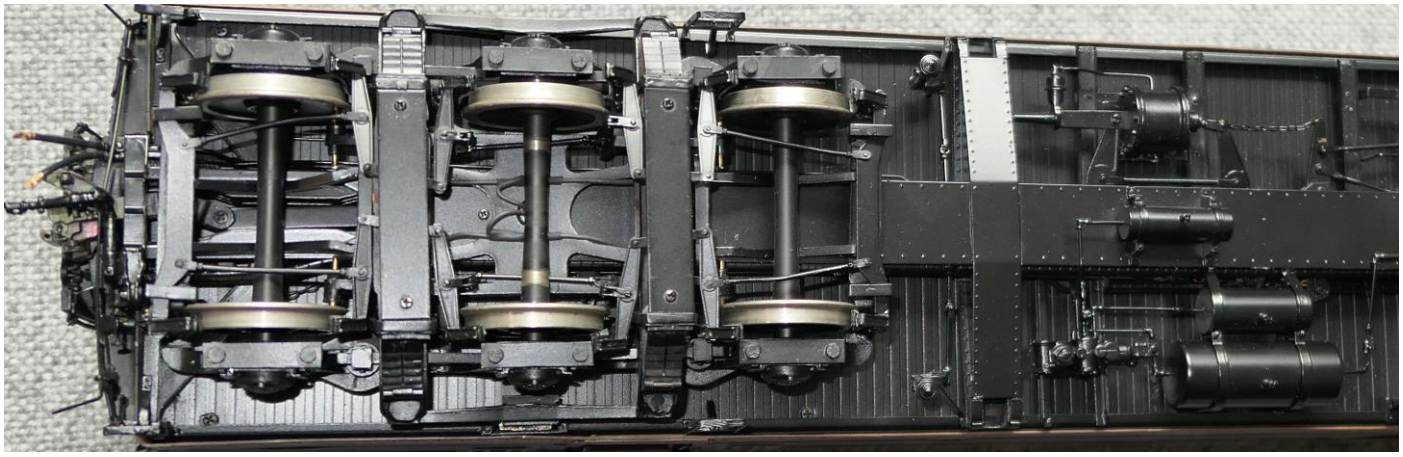
In a fine scale model all, or at least many, visible attributes of the real train are scaled down into the model. When also the running gear and wheel profile are exactly scaled, these models are very sensitive to the type of track they run on, if run at all. Sometimes these trains spend their life being admired in glass cases.


Custom made glass case for a very detailed fine-scale brass 0-gauge model of a Wagon-Lits restaurant car.

[7] Published by the British Railway Modelling Standards Bureau in 1941

Since the production methods are changed and the main customer group for model trains are adults, many models made today can be considered fine scale models. Here as an example a recent (2017) model made in Asia but commissioned by the French company REE Modèles of an H0-gauge SNCF 141E. It will fall apart when a child picks it up.


The term Finescale and Protoscale is also used for model trains that are made to stricter measurements then the standards like NEM. In these cases, the locomotives and rolling stock and the track must be made to the same strict standard. The picture below shows the underside of a model made to 1-Gauge Finescale standards by the American manufacturer Fine Art Models; although my 1-gauge track layout has a radius of 3 meter and there are no crossings or switches, the model does not run on my track.



## 3.3 Combining the two

Combining gauge and scale is the difficult part so let's start with something simple: floor trains.

### 3.3.1 Floor trains

A floor train is a toy train that is not made to run on track so there is no consideration of scale and gauge. Most floor trains are to be pushed or pulled, some have clockwork or battery power and then might run against the wall or furniture and might get damaged. Most wooden trains are floor trains, however there are some wooden trains, like Brio, that can run on track.


Three floor trains; a clockwork lithographed tinplate locomotive made by Tipp & Co; a wooden train still in its original packaging and a push train made in China.

### 3.3.2 Toy trains

Some toys like dolls, trains and cars are modelled after the real world. The size of toys however has more to do with the size of things children can handle than with the size of the real thing. For toy trains the size is in general not derived from the size of a real train. So, the scale/gauge combination is not fixed.


These two JEP toy Pullman cars are both running on 0-gauge track, but their scale is different and for both undefined.

For toy trains running on rails the scale is not, but the gauge is, important, since trains will run only correctly on a track with a gauge these trains are made for. Note that this does not mean that the track has to be made by the same manufacturer as the train. When mixing manufacturers products however, problems may arise on crossings, turn-outs, switches etc.., since there is no or minimal standardization in toy trains. Further it is up to the toy train player whether the size of the different trains he plays with should match. This next train looks a bit odd, I think, but is all 0-gauge and they did couple.


The coach is from the French manufacturer Edobaud, they are known for making very large items on 0-gauge. The locomotive is one of the smallest 0-gauge Bing clockwork locomotives.


Another example showing scale inconsistency. On the box of this Le Rapide train set is a picture of the train in the box with a boy. The train in the box is correctly rendered on the box, however much too large. The locomotive engineer doll, made for me by Greet, is much smaller than a boy (55 cm high standing), but he looks much larger than the boy on the picture when compared to the train.

The rails used for toy trains is of course toy track. The track is not made to look like the real thing: sleeper spacing is large; curves are sharp and the rail profile is too high. There is a great variation of toy train track made during the years. It was suggested to me to also make an e-book on that subject, however there is no reason to do that since Charles Cooper from Ontario, Canada already made the virtual Toy Train Track Museum.

### 3.3.3 Model trains

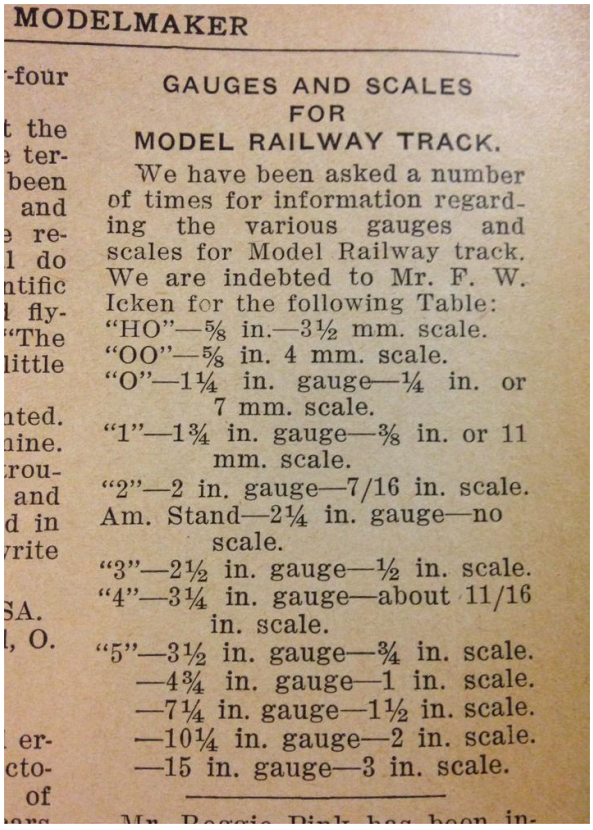
Two examples of scale and gauge in model trains:

- Suppose we like to have a model at a scale of 1:8 of a standard gauge (i.e. 1435 mm) locomotive. The track gauge should then be 1435:8 = 179 mm. In the real model world, however, track gauges of 184 mm and of 190 mm are known and used for 1:8 scale models; thus, when using 184 mm an error of almost 3% is accepted.
- We have a track gauge of 16.5 mm and want to model an English prototype. The scale should then be 1: (1435:16.5) = 1:86.97. We will round that number to 1:87, the English model with a track gauge of 16.5 mm however is generally made to a scale of 1:76. An error of some 11% is accepted.

It seems, when looking at other examples (see also the next chapters), that a completely correct gauge/scale combination is the exception rather than the standard. Many historical gauge/scale "errors" have a technical reason; the second example for instance was caused by the size of electric motors which were too large to fit in steam locomotive boilers of models of English prototypes. Some of these gauge/scale "errors" are now history, others are still used by the model railway industry. Note that model train enthusiasts that make their own track and/or rolling stock in general use a correct gauge/scale combination. One could question whether the gauge and the length, width and height of a train should all be scaled with the same proportion. Since wheel width and flanges in model trains are in general oversized, it might be a choice to "undersize" the gauge.

The history of toy and model-trains, including scale and gauge, has followed different paths in the different countries. A German, English and American path can be recognised and some detours for France and Switzerland were made. Examples will be mentioned in the next chapters. A special mention will occasionally be made for Japanese railway models, where narrow gauge was the standard.

The rails used for model trains is generally model track. Sleeper spacing, rail profile and rail height are looking like a model of the real thing. Modelling the radius of real track however is generally difficult since space does not always permit this. Also modelling correct rail height, as a consequence of using non-scale flanges on wheels, needs sometimes compromising. Since there are model train standards, trains made to such a standard can run on track made according to the same standards, irrespective of the manufacturer.



MODELMAKER

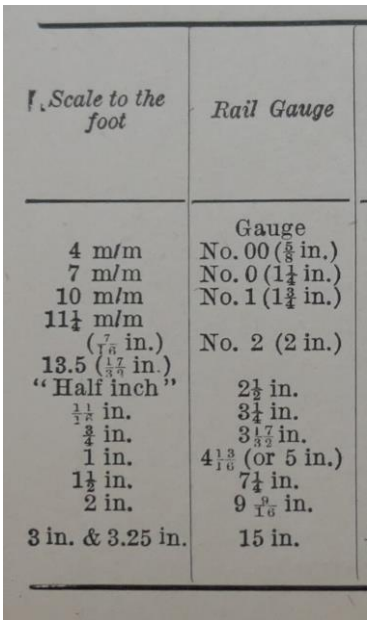
GAUGES AND SCALES FOR MODEL RAILWAY TRACK.

We have been asked a number of times for information regarding the various gauges and scales for Model Railway track. We are indebted to Mr. F. W. Icken for the following Table:

"HO"—⅝ in.—3½ mm. scale.
"OO"—⅝ in. 4 mm. scale.
"O"—1¼ in. gauge—¼ in. or 7 mm. scale.
"1"—1¾ in. gauge—⅜ in. or 11 mm. scale.
"2"—2 in. gauge—7/16 in. scale.
Am. Stand—2¼ in. gauge—no scale.
"3"—2½ in. gauge—½ in. scale.
"4"—3¼ in. gauge—about 11/16 in. scale.
"5"—3½ in. gauge—¾ in. scale.
—4¾ in. gauge—1 in. scale.
—7¼ in. gauge—1½ in. scale.
—10¼ in. gauge—2 in. scale.
—15 in. gauge—3 in. scale.

Already in 1928, the American magazine The Modelmaker recognised more than one scale combination with 0 and 1-gauge, see the table left. Striking in this table is the mentioning of "no scale" with the American specific (Lionel) gauge called "Standard Gauge" (The utmost misnomer that you can imagine).

The table right is from the, at least in England, very influential model train engineer Henry Greenly and dates from around 1924. Note that 00-gauge is already mentioned.



| Scale to the foot | Rail Gauge |
|---|---|
| | Gauge |
| 4 m/m | No. 00 ($\frac{5}{8}$ in.) |
| 7 m/m | No. 0 ($1\frac{1}{4}$ in.) |
| 10 m/m | No. 1 ($1\frac{3}{4}$ in.) |
| $11\frac{1}{4}$ m/m ($\frac{7}{16}$ in.) | No. 2 (2 in.) |
| 13.5 ($\frac{17}{32}$ in.) "Half inch" | $2\frac{1}{2}$ in. |
| $\frac{11}{32}$ in. | $3\frac{1}{4}$ in. |
| $\frac{3}{4}$ in. | $3\frac{17}{32}$ in. |
| 1 in. | $4\frac{13}{16}$ (or 5 in.) |
| $1\frac{1}{2}$ in. | $7\frac{1}{4}$ in. |
| 2 in. | $9\frac{9}{16}$ in. |
| 3 in. & 3.25 in. | 15 in. |

### 3.3.4 Modelling Non-standard gauge

Non-standard gauge can be broad gauge or narrow gauge. There seems to be not much modelling in broad gauge trains except for some modelling of the English broad gauge (2140 mm) as used by the Great Western Railway in the British scales of 4 mm and 7 mm to the foot. The interest in narrow gauge modelling is larger. However, I somewhere read the remark: the number of different gauge/scale combinations used for narrow gauge modelling seems almost as large as the number of narrow-gauge modellers. For narrow gauge modelling a gauge associated with a smaller gauge/scale combination is sometimes used, so when modelling in a scale of 1:87, for which the standard gauge (H0) is 16.5 mm, narrow gauge modellers for metre gauge use 12 mm (the gauge associated with TT gauge). The NEM standard specifies that narrow gauges are indicated by an additional letter added after the gauge name associated with the scale for standard gauge modelling as follows:

- m = metre gauge (prototype: 850–1,250 mm)
- e = narrow gauge (prototype: 650–850 mm)
- i or f = industrial (prototype: 400–650 mm)
- p = park railway (prototype: 300–400 mm)

For instance, narrow gauge trains with a prototype gauge of 850–1,250 mm are, were standard gauge would be H0, named H0m and use a gauge of 12 mm (which is TT gauge); narrow gauge trains with a prototype gauge of 650–850 mm would use a gauge of 9 mm (N gauge) which is called H0e. The NMRA standards use a different indication by adding a n and a number (feet or inches) to the gauge name; H0n3 would be modelling to a scale 1:87 for 3 feet narrow gauge railways.

My interest in narrow-gauge trains is not that large, but my interest in models of CIWL carriages is. So here a picture of narrow gauge (meter gauge) CIWL Pullman cars, the large one, made by LGB in IIm, the smaller one on top made by Bemo in H0m:

# 4 Comparing the Gauges

Before discussing and describing the different gauges in the next chapters (i.e. a chapter on each of the Gauges Z, N, TT, H0/00, S, 0, 1) it might be of interest to have an idea which gauge or gauges are the most popular and most used by manufacturers. The popularity of the different gauges proves to differ geographically and has changed over the years. From the beginning of model railways, the most popular gauge became smaller going from larger than 1 to 0, until H0/00-gauge became popular; after that smaller gauges have never succeeded in becoming more popular than H0/00 (except in Japan). The popularity of a gauge can be determined by, for instance:

- the number of people interested in a gauge,
- the number of people actually modelling or running trains in that gauge,
- the number of items manufactured (and sold) in a period for a gauge,
- the total amount spent or the turnover amount on a gauge in a period.

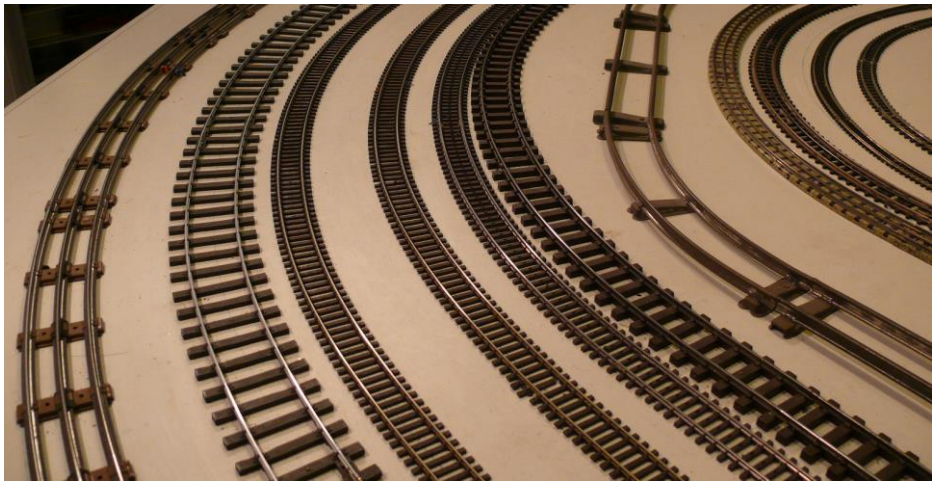
I have found some figures in books, magazines and the internet which give some idea but are certainly not good enough and sometimes even do not define the way they are determined, by just mentioning “market share”. Without specific figures the following can be noticed:

- For Western Europe excluding Germany and the UK: H0 is the most popular, followed by N and further 0 and 1; TT and Z are of minor interest.
- For Germany: H0 is the most popular, followed by N, followed TT and Z and then further 0 and 1 and minor interest in S.
- In the UK 00 is the most popular, followed by N and then 0 and 1; H0, TT and Z are of minor interest.
- In the US also H0 wins but 0 is a large second (caused by the popularity of 3-rail 0 gauge) followed by N and S; 1 and Z are of minor interest and TT even less so.
- In Japan N is the most popular followed by H0.

I suspect that the manufacturers interest for each of the gauges, or the number of manufacturers for each gauge, might differ from the popularity of a gauge but I do not have a way to further prove this. Further, model railway enthusiasts are a special breed, some of these wants to explore unknown areas and use gauges and or scales, or combinations thereof, that that might be called rare.

Just as a further detail here are the very subjective figures for myself: I am interested in all gauges, so there is no distinction in interest; I actually run trains in H0/00, S, 0 and 1-gauge, so the each get 25%. The number of items in each gauge and the amount spent, again as a percentage, is given in the table. The number of different manufacturers per gauge in my collection is given in the last column of the table.

| Gauge | % of number of items | % of amount spent | # Manufacturers |
|---|---|---|---|
| Z | 0.5 | 0.5 | 1 |
| N | 3 | 1 | 15 |
| H0 | 45 | 20 | 136 |
| 00 | 10 | 2 | 25 |
| S | 3 | 1 | 10 |
| 0 | 25 | 32 | 91 |
| 1 | 9 | 40 | 32 |
| Various (a.o. floor trains) | 4.5 | 3.5 | 46 |



A multi-gauge layout, from left to right: 0 3-rail, 0 2-rail, H0 2-rail (twice), H0 3-rail (Märklin), S, 0 clockwork, 00 3-rail, H0 3-rail (Trix), N, H0e

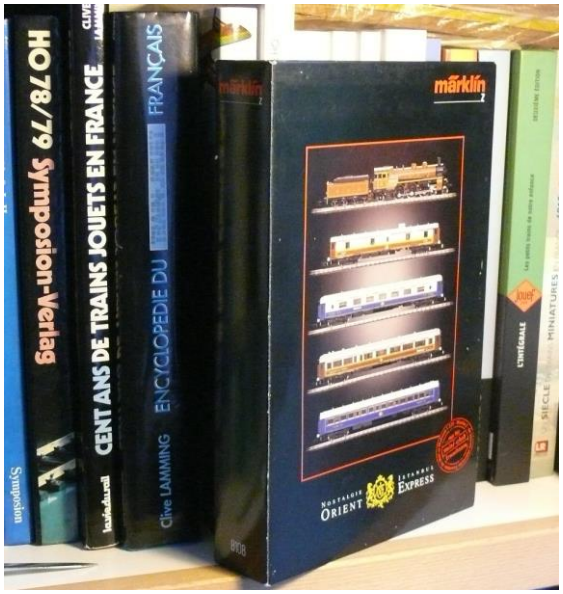
# 5 Z Gauge

Märklin named their smallest gauge, which they introduced in 1972, Z gauge. Giving it this name was of course indicating that this was the smallest gauge you could use for model trains. There are quite some modellers who consider Z gauge too small and are not interested in it at all.


When seen next to a packet of pocket handkerchiefs it is clear that this Z gauge Märklin locomotive would get lost in your pocket.

Märklin gave the Z gauge range of models the name Mini-Club and associated a scale of 1:220 and a gauge of 6.5 mm with it, all based on standard gauge prototype of 1435 mm. 220 * 6.5 mm = 1430 mm, so the gauge/scale combination is only 0.35 % off, which is negligible. Märklin is the initiator of a number of gauges; for Z gauge they are still the main manufacturer; there are only a couple of other manufacturers making Z gauge trains, an important one being Micro-Trains Line which makes American prototype trains. A couple of (in general smaller) manufacturers make accessories that can be used for Z gauge. Z gauge is alive in Germany, it has some following in the USA and in Japan. There is not much Z gauge in the other train modelling countries like for instance England and France.

Z gauge is too small and fragile to play with like kids do. Nowadays a large portion of model and toy-train hobbyists are adults, for Z gauge this portion is even larger. The small size makes it possible to have a train layout in a small space or to model a very large area. I do not have a fixed Z gauge layout. Z gauge is also a collector's gauge, since you can spend a large sum of money on a collection which you can keep in a drawer or on a bookshelf. Märklin facilitates this by making their trains available in presentation boxes, like this box with an Orient Express train set.





I have never seen or heard of Z gauge trains that were run by clockwork or steam; all Z gauge trains run on 2-rail DC with 8 Volt; Märklin also supplies working catenary such that two trains can be run on one track.

## 5.1 Non-standard gauge trains

In the scale associated with Z gauge, i.e. 1:220, there is little or none narrow-gauge modelling or broad-gauge modelling.

## 5.2 Smaller than Z gauge

Märklin used the name Z since they assumed a smaller gauge would not be possible; that proved to be wrong. T Gauge was introduced at the Tokyo Toy Show in 2006 by KK Eishindo of Japan, and went on sale in 2007. The T stands for three; track gauge is 3 mm and the scale 1:450. It is the smallest commercial model train scale in the world and mostly Japanese prototype trains are produced. A scale of approximately 1:450 is used for architectural models; T gauge is used for that also. I do not have any T gauge trains, so cannot show any pictures.

# 6 N Gauge

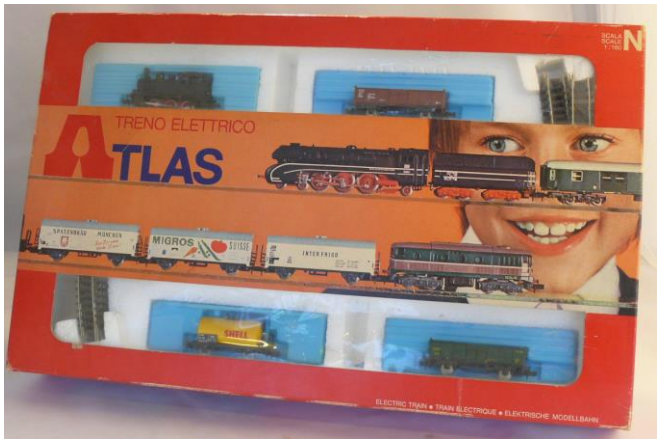
N gauge has its name from the 9 (Nine) mm of the gauge. Associated scale with N gauge is 1:160 which is quite good since 1435 mm divided by 160 is 8.96875 mm and 1435 divided by 9 gives a scale figure of 159,44444. However, in the UK a scale of 1:148 is used for N gauge. N gauge is a gauge not introduced by Märklin but by the company Arnold from Nuremberg , Germany in 1962. Because of this late introduction, the standards are clear and, apart for the scale difference between the UK and the rest of the world, kept uniform; it does not have an eventful history. N gauge is, after H0/00-gauge, the second popular gauge. It allows larger layouts in the same area or, as seems to be important in Japan, you can have a layout already in a small space. In Japan N gauge is the most popular gauge. To the approximate scale used for N gauge also a large number of push trains are or were made, most of these without track.

## 6.1 Main manufacturers

N gauge is less a modelmakers gauge than the larger gauges. Most equipment is available RTR (ready to run). There are many manufacturers, large and small, making N gauge equipment. To mention a few:

- Arnold: they initiated N gauge and made a range of European and American prototype trains. Their first range was called Rapido; the universal N gauge coupler is called the Rapido coupler. Production was in the German toy city Nuremberg. After 1995 the company had problems and was first owned by RivaRossi and then by Hornby International. Production is now in China.
- Graham Farish or Grafar is a company that produces large quantities of British outline model railway equipment in N gauge. Since a number of years, the company is owned by Bachmann.
- Kato: The main manufacturer of N gauge in Japan, where N gauge is the most important gauge. They not only make Japanese prototype trains but also European and American trains. Kato also manufactures an integrated roadbed model railroad track named Unitrack.
- Minitrix N gauge was initiated by Trix of Nuremberg at the same time Arnold started N gauge. Minitrix N gauge models were made from the late 1960s mostly of European prototypes (German and British primarily). North American prototypes were also manufactured and marketed under the Aurora and later Model Power and Con-Cor names. Minitrix is now owned by Märklin.
- A number of the larger continental H0 manufacturers like Fleischmann, RivaRossi, Roco also make or made an N gauge range.

RivaRossi made this N gauge European beginners train set which is branded Atlas (which is an American train manufacturer and importer). This train set is a typical product from the beginnings of N gauge:






Peco makes 1:148 British N gauge trains like this tank wagon. The packaging is well thought out; you can see what you buy.

With miniaturization going further, N gauge trains are getting more and more detailed; here is a recent (2017) model by Hobbytrain of a German (Baden) Pacific:


## 6.2 Japanese N gauge trains

N scale in Japan is normally built to a scale of 1:150, even though most rail lines are 3 ft 6 in (1,067 mm) gauge. This is a Japanese 3 ft 6 in JNR streamlined Pacific 4-6-2 C53 class made by MicroAce in 1:150:

Because the Japanese high speed railway Shinkansen lines are 1,435 mm (standard gauge), models of these are usually built to the scale of 1:160. This is the front part of a 7-piece, 115 cm long, Series 300 Shinkansen made by Tomix.

## 6.3 Non-standard gauge trains

Nn3 is a gauge used for American N Scale narrow gauge models. It uses 6.5 mm (the same as Z gauge) track to represent American narrow-gauge prototypes, especially these in Colorado, with a 3-feet track gauge. This scale-gauge combination has become popular, and has increased commercial support.

Nm gauge is used in Europe to model meter gauge railways, this also uses 6.5 mm (Z gauge) track. The Rhätische Bahn from Switzerland is popular in all gauges, also for Nm there are a number of manufacturers supporting.

## 6.4 Smaller than N gauge, larger than Z gauge

Is there a need for a gauge between these two?

CIWL LX sleeping car by RivaRossi in N and by Märklin in Z gauge

Apparently not; there seems to be no standard gauge models made for a gauge between 6.5 and 9 mm except for Lone Star trains. The British company Die Cast Machine Tools Ltd company started producing 2mm to the foot, British and American outline model push-along-trains in 1957 under the name Lone Star trains. These were called Treble O or OOO scale and utilised 8.25mm gauge metal track. As a push toy train this might fit better in the next paragraph.

## 6.5 N gauge push trains

Already in 1910 Bing of Nuremberg made a non-motorized train, which was a good-looking model, to a scale of approximately 1:140, i.e. a scale associated with N gauge, but without rails.

Miniatur=Eiſenbahnen ohne Uhrwerk.

10380 8

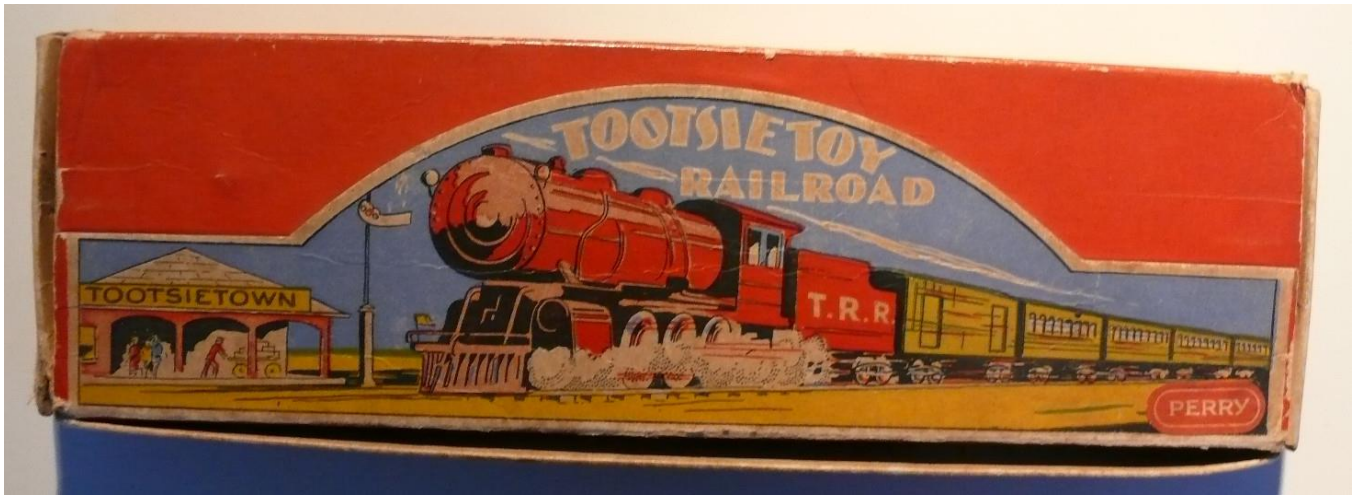
**Miniatur-Eisenbahnzüge ohne** Uhrwerk, in hübschem Karton eingeschnitten. **Reizende Neuheit!**

**10380**/3 bestehend aus: Lokomotive, Tender und 1 Wagen, Zuglänge 21½ cm . . . . . per Karton Mk. —.85
" /4 " " " " " 2 " " 30 " . . . . . " " " 1.05
" /5 " " " " " 3 " " 39 " . . . . . " " " 1.35
" /6 " " " " " 4 " " 47 " . . . . . " " " 1.55
" /8 " " " " " 6 " " 64 " . . . . . " " " 2.10

I had not thought that there would be a large amount of N gauge push trains, however Dutch collector Donald Troost made a reference guide for N gauge static and push toy trains that not only shows many trains but also mentions hundreds of manufacturers. Of course, the gauge for push trains is not exact; Donald Troost includes trains in scales between 1:180 and 1:140. These trains are made in all sorts of material. I just include a few here to illustrate the width of this subject.

This metal diecast train is from France and made some 80 years ago. It has a total length of 25 cm. It looks size-wise to be N gauge, but the gauge is about H0 since the wheels are outside the frames.

The American company Tootsietoy made a series of diecast train sets; here you see a goods train set in its original box.

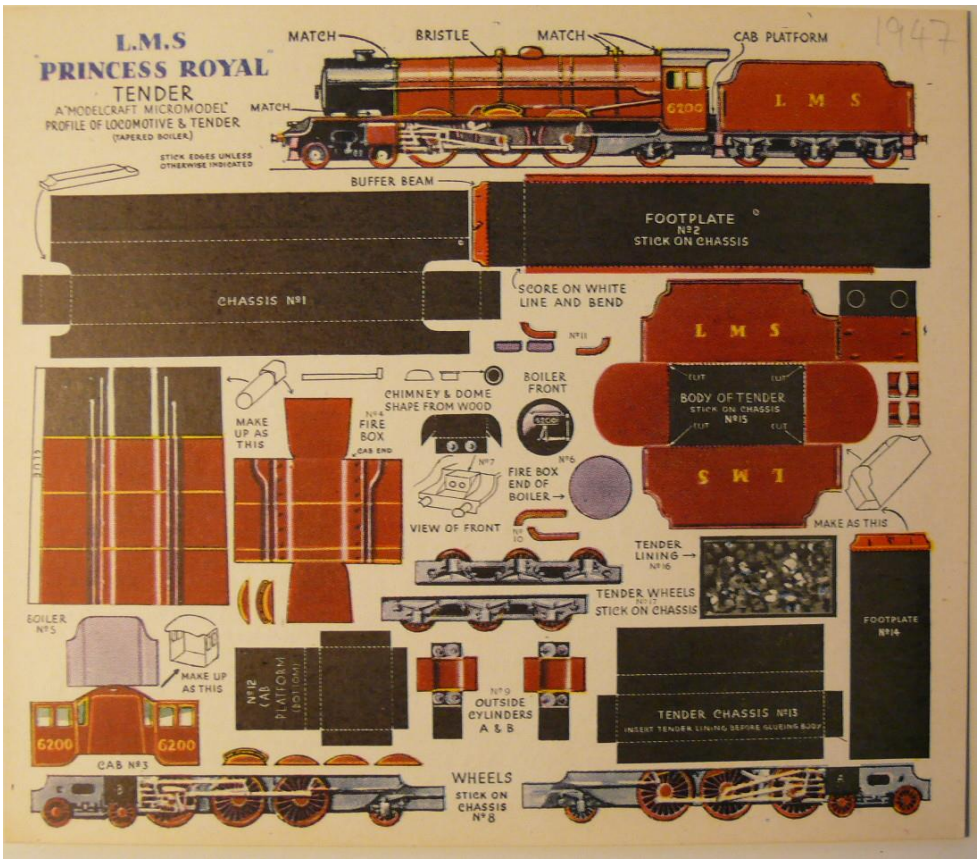




As an example of plastic push trains, a picture of a model recognisable as a German Baureihe 05 4-6-4 locomotive with tender and coach. This is an example of so-called margarine toys that were premium gifts with grocery products.


Del Prado is a Spanish publisher that issues booklet series with enclosed Japan made plastic models. The series of models of N 1:160 locomotives is quite extensive. Here is shown an English 4-2-2 model of a Midland single driver locomotive.

Through the years making models of printed cardboard has largely been forgotten. In the fifties the British company Micromodels made a large selection of small paper models including locomotives like this LMS 4-6-2. When made a locomotive in a scale of about 1:200 results.



# 7 TT Gauge

In the mid-forties of the last century, the smallest model railway size at that time was developed in the USA and called TT ("table top") because it takes up so little space that it fits on a table. TT gauge is a small gauge and it has only a small following. TT was introduced in 1945 in the USA by a company called H. P. Products. The gauge is 12 mm and the original scale is 1:120 which is correct since 1435 mm divided by 120 is 11.9583 mm, 1435 divided by 12 gives a scale figure of 119,583. All TT products are based on a 2-rail DC system. After World War II, TT model railways in West Germany were made popular by ROKAL and in East Germany by Zeuke. In the UK TT was introduced much later by Triang in 1960. In the UK the scale for TT is 3 mm to the foot which gives a scale of 1:101.6, i.e. almost 20% off. When N Gauge became popular around 1970 TT Gauge lost its following in the UK and USA. However, in East Germany TT gauge was kept alive supported by the products of various manufacturers. After East and West Germany became Germany TT Gauge also did get some extra popularity in the western areas of Germany. In Europe outside Germany there are almost no followers of TT Gauge. Even if you are interested in trains in all scales and gauges it is outside Germany difficult to get involved with any TT Gauge products. From one of my other interest (models of CIWL cars) here a picture of a sleeping car by ROKAL; the automatic coupler can be uncoupled by the knob on the roof.


## 7.1 Main manufacturers

A few of the important TT Gauge manufacturers are:

- ROKAL in Western Germany had no lasting success. In 1968 there were still ROKAL train sets in most toy shops and under many Christmas trees in Germany. ROKAL made some very nice models in the mid-1960s, but the time was already working against ROKAL and in the beginning of the seventies sales went down seriously. Problematic from the beginning was the insufficient market share of TT Gauge.
- Triang already made 00-gauge railways when they introduced Triang TT. Many of the TT models were smaller versions of items in their 00-gauge range; some models were made based on Australian and Canadian railways stock. Before Triang products were renamed Triang-Hornby (and later Hornby Railways) the TT Gauge was abandoned.

- Zeuke started manufacturing TT-gauge trains in 1957 in East Germany. In 1972 the company was nationalized and named Berliner TTBahnen; it was the main TT-gauge manufacturer and exported not only to Eastern European countries but also to West Germany. In the nineties the name was changed to Tillig, the name of the then new owner.

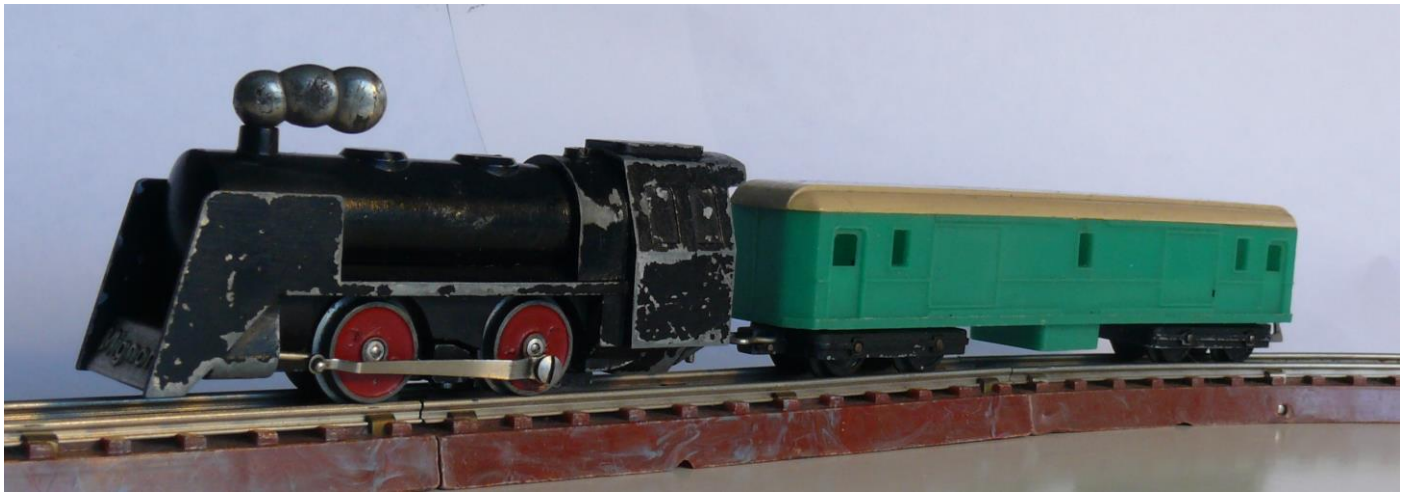
Some other manufacturers, like Roco and Piko, also make or made some product for TT Gauge.

## 7.2 Non-standard gauge trains

TTn3 is mentioned for narrow gauge modelling in the scale associated with British TT Gauge and using a gauge of 9 mm. I have never seen an example of this, apparently it is used by modelers in Australia and New Zealand.

## 7.3 Smaller than TT gauge, larger than N gauge

An interesting but short-lived product was the Mignon railway made between 1947 and 1952 by Staiger from the Black Forest, Germany. This railway had a gauge of 10 mm and the 2-rail track had integrated plastic track-bed. It was a 2-rail system on 16V AC. Change of direction was done by turning the (metal) smoke cloud coming from the chimney in the other direction, which switched the direction switch. The locomotive was metal, all rolling stock was plastic. The scale was not specified.



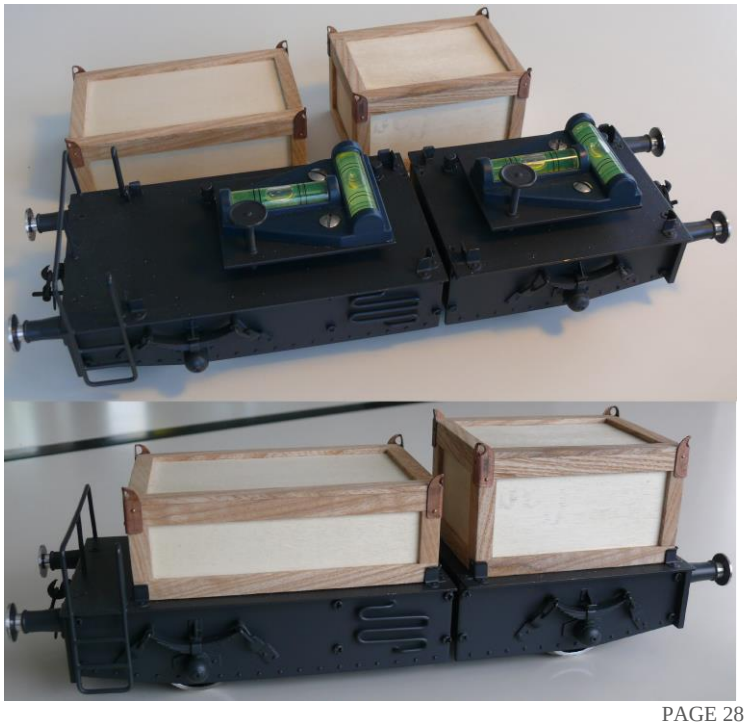
# 8 Kit and scratch-build

Before discussing gauges H0/00 and larger here are some notes on gauge and scale of kit and scratch-build trains. Starting with the gauges H0/00 the share of scratch building and kit building is larger for each next gauge. For the largest (miniature train) gauges the amount of RTR models is almost nil.

## 8.1 Scratch-building

For scratch-building, i.e. making a model using raw materials, the builder can of course use any gauge and scale combination he likes. An example are the miniature train locomotives and stock made by the brothers Paul and Kejo Genzel. They started with drawings of real locomotives and decided to scale down to 1:7 and using a gauge of 203 mm. Their resulting Genzelbahn is a success but as far as I know the only representation of this gauge/scale combination. In the larger gauges (1 and up) and certainly for live steam, scratch-building is used a lot, sometimes using some parts like wheel castings from suppliers. My coal fired, live-steam 3.5 Inch gauge 0-8-0 locomotive (GTW 8373) was scratch-built by Norman Spinks who also supplied castings for this locomotive for other builders/model-engineers.


In general, an item that is scratch-build is made for the builder himself and kept and operated by him. Scratch-builders might make items to be sold, in that case the builder might make more than one copy. Also, an item might be sold by the builder to raise money for tools and material for a next item, possibly in another gauge/scale combination, to be build.



Another example of scratch-building; this is for gauge 1, the scale however is undefined since this is not a model. It is a very clever car made by Rob for me. With this car the track level and track elevation for my garden railway can be checked. With the wooden boxes placed on the car and hiding the spirit levels, it looks like a special purpose railway wagon, which it is.

## 8.2 Kit building

The more common and well-known trains, like for instance the Union Pacific BigBoy, are available RTR in a number of gauges. Lesser known prototypes might sometimes not be available in the gauge a hobbyist is modelling in; in some cases, however kits are available for these prototypes. Also, in less common gauge/scale combinations, like modelling GWR broad gauge, there are no RTR models but there are kits on the market. There are many different types of kits, from a "shake the box"[8] kit for an American boxcar to an unpainted brass kit needing soldering and painting skills to make a British locomotive. Since some trains are only available in kit form, there is also a (small) kit building industry, i.e. individuals that will assemble and/or apply a paint finish to a model. Some of these have some fame. A well-built and finished model from a kit will have some extra value; a poor paint job might spoil a model and the value of it. The Southern Railway locomotive number 383 is made from a kit for a LSWR K10 4-4-0 locomotive and this one is painted and signed (see inset) by well-known British model locomotive painter Larry Goddard in 1987.



Note that some RTR (Ready-to-Run) products made by for instance Roco of Austria have the hint of a kit. Many detail parts need to be attached by the buyer of such a model. Sometimes this is not an easy task when locating holes are misaligned or parts are too fragile to handle.

This baggage car from a H0 train set by ACME was RTR. The steps at the doors had to be attached by the buyer (me) and not only were the holes for the steps not correctly aligned, also the pins protruding from the steps to insert in the holes were much too large.

A special mention for this kit of a CIWL sleeping car made by the Italian manufacturer Amati for 1-gauge. Amati is known for its kits of ships and seems to have little knowledge of model railways. When built according to the instructions a good looking but non-running car will result (but I assume it will float on water like the Amati ships). More of this kit can be seen here: CIWL LX 3533


[8] A simple kit with just a minimal number of parts is known by this name; if you shake the box well enough the kit is made 😉

# 9 H0/00-Gauge

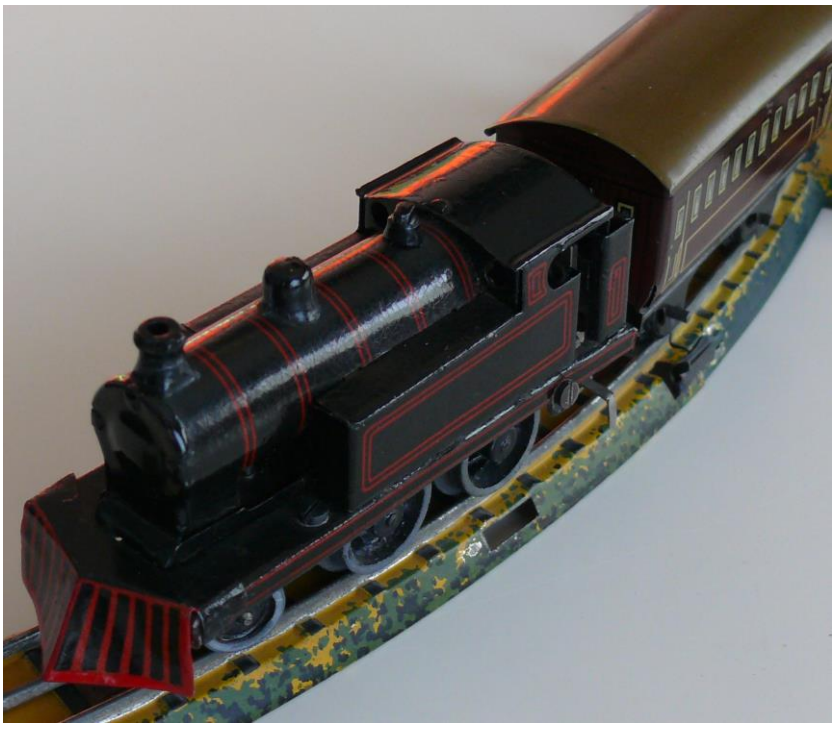
H0/00-gauge has a distance between the rails of 16.5 mm. In the UK this gauge is called 00 and is associated with a scale of 1:76 while elsewhere the gauge is named H0 and associated with a scale of 1:87. 16.5 mm and a scale of 1:87 seems correct since 1435 divided by 87 is 16.494 and 1435 divided by 16.5 give a scale figure of 86.96. 1435 divided by 76 gives 18.88 so the gauge of 16.5 is a bit small (more than 10% off) for a scale of 1:76 associated with 00-gauge. While 0-gauge was introduced in the 19th century, H0/00-gauge is a product of the twentieth century and it is still the most popular gauge in the twenty first century.

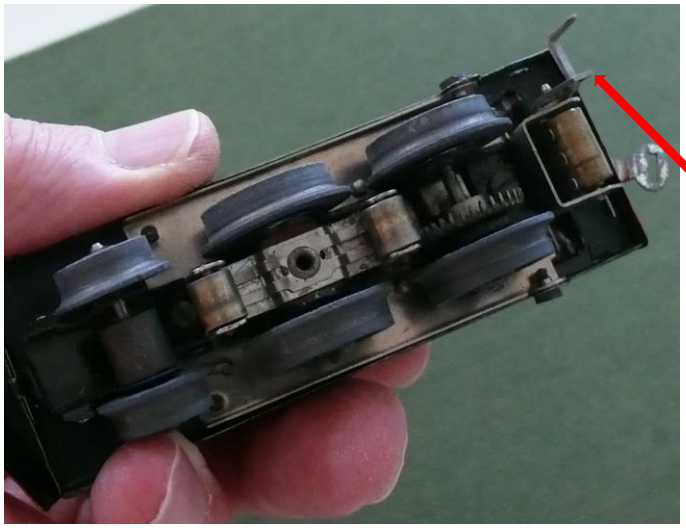
## 9.1 Some history

It is generally acknowledged that the Bing Table Railway, introduced in a clockwork version in 1923 and in an electric version in 1925, was the first 00 railway. The terminology H0 was not then used. The scale of this table railway was undefined, but the size was such that a circle of track could easily be laid on a, not too small, round coffee or dinner table. The gauge was half of 0 gauge (32 mm) at approximately 16 mm. Later 16.5 mm was taken as standard gauge size for H0/00; the reason this figure is believed to be the profile of the wheels of the Bing Table Railway. These had a huge root radius which was fine on round-topped tinplate rails, but when modellers started making hand-built track, using brass bar for the rails, it was necessary to spread the gauge slightly to ensure the flat part of the tread was running on the flat rail surface (see also 3.1.4).


The first 00 railway was made by Bing in Germany but for the British market as can be seen at the lettering on the control rail (OFF/ON).

This Bing table railway locomotive was made for the American market and that is why it has a “cow catcher”. The locomotives and rolling stock had a general outline and were not models of specific prototypes. Similar types were sold in England, the USA and Germany. In France JEP made a similar system with a gauge of 16 mm called JEP Mignon. The 2-4-0 locomotive JEP designed looked like a copy of the Bing locomotive.





Like many early electric H0/00 trains a 3-rail system was used. Bing used roller pick-ups. The small copper drum at the right is the direction control which could be operated from trackside by

this handle.

Bing stopped manufacturing trains in 1933, BUB added then the Bing table railway to their range. It was ten years after the introduction of electric 00-gauge trains by Bing before Trix and Märklin introduced their H0/00-gauge trains in 1935. A few others, like Hornby Dublo in the UK and Gilbert in the USA followed still before WW2. After WW2 a large number of model-train manufacturers from many countries made, and often still make, H0/00-gauge trains. The American train-maker Lionel also introduced smaller than 0-gauge trains before WW2 which were called 00-gauge; these however were not running on H0/00-gauge track but on a larger gauge of 19 mm.

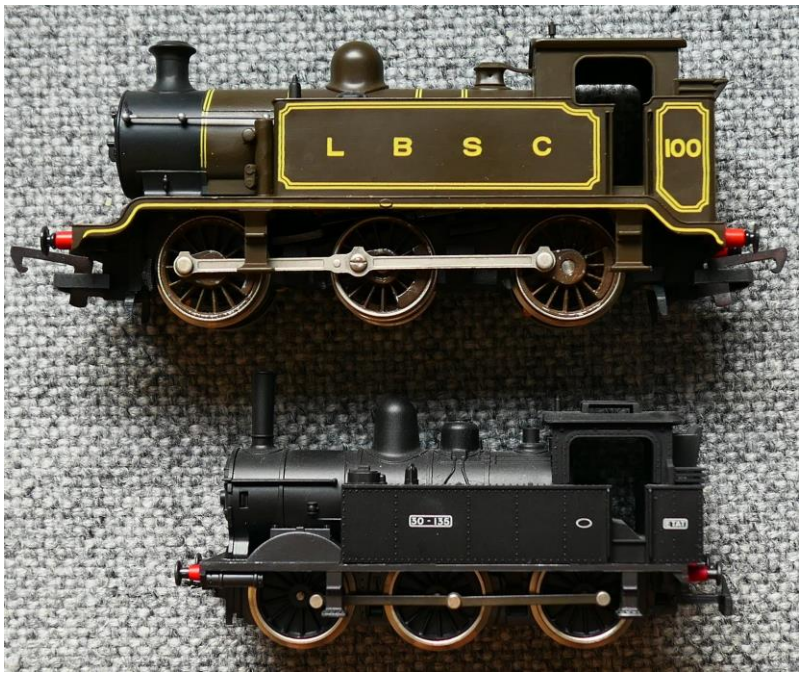

Pre-war H0/00 trains are rather rare; this is a rare prewar Trix locomotive for the French market; apparently a collaboration between German and British Trix and a French distributor.

## 9.2 H0 or 00 Gauge

When discussing a gauge of 16.5 mm it can be called H0 or 00 Gauge or H0/00-gauge. The term 00-gauge, which was used before the designation H0, is in general now used for model trains running on 16.5 mm modelled after British prototype and made to a scale of 4 mm to the foot. H0 is used for model trains running on 16.5 mm modelled after non-British (like American or Continental) prototypes and made to a scale of a 1:87. As you can imagine a model made to 1:76 is larger than one made to 1:87. This next picture, of a H0 model at the left and two 00 models next to it, seems not to prove this. The locomotive to the left however is an American NYC Dreyfuss Hudson and those on the right are English LNER A4 Pacifics. They look equal sized; in reality the Hudson was much larger at a height of 460 cm while the A4 was only 399 cm high. The scale of 1:76 seems to be used in Britain since the British (steam) locomotives are a bit smaller; by using this scale enough room in the body of the locomotive was available for the electric drive.

Some manufacturers, like the Italian company RivaRossi tried to introduce English H0 models but because of the difference in size these did not sell well. The size difference can be seen with these two similar tenders, 1:76 on the left and 1:87 on the right.

Another comparison of H0 and 00. The LBSC 0-6-0 tank locomotive is an 00 model by Hornby while the French ETAT 030 locomotive was made by Jouef for H0.

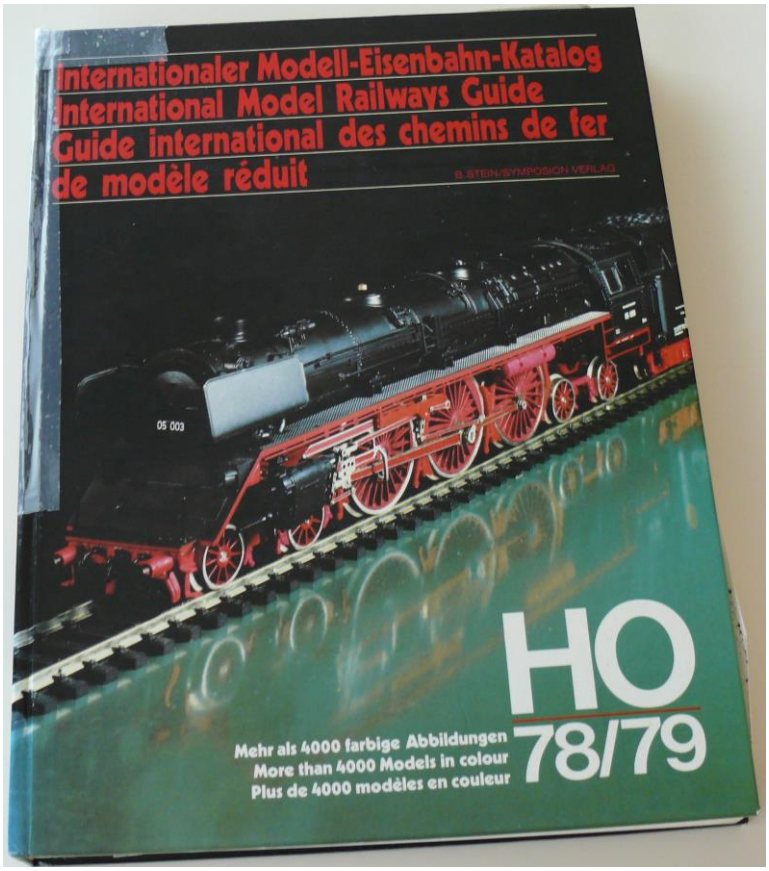



The 1:87 scale was not in all cases used with H0-gauge; some manufacturers used larger or smaller scales in the beginnings. Fleischmann for instance used first 1:82, then 1:85 before using the correct 1:87 scale while Trix Express used 1:90 in the beginning. Further, and even in recent times, sometimes models are made to scale in height and width but not in length. Having a shorter length for long passenger cars was, and still is, done to make it possible to use these passenger cars on small radius track.

Shown here are three German coaches which have an original length of 26.4 meter. The top two are made by Märklin and are made to a length-scale of 1:110 and 1:100. The third car is made by ADE and is to the correct scale length of 1:87.

## 9.3 Manufacturers

There are and were many H0/00 manufacturers. This book lists more than 80 manufacturers of locomotives and/or rolling stock. Before the book was published in the late seventies already manufacturers had disappeared. Since this book was published a number of new manufacturers had started and a number of the ones mentioned in the book stopped. Of course, the products of all former manufacturers might still be present in collections.




Making a choice and naming the main manufacturers would be subjective. Every H0/OO hobbyist could make their own list. So here is a list of manufacturers of which I have at least one item in my collection, so I know they exist or at least existed once.

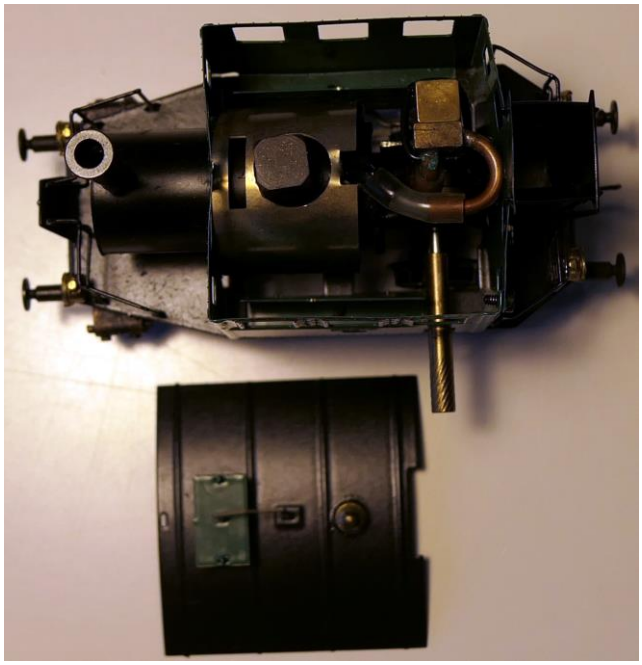
- H0: ACME, Ade, AHC, AHM, Ajin, Alco, Altaya, Antal, Artitec, AS, Athearn, ATT, Bachmann, Beckh, Bing, BLZ, Bowser, Brawa, Broadway Ltd, Bub, Bubimodel, Buco, C&BTshops, CEMP, Concor, CPMR, CustomBrass, Diapet, DJH, Drusba, E&B Valley, Electrotren, Erga, Favero, Fex-Miniatrain, Fleischmann, Fobbi, Fox Valley, France Trains, Fulgurex, GéGé, Gilbert, Gingerbread, Grotsch, Gutzold, Hachette, Heinzl, Heljan, Heris, Hielscher, Hobbytrain, Hornby Acho, Hruska, Ibertren, INGAP, Inter Mountain, JEP, Jocadis, Jouef, Kasiner Hobbies, Kato, Key, Kitmaster, Klein, Kleinbahn, KTM, Lemaco, Lifelike, Liliput, Lima, Lionel, LS Models, M+F, Makette, Mantua, Märklin, Martin, McKean, MDC, Mehano, Menzies, Metropolitan, Micro-Metakit, MicroTrains, MMM-RG, Modelprodotti, Monogram, NewRay, NPP, NWSL, Olaerts, OMI (Overland Models), Os.Kar, OVB, Paya, Philotrain, Piko, PMP, Pocher, Primex, Raimo, Rateau, RedCaboose, REE modèles, Revell, RivaRossi, RMA, Roco, Roundhouse, Röwa, Scellebelle, Schicht, Silver Streak, SMCF, SMF, Spectrum, StromBecker, SunsetModels, Suydam, TAB, Tenshodo, TMI, TMN, TrainsRousseau, Tram, Trax, Triang, Trix, Troby, Tyco, VanHobbies, VB, Wabu, Walthers, Westside, Ye Olde Huff N Puff.
- 00: Airfix, Bachmann, Budgie, Dapol, GMR, Grafar, Hornby Railways, HornbyDublo, Kitmaster, Lima, Mainline, Merco, Oxford Rail, Peco, Playcraft, Ratio, Triang, TriangHornby, TriangWrenn, Trix/TTR, Wrenn.

## 9.4 Compatibility

In the smaller gauges (TT/N/Z) there do not seem to be many compatibility problems. Track and wheel standards, power supply type and even couplers are shared by most manufacturers for that gauge. In the larger gauges, starting with H0/00, this compatibility is gone. A number of incompatibility aspects are discussed in the next paragraphs. Most of these are also valid for the larger gauges (0/1).

### 9.4.1 Power supply

Most H0/00-gauge are electrically powered, however there are some examples from the beginning of this gauge of clockwork powered locomotives like the Beckh German streamliner from around 1960 shown here (below, note the key hole). Also, some live steam locomotives exist, amongst others made by Hielscher (right). Live steam in this gauge however is more a novelty than a realistic proposition.



Without further discussing the pro and cons of the various systems, electrical H0/00-gauge train systems exist in AC and DC. In these systems a dedicated transformer or controller is used to run the trains. Most AC systems use a variable voltage up to 16 V while the DC systems use normally a maximum of 12 V. In DC also battery systems existed running on lower voltage (3/4.5 V) batteries. In some AC systems (the most well-known being the Märklin system) a higher voltage pulse can be sent from transformer to control direction; in most DC systems the direction control is done by inverting the DC voltage. For quite some years now various (digital) control systems are introduced. The most well-known system is the DCC (Digital Command Control) system. In these the voltage is modulated (effectively you might call this AC) and the modulation frequency (length and width) is used to encode data being sent from the controller and received and decoded by the locomotive and in this way the speed and sound (and more) of the locomotive is controlled. Anyway, the type of electrical supply and control should match the possibilities of the locomotive used. Some recent locomotives, notably however in the larger gauges, detect the type of (electrical) supply and can be used on more than one type.

### 9.4.2 Track and wheel standards

When the distance between the running rails is 16.5 mm the gauge is called H0/00. However, the height of the rails, the radius of curved rail, the measurements of the frog and other parts of points/turn-outs define the compatibility for different makes of trains. Different makes of trains, locomotives or carriages, might have been made with different flange forms and sizes and with a different "back-to-back"[9]. Further, for electric running, the isolation of the running rails and the presence or absence of a "third rail" or other conductor defines the compatibility. The ultimate solution, which might however not to anyone's liking, is a track with large radii, no points, isolated running- and conductor-rails and high rails. Some manufacturers, like RivaRossi, made items in different versions to be compatible with some of the other large manufacturers' products. Nowadays most available H0/00 trains are made to one of the standards as published by the MOROP or NMRA such that a buyer can find out beforehand whether a new rolling stock item will be compatible with his track. A popular standard for wheel contour is the NMRA RP25 standard; wheels made to this standard combine good looks with optimum track holding ability. For older trains some trial and error might be necessary to find out the compatibility.

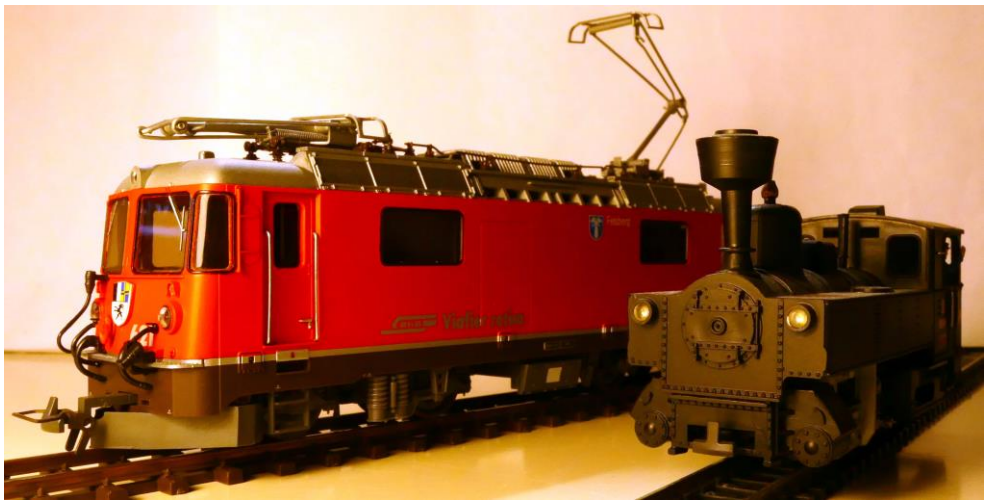
### 9.4.3 Couplers

Germans interested in model railways use the term "Kupplungssalat" (coupling salad) for the coupler incompatibility. German H0/00 collector Rainer Haug made a book "Bestimmungshilfen Tinplate 00 und H0 Eisenbahnen" which gives a view on this salad. Many different types of couplers were made through the years, many of these proprietary designs of a manufacturer. The H0/00 coupler world seems to be divided in three parts, each with its own (history of) types of couplers: continental Europe, USA and UK. In general couplers on H0/00 trains are not to scale, however many USA H0 trains have knuckle couplers which look scale-like. These knuckle couplers, of which Kadee is a well-known supplier, are also sometimes used by European modellers. More recent European rolling stock is often supplied with a standardised coupler holder, giving the possibility to insert the coupler of your choice.

[9] The distance between the backsides of the two wheels on an axle.

## 9.5 Non-standard gauge trains

Since H0/00-gauge has the largest following it is not surprising that for the scale associated with this gauge there are also non-standard gauge products available. Narrow gauge trains with a prototype gauge of 850–1,250 mm, were standard gauge would be H0, are called H0m (HOn3½ in the USA) and use a gauge of 12 mm (which is TT gauge). Narrow gauge trains with a prototype gauge of 650–850 mm use a gauge of 9 mm (N gauge), this gauge/scale combination is called H0e in Europe and 009 in Britain while it is called H0n30 in the USA. These two are the most popular gauge/scale combinations for narrow gauge trains. There are more specialist gauges, e.g. for the broad gauge (7 feet) trains of the Great Western Railway there is a standard called BG4, which uses a gauge of 28 mm. And there is H0f which uses a track of 6.5 mm (Z gauge track) for modelling the narrowest gauge trains.



Switzerland and Austria both have narrow gauge railways and examples of these are available in 1:87 scale. Left an electric Swiss locomotive made by Bemo for H0m and right an Austrian Liliput H0e example. The size difference, caused by the gauge difference, is notable; both are correctly made to a scale of 1:87.

## 9.6 Smaller than H0-gauge, larger than TT gauge

The only gauge I know between 16.5 and 12 mm is the gauge used by WESA of Switzerland. WESA AG was founded in 1945 in Inkwil in the Swiss Oberaargau (canton of Bern) and produced model railways with 13 mm gauge, which corresponded approximately with, but is still larger than TT gauge. The first locomotives and wagons had a scale of about 1: 110 and were powered by alternating current. From 1950 a scale of 1: 100 was used. It was remarkable for the time that the WESA railway was already exported in 1949 to more than 70 countries. In 1966 production ended, but WESA still has a following in Switzerland.

The picture shows the size difference between a WESA (left) and a TT Gauge Rokal (right) sleeping car.

# 10 S Gauge

S gauge is a gauge of 22.5 mm, or in the USA where it originated 7/8 Inch. So both in mm as in inches S gauge is half 1 gauge (which is 45 mm and 1 3/4 inch). Standard gauge trains for S gauge have a scale of 1:64 and 1435 mm divided by 64 is 22.421875, so the gauge of 22.5 and scale of 1:64 seems to be a good match. S Gauge originates from the USA and with S the scale went ahead on the gauge. American Flyer started in 1939 to make trains to a scale of 1:64 running on 32 mm (0-gauge) 3-rail track; after the war American Flyer matched the scale and gauge by making their 1:64 trains to run on 22.5 mm track[10]. They also changed at that time from 3-rail to 2-rail track and were advertising the realistic outlook of their new products. American Flyer succeeded in getting a fair share of the market in the USA, because of this S is still alive in the USA. When measuring some S gauge rails from different manufacturers, I noticed that gauges between 22 and 23 mm can be found. Compatibility between rails and trains of different manufacturers is thus not guaranteed.

## 10.1 S gauge in Europe

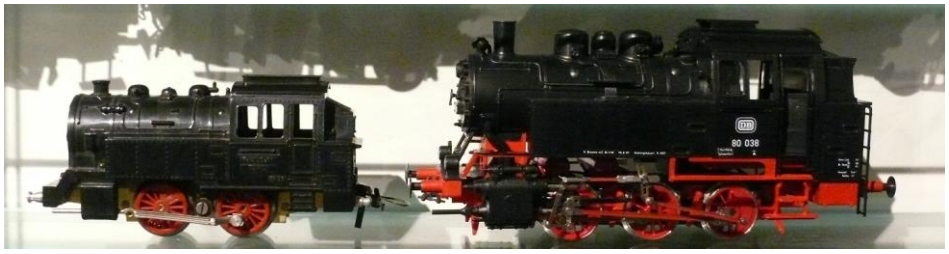
In Europe there is, as far as I know, only some following in the UK (a few scratch builders) and Germany (some collecting activity), S gauge has almost disappeared. But there has been some European S Gauge, the next paragraphs described some French and German S. Further I have seen some mentioning and a few pictures of other S Gauge trains from amongst others the Czech Republic and Italy.

JEP (Jouet de Paris = Toys from Paris) was the largest toy train manufacturer in France. After a visit to the USA in the fifties of one of the JEP employees they decided to add S gauge trains to their range which already included 0-gauge and H0-gauge. They only made a small number of different items: some clockwork trains and some electric trains. The range was not successful at all and JEP quit making S gauge in 1960, 4 years before the company was dissolved. In their catalogue of 1955, they did mention the advantages of S gauge (maybe copied from an American Flyer brochure?) like: You need less space for a layout (compared with 0-gauge); scale rolling stock can be made which will not be too large; 2-rail track is more realistic than 3-rail.


JEP mentioned scale rolling stock but they did not make that. They however made, in their typical JEP method, S gauge trains in various sizes. Since these trains do not resemble any real train it can not be called different scales.

Carl Liebmann founded the company Carl Liebmann Metallwerke in Stadtilm (East Germany) after WW2. The company made 0-gauge trains. The factory was transferred in 1953 to the VEB Metallwarenfabrik Stadtilm and in 1956 the production of S Gauge trains started. Production stopped in 1964, but the S gauge production cannot be considered a failure. I wonder why in East Germany S, and also TT gauge, were a success; maybe the reason is that less raw material is required for the manufacturing compared with 0 and H0-gauge. The locomotives were made with 4.5 V and 12 V motors; the lower voltage could be supplied by batteries.

[10] The French manufacturer LR (Le Rapide) made some of their line in a scale approximately 1:64, however they still used 0-gauge track.



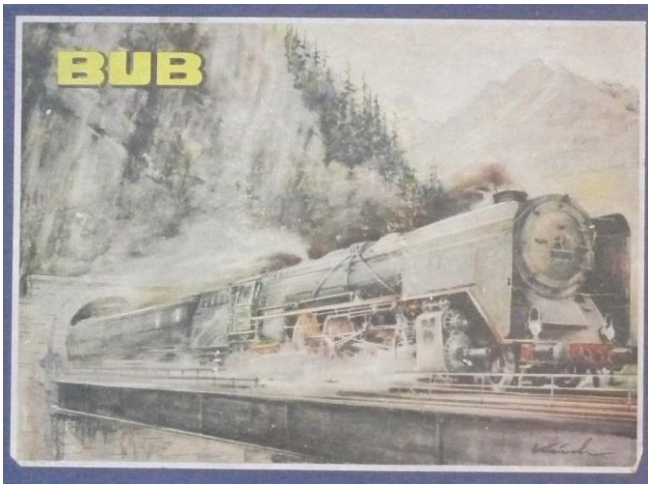
The Stadtilm 0-4-0 locomotive has inscriptions for a Baureihe 80, which however in reality is an 0-6-0 (see the Stadtilm locomotive next to a RivaRossi 0-gauge model,

Although these S trains are sometimes called Liebman the brand and trademark are Stadtilm.


BUB (KBN) was before WW2 one of the larger toy train manufacturers in Nuremberg, Germany. In 1948, in addition to continuing manufacturing 0-gauge trains, a production of 2 rail DC trains for S gauge, with tubular track (see 3.1.4) and inspired by American Flyer, was issued. These trains could not compete with the upcoming trend of H0 gauge and proved to be a commercial failure. In 1958, after a heavy commercial loss, BUB discontinued this program. BUB introduced S with an ambitious product range including a rail system and accessories such as stations, signals, tunnels, buffer stops and figures etc.


The top of the BUB Spur S line was a German Baureihe 05 4-6-4 locomotive with tender and a matching express train. This 4-6-4 was also available in blue with coaches in an English (red/cream) livery, BUB made this version for the English market (without any success as far as I know).

The picture on the BUB box (see below) is impressive.




## 10.2 The USA scene

In the USA S gauge was and is a substantial niche in the toy and model train world. While the American Flyer company does not exist anymore the brand still does exist and American Flyer trains are now made by their former opponent Lionel. The S world in the USA is divided in an AF and a scale segment. AF is used for trains with track and wheel standards like originally introduced by American Flyer; there are many American Flyer operators and collectors keeping this alive. Scale S gauge trains use the same gauge and scale but have smaller wheel flanges and lower rail profile. These two are incompatible, but conversion from one to the other is sometimes done.

A striking blue American Flyer locomotive, but not a scale model.



This early American Flyer toy-like caboose shows the giant hook couplers. These were in later versions changed to better looking but still very large knuckle couplers.


Already in the sixties scale-like S Gauge existed like this model of a suburban tank locomotive proves with its scale-like couplers and wheels. This locomotive is made from a Rex kit.

A number of larger and smaller manufacturers supply S gauge items (AF or scale) in the USA. To find out more about S gauge in the USA take a look at the NASG website.

## 10.3 Non-standard gauge trains

There is some modelling of narrow-gauge trains in the scale associated with S gauge. 1:64 is a bit better suited than 1:87 in my view but it is still a niche. There is Sn2 and Sn3 for modelling 2-and 3 feet gauge railways and Sn3½ which uses the track gauge of 16.5 mm as is used for H0-gauge.

## 10.4 Smaller than S gauge, larger than H0-gauge

There are some standards defined in England to model 4 mm to the foot (1:76) trains on a more correct gauge of about 18 mm. Further in the USA Lionel introduced a range of OO models in 1938 which used a gauge of 19 mm. It did not prove popular and remained on the market only until 1942.

# 11 Collectors and Operators

Above is mentioned that collectors and operators keep American Flyer trains alive. Before discussing 0-gauge it might be good to define these terms a bit further, since 0-gauge is also predominantly kept alive by what is called in the USA collectors and operators. Most toy and model trains made industrially were made as toys for boys. They were made to be played with by boys and were not made for adults. But already more than 100 years ago more expensive model trains were made as a hobby for grown-ups like the 0-gauge trains made by Bassett-Lowke in England or Marescot in France.

Marescot ETAT Pacific locomotive from around 1925, certainly not made as a toy.

Over the years the shift in gauges and the shift from toys to models took place; in the last 40 or 50 years also an age shift of people, generally boys and men, interested in toys and model trains has taken place. So, boys playing trains is a dying breed. A model train hobbyist can be called that or can be called model railway enthusiast or model railroader. Men with a larger number of toy or model trains can be called (model train) collector. These collections, often growing larger and larger, are displayed (a museum at home) or kept in stacks of boxes. Men that might have a small or a large amount of trains, but who also run their trains on a layout, at home or at a club or train-show, call themselves sometimes operator.

The author: Collector (left) and operator (below); pictures from DHRCA


Train collectors and operators have organised themselves, or are member of, larger of smaller societies like the British TCS (Train Collectors Society), the TCA (Train Collectors Association) and LOTS (Lionel Operating Train Society) from the USA, the French CFE (Cercle Ferroviphile Européen) and the small DHRCA (Dutch Hornby Railway Collectors Association) from Netherlands. Also, some organizations are targeted to different areas like a specific gauge (G1MRA (for gauge 1)) or scale (The 3mm Society), a specific manufacturer (Märklinfan Club Italia), a specific prototype railway/railroad (British Railway Modellers of North America (BRMNA)) or running 0-gauge trains (Northants and Rutland O Gauge Group - Narogg).

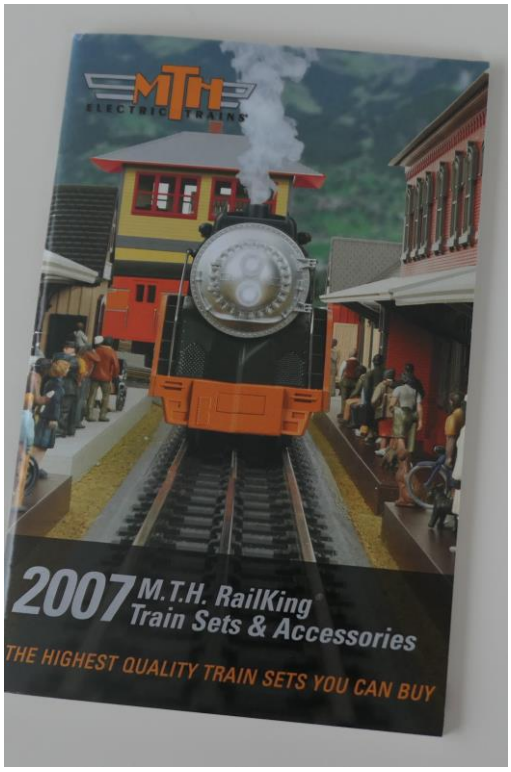
Collectability: Any type of toy and model train can be and is collected. Well-known collectable areas are: - Märklin, Hornby and Lionel trains (often a collector chooses a specific era of production). - Older tinplate toy trains in general. - High end models made for collectors like products of Fulgurex and Lemaco and the brass trains made in Asia for the US market. - Trains from the DDR (former East Germany). Some collectors also have some special interest like toy train tunnels or toy and model signals. And there are collectors that are searching for the trains they had, or were longing for but could not afford, when they were young boys.

# 12 0-Gauge

0-gauge was introduced by German toy manufacturer Märklin at the end of the 19th century. 0-gauge grew rapidly to be the most popular gauge, which it was until H0 came along and took over just after WW2. However, 0-gauge is kept alive and still has a large following in operators and collectors and manufacturers supplying their needs. The gauge for 0 is 32 mm. In the beginning toy trains and not model trains were made, so no specific scale was used.


Two toy locomotives made for 0-gauge and both not to any scale. Both are British products. The red clockwork locomotive, made by Brimtoy, is only 11 cm long and 6 cm high. The green live steam locomotive, made by Bowman, is 31 cm long and 12 cm high.

Later the scale associated with 0-gauge differed around the world. The not completely correct scale of 1:43.5 (or 7 mm to the foot) was used for a long period outside the USA, while in the USA a scale of 1:48 (quarter inch) was and still is used[11]. Nowadays the gauge for new products in Germany and Switzerland is the correct scale of 1:45, while in the UK and France still 1:43.5 is used. The standard gauge of 1435 mm on a scale of 1:45, as used now in Germany and Switzerland, gives 31.9 mm, which is only 0.3% off the gauge of 0 of 32 mm. The standard gauge of 1435 mm on a scale of 1:48 and 1:43.5 would give a gauge of respectively 29.9 mm and 33 mm, which is respectively more than 6% and 3% off the used gauge of 32 mm.




I assume, but cannot find proof, that nowadays most locomotives and rolling stock for 0-gauge are made in the USA. Nowadays 0-gauge still has a large market share in the USA while the share of 0-gauge in the rest of the world is smaller compared to other gauges (H0/00 in Europe and N in Japan). In the USA there are even still 0-gauge train sets in the market as the MTH catalogue (left) shows; in the rest of the world 0-gauge train sets are almost non-existent. A distinction in the USA is made between 0 "scale" (2-rail DC) and 0 "tinplate" (3-rail AC) trains, the market share of the latter is much larger than that of the former. The boundary between "scale" and "tinplate" is becoming blurred by the outstanding 1/48 models offered in the 21st century by Atlas, Lionel, MTH and others; but their AC power systems, third-rail pickups and Lionel-style couplers clearly place them in a different market than the 2-rail, DC-powered models which frequently use Kadee-style magnetic couplers. MTH further complicates this issue by producing some locos that can run on either 2-rail or 3-rail track.

[11] It's very convenient to design 1/48 scale models if you happen to be using an English ruler, since 1/4" = 1'.

Note that the general use of a scale of 1:45 in Germany is fairly recent, so a mix of items to different scales is sometimes seen, even in one train. The following picture tries to illustrate the difference between 1:43.5 and 1:45. At the top you see two locomotives (Jouef SNCF 141P and Jouef SNCF 150X) to a scale of 1:87 while at the bottom you see the same two locomotive types however the left one (MTH 141P) is to a scale of 1:43.5 while the right one (MTH 150X[12]) is to a scale of 1:45.

A naming convention as used with H0 and 00-gauge to differentiate between the different scales is not used with 0-gauge. The illustration here shows however a similar scale difference picture as shown with H0 and 00-gauge (see 9.2). From left to right a 1:48 2-rail fine scale model of the NYC Dreyfuss Hudson made by Fine Art Models for the Lionel Smithsonian collection, a fine scale 2-rail 1:43.5 model of LNER A4 Silver Fox by 3rd Rail and a 1:43.5 coarse scale 3-rail model of LNER A4 Mallard by ACE of London.


## 12.1 Manufacturers

0-gauge trains are and were made by a large number of manufacturers. I have no count to prove it but I assume that the number of manufacturers through the years of 0-gauge trains was even larger than the number of manufacturers of the now much more popular H0/00-gauge trains. A knowledgeable Dutch collector let me know that he has tinplate 0-gauge trains of more than 160 different manufacturers in his collection and that a British collector made a list of more than 400 (toy-)train manufacturers. Three of the most important manufacturers around the world of 0-gauge trains do still exist: Lionel, Hornby and Märklin. But only Lionel is still making 0-gauge trains, Hornby is strictly 00-gauge and Märklin is making trains for a number of gauges but not 0.

## 12.2 Only the gauge is shared

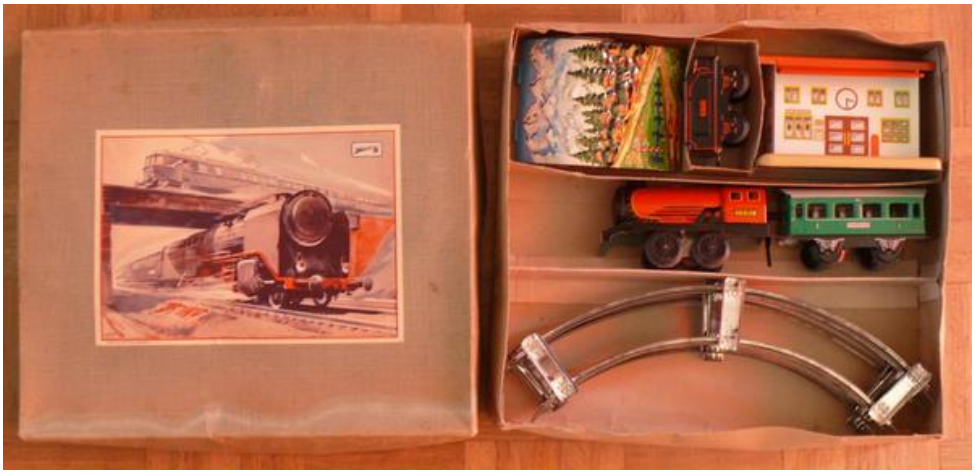
The scale difference is mentioned, but there is much more that differs while only the gauge of 32 mm is shared.

### 12.2.1 Mit Uhrwerk, Dampf und Strom (Clockwork, Steam and Electric)

Gustav Reder wrote a book with this title and with 0-gauge all these methods of propulsion are represented in large numbers. The first Märklin 0-gauge trains were powered by clockwork and until the nineteen sixties clockwork trains were made. Not all clockwork trains were made as toys; most were since for years an affordable present for a boy would be a boxed toy train set with a clockwork powered locomotive, mostly of the 0-4-0 type. Tens of thousands of these sets were made through the years.

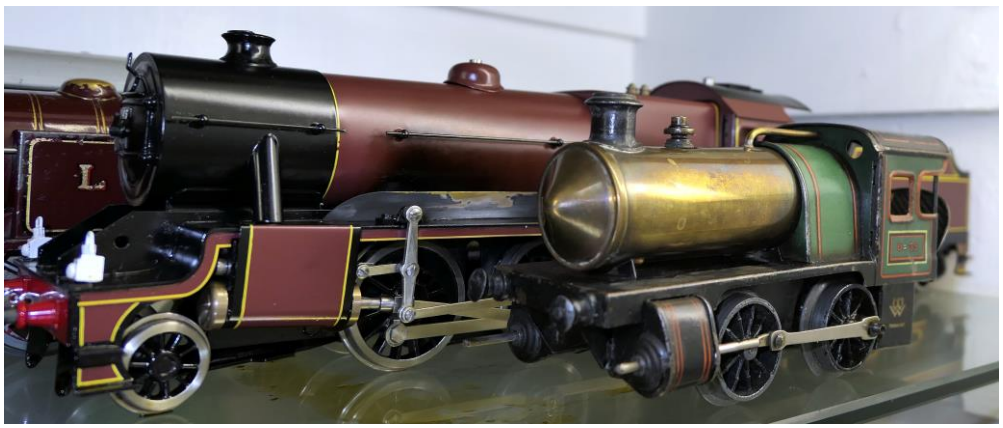
[12] This SNCF (French) locomotive is based on a model MTH made of a German Baureihe 44 locomotive and this was made to the German scale of 1:45.

A boxed clockwork train set made by Beckh from Germany in the fifties for sale via toy departments of department stores. As with most train sets the picture on the cover does not represent the content. This set with just a small circle of track does include accessories as a station and tunnel. A tinplate toy like this would now not be allowed; a child could hurt himself with the thin tin material.




There were clockwork locomotives that were made as models and not toys. Left a comparison between a recent fine scale 0-gauge model of the Flying Scotsman locomotive (top) with a Bassett-Lowke made clockwork version (bottom).

0-gauge is considered as the smallest gauge to run live steam locomotives. However, in contrast to 1-gauge, some locomotives do show in their appearance this type of propulsion with copper or paint flaking boilers and unrealistic cylinders and valve gear.



Model-like live steam is in 0-gauge rare. Here a toy steam locomotive by Bing and a modern replica Bassett-Lowke almost scale like model but with traces of usage.

The history of electric propulsion for 0-gauge has shown a large variety and 0-gauge trains made today are still showing a variety. The use of high (mains) voltage to run trains, used until the twenties, is however safely abandoned. Before the availability of mains power and transformers, low voltage (4 Volt) trains were available which could be run on accumulators/batteries. Later trains were run using transformers/rectifiers supplying AC or DC at a voltage range of 12-24. Because there were so many different manufacturers there are also many different motor types and methods to change direction. Like in all gauges, digital control is recently also available in 0-gauge; in Europe DCC is used but, in the USA also some proprietary digital systems from manufacturers like Lionel and MTH are used.

This transformer set-up can be used to control all type of electric 0-gauge trains.

## 12.2.2 To guide the wheels

Tin-plate 3-rail track, with an isolated third middle rail, was used for a long period and in the USA track like that is still available. Of course, for this tinplate track a coarse wheel profile is used; further there is no need to isolate all wheels of the rolling stock so often tinplate wheels on steel axles were used. More modern 2-rail and 3-rail track is used for trains with more scale like wheels. More recent wheels and track are now according to the standards (NEM or NMRA).

From left to right: Scale 2-rail rail from RivaRossi, Rossignol clockwork rail, tinplate 3-rail electric Merkur rail and a curve of JEP 3-rail electric tinplate rail.

## 12.2.3 Prototypical couplers

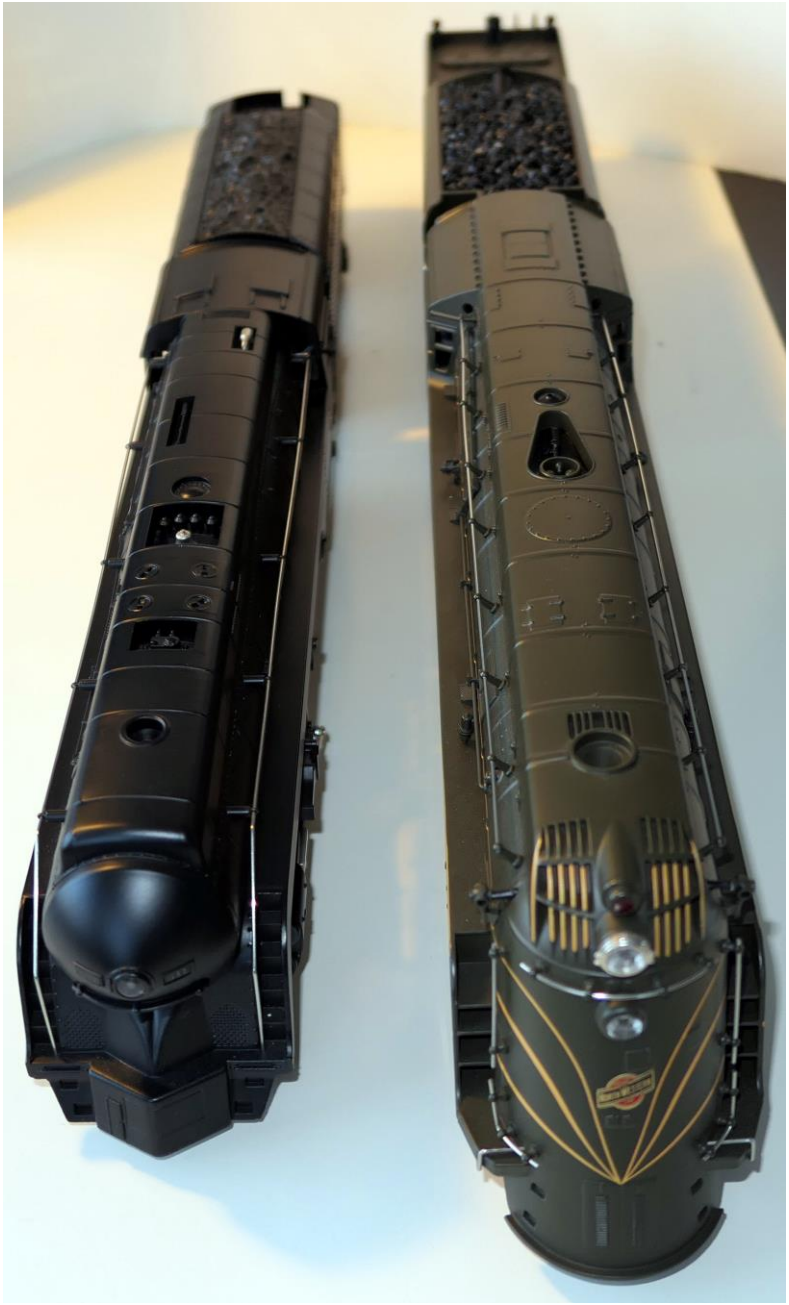
The size of 0-gauge makes it possible to use couplers which look like and operate as prototype couplers, at least when the radius of the track allows for this. But there is only a very small number of 0-gaugers doing this. Here an example of a 0-gauge European screw coupler and an American knuckle coupler.

There were and are many more couplers in 0-gauge than in H0, so the coupler salad is a large bowl. Just as an example the 5 types of couplers used by the French toy train manufacturer JEP:


## 12.2.4 Cookware sets

Many of the larger toy and model manufacturers made different sized series of 0-gauge trains. Some of the tinplate toy manufacturers had also made metal pots and pans and the story goes that, since these were made in different sizes, this influenced them to also make their trains in different sizes as you can see in the picture below with 3 sizes of JEP Pullman cars (from left to right 15, 20 and 24 cm long). Of course, the different sized trains were made for the different budgets of the parents buying a train for their boy.


Not only the French company JEP, but also the German companies Märklin and Bing are known to have been involved in the manufacturing of household items.



A size difference caused by a scale difference is also present by American manufacturers like MTH and Lionel. They use the term “traditionally sized” for trains that are a bit smaller than the 1:48 scale, but do have correct looks. The picture shows two locomotives by MTH, the left one a traditionally sized N&W 4-8-4 locomotive from the MTH Railking series and the right one a scale-sized C&NW 4-6-4 from the MTH Premier line. The real N&W locomotive is 33 meter and the real C&NW locomotive 31 meter long.

American manufacturers also used the term O-27 for trains and track that were smaller than their standard 0-gauge products. Not only the rolling stock was smaller (and less detailed), also the rail height was a bit lower and the radius smaller. Hornby did something similar with their M1 and M0 series. But all of these were 0-gauge (32 mm).

Also, Hornby France made a series of trains including accessories like the train and station seen here which were smaller than their other products; this was called Serie M.

## 12.2.5 Some of the many specialties

Just a selection of some remarkable specialties that occurred in the history of 0-gauge:

The 1930's saw many smaller US manufacturers, Scalecraft amongst others, spring up to supply more realistic model trains than those being sold by Lionel etc., some of these wired for outside 3 rail pick up. Much of this was home-made; in Richmond Hill, NY, the small company Fixen offered sectional O scale track with an outside 3rd rail. Also, a scale of 17/64 Inch to the foot or about 1/45(i.e. larger than 1:48 used generally in the US) was used.

Clockwork and electric combined? To have a lighted headlight a couple of manufacturers made clockwork trains with a battery powered head light. Shown right is an American Hafner locomotive with the headlight on; the 2 AA batteries are situated in the boiler above the clockwork motor.

3-rail track, with an isolated third middle rail is mentioned before. Some manufacturers, including the Belgian company Gils, also had the left and right running rails isolated. Now the wheels had to be isolated also. In the Gils system power between the right rail and the third rail moves the locomotive forward, while power to the left rail and the third rail makes it running backward. Of course, tender and rolling stock wheels had to be isolated; the picture shows a Gils locomotive with plastic tender wheels.


## 12.3 Non-standard gauge trains

0j is used in Japan to model in 1:45 the Japanese 1067 mm (3 feet, 6 inches) gauge trains; the gauge used is 24 mm.

0m has some following, amongst others for modelling the Swiss narrow-gauge railways to a scale of 1:45 and using a gauge of 22.2 mm. A number of Swiss manufacturers make products to model to the scale/gauge combination. The track made for 0m made with the name Alpinline by Fama and later Roco can be used for S gauge trains as can be seen by clicking the picture.

0n30 (also called 0n2½, 016.5 and 0e) is used for the modelling of narrow-gauge railways with a gauge smaller than 1 meter on H0 gauge (16.5 mm) track in 1:48 scale (USA) or in 1:43.5 scale/1:45 scale (Europe).

## 12.4 Smaller than 0-gauge, larger than S gauge

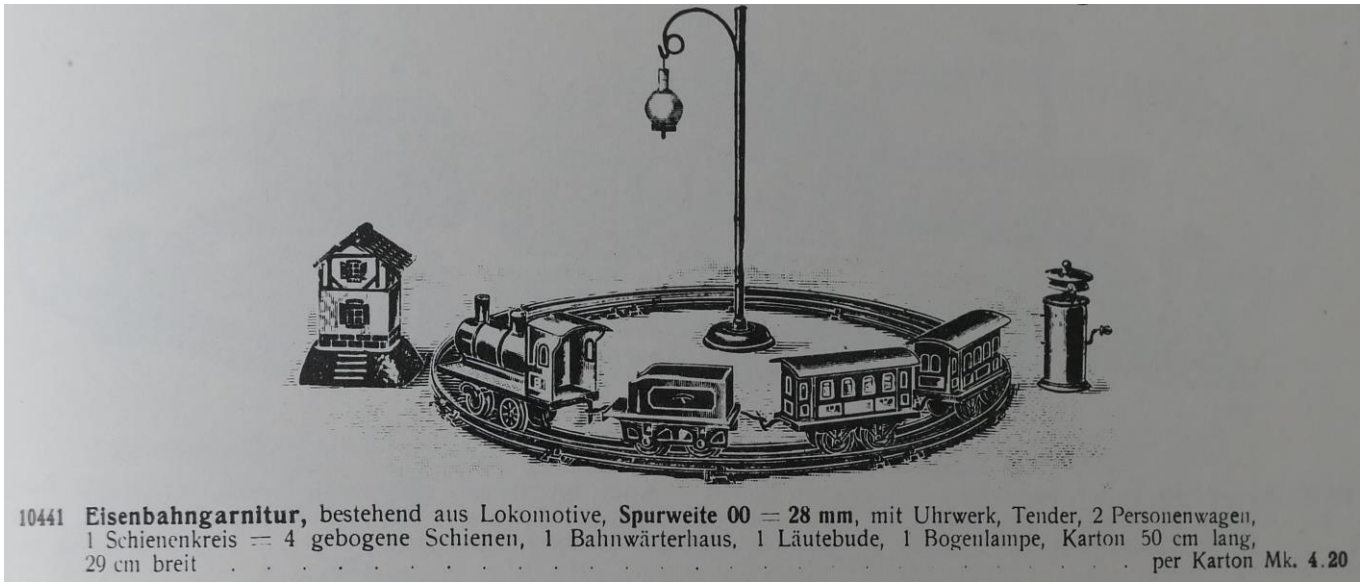
Up into the 1960's the American model railroad magazines and literature sometimes referred to "Q scale". John Armstrong's book "Track Planning for Realistic Operation" (1963 version) mentioned Q scale as using 1.177" (30 mm) track gauge for 1:48 scale, so it was the accurate gauge for standard gauge in this typical USA scale of 1:48. Later the name Proto48 or P48 was given to this gauge/scale combination.

In the beginning of the fifties Z0-gauge was devised which it is completely forgotten now. It was supposed to be in between 0-gauge and H0-gauge with a gauge of 24 mm and a scale of 1:60. The Z came from the German word “Zwischen”, i.e. in between.

Most train sets were bought as a present for a child. Until a couple of years ago I assumed that train sets where made by the toy or model train manufacturers to initiate the child to a hobby, such that they would want more, profit generating, items to expand on the set. Recently I came to the conclusion that cheap tinplate clockwork train sets were sold as a toy by itself; the manufacturer just gets profit from making and selling sets. Some manufacturers, like JEP, CR (Rossignol) and Bing, even made train sets using a gauge for which they did not supply extra track or rolling stock to expand the set. Gauges of 30 mm and 25 mm were used, which, as was normal with tinplate trains, were called respectively 33 mm and 28 mm. Below a picture of a 30/33 mm JdeP (JEP) train which is balanced on 0-gauge track, but it will not run on that track.



Bing from Germany also made these small train sets with a gauge of 25/28 mm. This little simple clockwork train is still in a very good condition and is beautifully lithographed in correct English LSWR colors. As can be seen in the catalogue page below Bing called this train 00-gauge at that time.



10441 **Eisenbahngarnitur,** bestehend aus Lokomotive, **Spurweite 00 = 28 mm**, mit Uhrwerk, Tender, 2 Personenwagen, 1 Schienenkreis = 4 gebogene Schienen, 1 Bahnwärterhaus, 1 Läutebude, 1 Bogenlampe, Karton 50 cm lang, 29 cm breit . . . . . per Karton Mk. **4.20**

# 13 1-Gauge

1-gauge or gauge 1 or “Spur I” was the smallest gauge when standard gauges were introduced by Märklin in 1891. Nowadays it is generally considered the largest gauge for model trains. It was introduced at a gauge of 48 mm measured from the middle of the rails. The measurement between the rails, which is the normal way of measurement nowadays, gives a gauge of 45 mm. In the beginning only toy trains were made, but when trains modelled to a prototype started to be introduced a scale of 10 mm to the foot (in the UK) or 1:30 (in continental Europe) was used, both about the same at 5% too large for the gauge. In the USA 1-gauge had some popularity until the nineteen twenties. When Lionel introduced their Standard Gauge, 1-gauge virtually disappeared. In the thirties 1-gauge also virtually disappeared from the European scene being pushed aside by the popularity of 0-gauge. In the fifties in the UK the G1MRA (Gauge 1 Model Railway Association) kept using the gauge, mainly for running live steam. In the late sixties Märklin re-introduced the gauge in their product range. Märklin used the (correct) scale of 1:32 and this scale is used now generally outside the UK. In the UK both 1:32, especially for ready-made products, and 10 mm to the foot, for scratch and part of the kit building, is used. But the scale confusion is still there in 1-gauge as this citation from a UK sellers website (where all 1-gauge items are ready made products to a scale of 1:32) shows: *Welcome to Steamline Ltd. IMPORTANT NOTE : All models offered for sale on the pages of this website are in Gauge 'O' (a scale of 7mm = 1 foot) EXCEPT those shown on the 'GAUGE 1' Page (where the scale is 10mm = 1 foot).*


The height difference is obvious in the picture of a 10 mm kit-built scale model of A3 Flying Scotsman (left) and a 1:32 scale model of A4 Mallard (build from an Aster kit)

## 13.1 Manufacturers

Tinplate style 1-gauge trains were made by all the German manufacturers like Märklin, Bing, Carette and Bub. In the UK Bassett-Lowke made 1-gauge trains, but also sold products made for them by the German manufacturers. In the rest of Europe there was, except for a small range by JEP, virtually no 1-gauge production. As with early 0-gauge, locomotives with clockwork, low and high voltage electricity and steam propulsion were made. Some of the later larger live steam locomotives had high pressure boilers and were able to run for a longer period. In the USA there were around 1900 some manufacturers, like Boucher and Ives, that made 1-gauge trains; the 1-gauge production in the USA was much smaller than the later Standard Gauge, see 14.2, production.

Left a Bing tinplate Midland Railway luggage van made for the British market and having a Märklin coupler. Right a Bassett-Lowke wooden bodied Great Western 5-plank wagon.

A Märklin high voltage train with its controller with resistors lamps. At a derailment 220 V can be present on the track, so happily I do not have dogs or cats.

From the sixties/seventies a number of manufacturers started to make 1-gauge model trains. Märklin of course as already mentioned, they started to make affordable trains and later introduced a lower cost range called Märklin Maxi. A number of smaller manufacturers also introduced 1-gauge trains, in general these were costlier and very detailed models. Some 1-gauge items were and are products of a cottage industry, like the coaches of J&M Models and the locomotives of Bockholt, but more and more 1-gauge items are made in Asia. To mention a few: Aster, Accucraft, KM1, Kiss. Also, the high-level model companies like Lemaco/Lematec and Fulgurex are involved in production for 1-gauge.

Märklin introduced around 1985 a very detailed electrically powered model of the first German train with locomotive “Der Adler”. This 1-gauge set also contained a number of figures (passengers and railway crew) in period apparel.

## 13.2 Live steam or electric

When 1-gauge regained its popularity a split between live steam and electric running became apparent. In the UK live steam running, preferably outside, is popular while in Germany electric running on detailed model railways is done more often.

A meet (Get-together) of the British gauge 1 association at a large garden railway in the south of England.

A detailed German diorama with electrically digital controlled locomotives at the yearly 1-gauge meet (Spur 1 Treffen) in Sinsheim

## 13.3 Non-standard gauge trains

There is not much narrow-gauge modelling in 1:32. The former German manufacturer Hübner made, besides a range of 1-gauge trains also some trains called 1e based on Saxonian narrow gauge railways and using a gauge of 22.5 mm. Recently the 1-gauge manufacturer KM1 also introduced some 1e models and including narrow-gauge and combined narrow-gauge/standard gauge track.

## 13.4 Smaller than 1-gauge, larger than 0-gauge

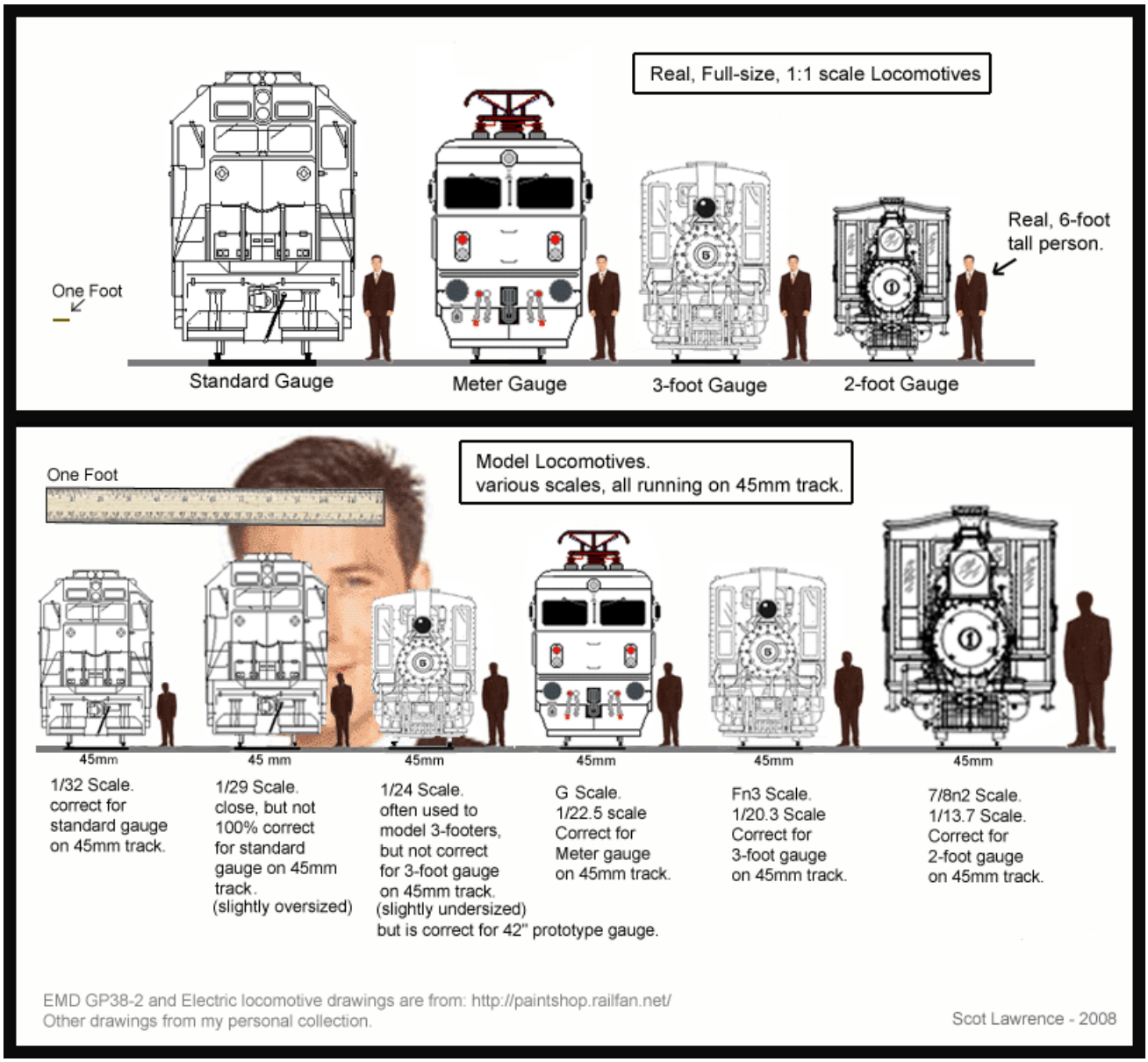
Apparently, there was never someone that thought it was wise to use a gauge associated with a scale between 7 mm and 10 mm to the foot or between 1:32 and 1:43.5 when modelling standard gauge trains.

## 13.5 G Scale and G Gauge

When Lehmann from Nuremberg introduced LGB (Lehmann Gross Bahn) trains they decided to use a gauge of 45 mm and a scale of approximately 1:22.5. For narrow gauge trains based on a prototype gauge of 1 meter, a very popular gauge in Switzerland, this is a correct gauge/scale combination. This gauge/scale combination is called IIm according to MOROP standardization. LGB made also models of trains from other narrow-gauge track-widths however keeping to the 45 mm gauge and thus either adopting the scale or having a not completely correct gauge/scale combination. Later they even made standard gauge trains on 45 mm, but they decided these should look large and made the bodies to a scale of approximately 1:26 while the running gear was smaller. So LGB used no uniform scale but used a uniform gauge, but they did not call it 1-gauge but just LGB or G.

The G can stand for Garden of for the German words Garten or Gross (Large). Since LGB had some export success to the USA, also some manufacturers from the USA, like Aristocraft, started to make trains using a gauge of 45 mm but at a scale of 1:29. Since 1-gauge never was popular in the USA, even proper 1-gauge trains are generally called G there. The German manufacturer Piko also makes trains for 45 mm at a incorrect scale (approximately 1:27) which they call G scale. Bottom line with "G" is that the gauge stays the same and the scale changes. The terminologies Large Scale or G scale or G gauge are all used for trains to any scale but using a gauge of 45 mm. The track used is in general over-scale (large sleepers and large rail heights) which, because of its size and durability, is often used outdoors.

Brawa made a small range of trains based on 1-meter gauge railways running on 45 mm track and called these correctly IIm.

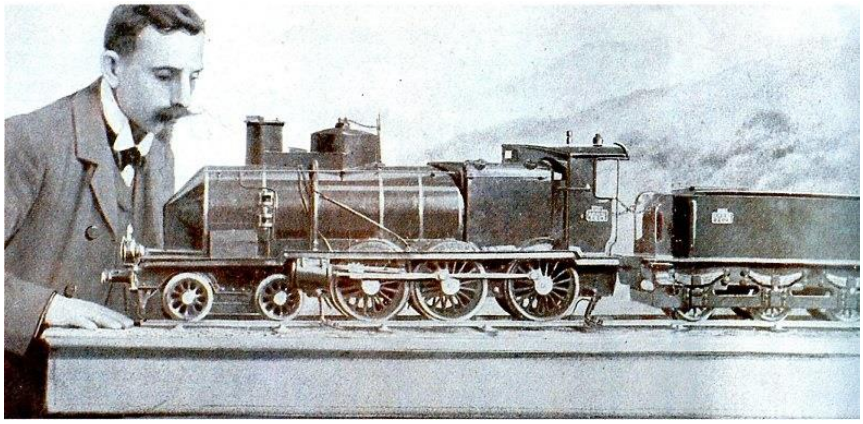



I found this picture/diagram on the website of Scot Lawrence. The picture explains the G gauge/scale combinations.

# 14 The Larger Gauges

With the larger gauges is meant everything above a gauge of 45 mm but still toy and model trains and not miniature railways, which are discussed in the next chapter. A miniature train can transport people, at the minimum its driver. I do not know what the maximum gauge for toy and model trains might be but I assume that a gauge of 3.5 Inch (89 mm) as used for the Hornby Rocket (left) was the largest for trains available on the market.

Below: In the period before Christmas 1905 a large train was displayed at Galeries Lafayette in Paris. This train, called “Le Train Géant” was made by the French distributor and manufacturer Brianne. It had a gauge of 140 mm and the locomotive was modelled after a PLM 4-6-0 locomotive built in 1901.



## 14.1 Historical Larger Gauges

Märklin introduced in 1891 not only gauge I but also the gauges gauge II, III and IV (see 3.1.2) with nominal gauges of 51, 72 and 92 mm. Later also a gauge called IIa or 3 with a gauge of 62 mm was introduced by the Nuremberg toymakers, while they called the Märklin gauge III gauge 4. Most of these larger gauges were gone before 1920 and examples of trains of these gauges are seldom seen.

There is a range of coaches made by Bing for Bassett-Lowke that were made for gauge II (51 mm) but did not sell at all since the interest in gauge II had waned. Bassett-Lowke changed the bogies to gauge I and then they were sold. Here a picture of a Midland and an LNWR version of these coaches.

When running with a 1:32 scale 1-gauge LNWR locomotive the correct liveried combination still does not look correct because of the scale difference.

## 14.2 Standard Gauge

In the USA Lionel defined in 1906 a gauge of $2^1/_8$ Inch (54 mm) which was called Standard Gauge. Standard Gauge is 3 mm wider than Gauge II and only known in the USA, but it is still there and products for this gauge are still manufactured, amongst others by MTH. Most of these products are in a tinplate/coarse scale/toy style; there is no scale assigned to Standard Gauge. Standard Gauge trains are big and heavy and I assume that is why Americans like them. American Flyer (American Flyer Manufacturing Company of Chicago, Illinois, USA) and Ives of Bridgeport, Connecticut, USA were also major manufacturers of Standard Gauge trains. American Flyer called theirs "Wide Gauge". Ives converted their 1 Gauge trains to operate on Standard Gauge track in the face of the competition from the others. Dorfan manufactured Standard Gauge trains and the older company Carlisle and Finch modified their 2-inch gauge trains to Standard Gauge as well. Lionel and American Flyer were the dominant manufacturers. As an illustration of their size a picture of a Lionel Standard Gauge crane (right) with a Märklin Maxi 1-gauge crane (left).

## 14.3 Recent Larger Gauges

When MOROP issued the NEM standards the historical gauge numbers for the larger gauges were forgotten and the gauge of 64 mm was called II. The American NMRA standards seems not to mention larger gauges.

In the eighties the German small manufacturer Christian Höhne made to a gauge of 45 mm highly detailed metal models of narrow-gauge locomotives, which were marketed by LGB. Under the name Magnus he also made, to a scale of 1:22.5, a small range of gauge II (64 mm) standard gauge trains.

Some years ago, some Chinese-made live steam locomotives made to a gauge of 64 cm and a scale of 1:22.5 were marketed from England with the name Kingscale and advertised as Gauge 3. More recent the same locomotives are also marketed in Germany by KM1 who calls these Spur 2 (Gauge 2 or II). Some confusion in the larger scales seems unavoidable.

# 15 Miniature Railway Gauges

Miniature railway gauges deserve a book by itself. These are in the realm of the model engineer and not of the model train enthusiast. The boundary between the two is flexible but recognisable when one defines that a miniature railway can and will transport people, at the minimum its driver. The author is running his miniature locomotive when he was much younger.

The English company Bassett-Lowke with their design engineer Henry Greenly is one of the main originators of miniature railways as can be seen in a few pages of their catalogue of 1911:




Bassett-Lowke made in 1911 equipment for the gauges 3.25, 7.25, 9.5 and 15 Inch. The 3.25 Inch (83 mm) gauge with a scale of 1:17 could also be considered a model railway instead of a miniature railway since Bassett-Lowke also could supply accessories like station buildings and coaches and wagons to the same gauge/scale combination. The 3.25 Inch gauge was however soon abandoned and replaced by 3.5 Inch gauge with a scale of 1:16 and this is considered a model engineering scale.

Left a 3.5 Inch gauge 0-8-0 locomotive based on the Caribou design of well-known model-engineer Martin Evans. Note that the driver (me) dwarfs the engine.

Below a 3.25 Inch gauge Bassett-Lowke GNR Atlantic waiting to be restored.

The European model engineering gauges (and scales) for miniature train are 3.5 Inch (1:16), 5 Inch (1:11), 7.25 Inch (1:8); in the USA also 4.75 Inch (1:12) and 7.5 Inch (1:8) are used. In general tracks for these gauges are made by a group of hobbyists arranged in a model engineering society; many tracks like these can be visited in summer weekends. Standard gauge locomotives and narrow-gauge locomotives share the same track at these societies. Until a number of years ago most 5- and 7.25-Inch locomotives made were scale like, standard gauge, locomotives; more recent narrow gauge or even free-lance locomotives are more popular. Below shows a free-lance locomotive driven by its builder W. van der Heiden from Rotterdam, he designed and build a number of free-lance locomotives in various gauges. He once told me that he liked miniature locomotives but was not interested at all in the real railways, so he made no scale locomotive models.

Larger gauges are in general used for tracks in public spaces. Among the larger gauges are 9.5 Inch, 10.25 Inch and 15 Inch were the approximate scale would be 1:6, 1:5 and 1: 4 respectively. The scale used with locomotives in these larger gauges is indeed approximate and seldom accurate. Of course, the wagons used, which carries 1:1 scale passengers, are also not to scale. But the sight of a 15 Inch Pacific locomotive with its train on the Romney, Hythe and Dymchurch Railway in the south of England is breath-taking. The picture shows the RH&DR locomotives Southern Maid and Winston Churchill while being prepared for the days run.


BonBoni